

### Algebra II Regents at Random Worksheets

- Susan won \$2,000 and invested it into an account with an annual interest rate of 3.2%. If her investment were compounded monthly, which expression best represents the value of her investment after  $t$  years?
  - $2000(1.003)^{12t}$
  - $2000(1.032)^{\frac{t}{12}}$
  - $2064^{\frac{t}{12}}$
  - $\frac{2000(1.032)^t}{12}$
- Expressed in simplest  $a + bi$  form,  $(7 - 3i) + (x - 2i)^2 - (4i + 2x^2)$  is
  - $(3 - x^2) - (4x + 7)i$
  - $(3 + 3x^2) - (4x + 7)i$
  - $(3 - x^2) - 7i$
  - $(3 + 3x^2) - 7i$
- The average monthly temperature,  $T(m)$ , in degrees Fahrenheit, over a 12 month period, can be modeled by  $T(m) = -23 \cos\left(\frac{\pi}{6}m\right) + 56$ , where  $m$  is in months. What is the range of temperatures, in degrees Fahrenheit, of this function?
  - $[-23, 23]$
  - $[33, 79]$
  - $[-23, 56]$
  - $[-79, 33]$
- Given the geometric series  $300 + 360 + 432 + 518.4 + \dots$ , write a geometric series formula,  $S_n$ , for the sum of the first  $n$  terms. Use the formula to find the sum of the first 10 terms, to the nearest tenth.
- Solve the equation  $3x^2 + 5x + 8 = 0$ . Write your solution in  $a + bi$  form.
- Algebraically solve the following system of equations.
$$(x - 2)^2 + (y - 3)^2 = 16$$
$$x + y - 1 = 0$$
- Given  $p(\theta) = 3 \sin\left(\frac{1}{2}\theta\right)$  on the interval  $-\pi < \theta < \pi$ , the function  $p$ 
  - decreases, then increases
  - increases, then decreases
  - decreases throughout the interval
  - increases throughout the interval
- Given that  $i$  is the imaginary unit, the expression  $(x - 2i)^2$  is equivalent to
  - $x^2 + 4$
  - $x^2 - 4$
  - $x^2 - 2xi - 4$
  - $x^2 - 4xi - 4$
- Given  $x \neq -2$ , the expression  $\frac{2x^2 + 5x + 8}{x + 2}$  is equivalent to
  - $2x^2 + \frac{9}{x + 2}$
  - $2x + \frac{7}{x + 2}$
  - $2x + 1 + \frac{6}{x + 2}$
  - $2x + 9 - \frac{10}{x + 2}$

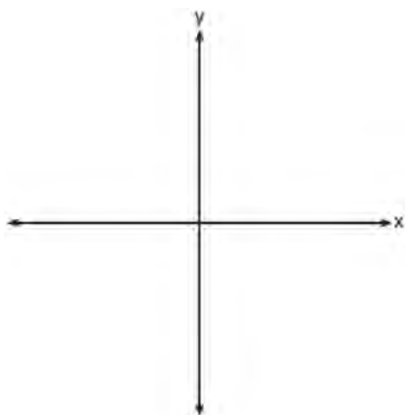
- 10 The function  $N(x) = 90(0.86)^x + 69$  can be used to predict the temperature of a cup of hot chocolate in degrees Fahrenheit after  $x$  minutes. What is the approximate average rate of change of the temperature of the hot chocolate, in degrees per minute, over the interval  $[0, 6]$ ?
- 1)  $-8.93$
  - 2)  $-0.11$
  - 3)  $0.11$
  - 4)  $8.93$
- 11 A rush-hour commuter train has arrived on time 64 of its first 80 days. As arrivals continue, which equation can be used to find  $x$ , the number of consecutive days that the train must arrive on schedule to raise its on-time performance rate to 90%?
- 1)  $\frac{64}{80+x} = \frac{90}{100}$
  - 2)  $\frac{64+x}{80+x} = \frac{90}{100}$
  - 3)  $\frac{64+x}{80} = \frac{90}{100}$
  - 4)  $\frac{x}{80+x} = \frac{90}{100}$
- 12 According to a study done at a hospital, the average weight of a newborn baby is 3.39 kg, with a standard deviation of 0.55 kg. The weights of all the newborns in this hospital closely follow a normal distribution. Last year, 9256 babies were born at this hospital. Determine, to the *nearest integer*, approximately how many babies weighed more than 4 kg.
- 13 Describe the transformation applied to the graph of  $p(x) = 2^x$  that forms the new function  $q(x) = 2^{x-3} + 4$ .
- 14 For all positive values of  $x$ , which expression is equivalent to  $x^{\frac{3}{4}}$ ?
- 1)  $\sqrt[4]{x^3}$
  - 2)  $\sqrt[3]{x^4}$
  - 3)  $(x^3)^4$
  - 4)  $3(x^4)$
- 15 Biologists are studying a new bacterium. They create a culture with 100 of the bacteria and anticipate that the number of bacteria will double every 30 hours. Write an equation for the number of bacteria,  $B$ , in terms of the number of hours,  $t$ , since the experiment began.
- 16 Given  $f(x) = -\frac{2}{5}x + 4$ , which statement is true of the inverse function  $f^{-1}(x)$ ?
- 1)  $f^{-1}(x)$  is a line with slope  $\frac{5}{2}$ .
  - 2)  $f^{-1}(x)$  is a line with slope  $\frac{2}{5}$ .
  - 3)  $f^{-1}(x)$  passes through the point  $(6, -5)$ .
  - 4)  $f^{-1}(x)$  has a y-intercept at  $(0, -4)$ .
- 17 The heights of the 3300 students at Oceanview High School are approximately normally distributed with a mean of 65.5 inches and a standard deviation of 2.9 inches. The number of students at Oceanview who are between 64 and 68 inches tall is closest to
- 1) 1660
  - 2) 1070
  - 3) 2244
  - 4) 1640

- 18 In order to decrease the percentage of its residents who drive to work, a large city launches a campaign to encourage people to use public transportation instead. Before starting the campaign, the city's Department of Transportation uses census data to estimate that 65% of its residents drive to work. The Department of Transportation conducts a simulation, shown below, run 400 times based on this estimate. Each dot represents the proportion of 200 randomly selected residents who drive to work.



Use the simulation results to construct a plausible interval containing the middle 95% of the data. Round your answer to the *nearest hundredth*. One year after launching the campaign, the Department of Transportation conducts a survey of 200 randomly selected city residents and finds that 122 of them drive to work. Should the department conclude that the city's campaign was effective? Use statistical evidence from the simulation to explain your answer.

- 19 Patricia creates a cubic polynomial function,  $p(x)$ , with a leading coefficient of 1. The zeros of the function are 2, 3, and  $-6$ . Write an equation for  $p(x)$ . Sketch  $y = p(x)$  on the set of axes below.



- 20 Show why  $x - 3$  is a factor of  $m(x) = x^3 - x^2 - 5x - 3$ . Justify your answer.

- 21 The inverse of  $f(x) = -6x + \frac{1}{2}$  is

1)  $f^{-1}(x) = 6x - \frac{1}{2}$

2)  $f^{-1}(x) = \frac{1}{-6x + \frac{1}{2}}$

3)  $f^{-1}(x) = -\frac{1}{6}x + \frac{1}{12}$

4)  $f^{-1}(x) = -\frac{1}{6}x + 2$

- 22 Which expression is a factor of

$$x^4 - x^3 - 11x^2 + 5x + 30?$$

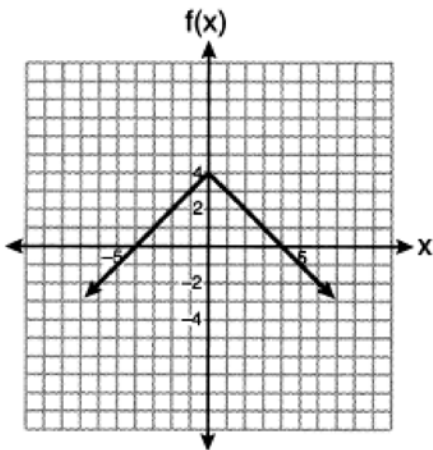
1)  $x + 2$

2)  $x - 2$

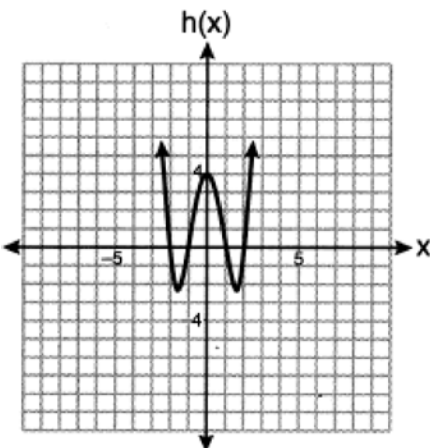
3)  $x + 5$

4)  $x - 5$

- 23 Which function has a maximum y-value of 4 and a midline of  $y = 1$ ?



- 1)  $f(x) = -3\cos(x) + 1$   
2)  $g(x) = -3\cos(x) + 1$



- 3)  $j(x) = 4\sin(x) + 1$   
4)  $j(x) = 4\sin(x) + 1$

- 24 Which expression is equivalent to  $\frac{x^3 - 2}{x - 2}$ ?

- 1)  $x^2$   
2)  $x^2 + 2x + 4 + \frac{6}{x - 2}$   
3)  $x^2 - 2$   
4)  $x^2 - 2x + 4 - \frac{10}{x - 2}$

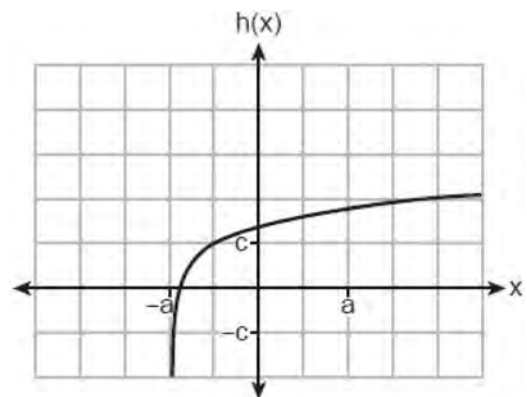
- 25 A recursive formula for the sequence 40, 30, 22.5, ... is

- 1)  $g_n = 40\left(\frac{3}{4}\right)^n$   
2)  $g_1 = 40$   
 $g_n = g_{n-1} - 10$   
3)  $g_n = 40\left(\frac{3}{4}\right)^{n-1}$   
4)  $g_1 = 40$   
 $g_n = \frac{3}{4}g_{n-1}$

- 26 To the nearest tenth, the solution to the equation  $4300e^{0.07x} - 123 = 5000$  is

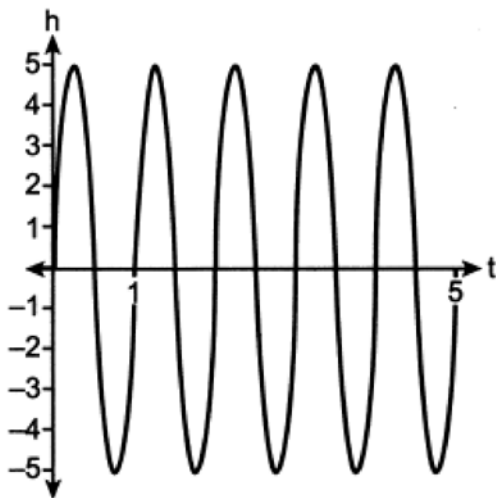
- 1) 1.1  
2) 2.5  
3) 6.3  
4) 68.5

- 27 Which equation best represents the graph below?



- 1)  $h(x) = \log(x + a) + c$   
2)  $h(x) = \log(x - a) + c$   
3)  $h(x) = \log(x + a) - c$   
4)  $h(x) = \log(x - a) - c$

- 28 A cyclist pedals a bike at a rate of 60 revolutions per minute. The height,  $h$ , of a pedal at time  $t$ , in seconds, is plotted below.



The graph can be modeled by the function  $h(t) = 5 \sin(kt)$ , where  $k$  is equal to

- 1) 1
  - 2)  $2\pi$
  - 3) 60
  - 4)  $\frac{\pi}{30}$
- 29 For  $n$  and  $p > 0$ , is the expression  $\left(p^2 n^{\frac{1}{2}}\right)^8 \sqrt{p^5 n^4}$  equivalent to  $p^{18} n^6 \sqrt{p}$ ? Justify your answer.

- 30 Write the expression  $A(x) \cdot B(x) - 3C(x)$  as a polynomial in standard form.

$$A(x) = x^3 + 2x - 1$$

$$B(x) = x^2 + 7$$

$$C(x) = x^4 - 5x$$

- 31 Algebraically determine the zeros of the function below.

$$r(x) = 3x^3 + 12x^2 - 3x - 12$$

- 32 The solution to the equation  $5e^{x+2} = 7$  is

1)  $-2 + \ln\left(\frac{7}{5}\right)$

2)  $\left(\frac{\ln 7}{\ln 5}\right) - 2$

3)  $\frac{-3}{5}$

4)  $-2 + \ln(2)$

- 33 Which expression is *not* a solution to the equation  $2^t = \sqrt{10}$ ?

1)  $\frac{1}{2} \log_2 10$

2)  $\log_2 \sqrt{10}$

3)  $\log_4 10$

4)  $\log_{10} 4$

- 34 Which function is even?

1)  $f(x) = x^3 + 2$

2)  $f(x) = x^2 + 1$

3)  $f(x) = |x + 2|$

4)  $f(x) = \sin(2x)$

- 35 Which expression is an equivalent form of  $a^5 \sqrt{a^4}$ ?

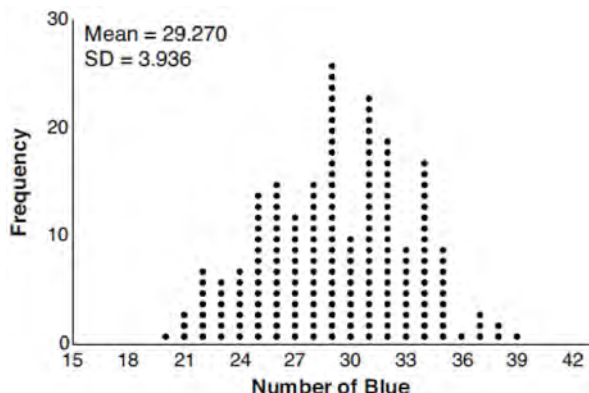
1)  $a$

2)  $a^{\frac{9}{5}}$

3)  $a^{\frac{9}{4}}$

4)  $a^{\frac{1}{5}}$

- 36 The J& B candy company claims that 45% of the candies it produces are blue, 30% are brown, and 25% are yellow. Each bag holds 65 candies. A simulation was run 200 times, each of sample size 65, based on the premise that 45% of the candies are blue. The results of the simulation are shown below.

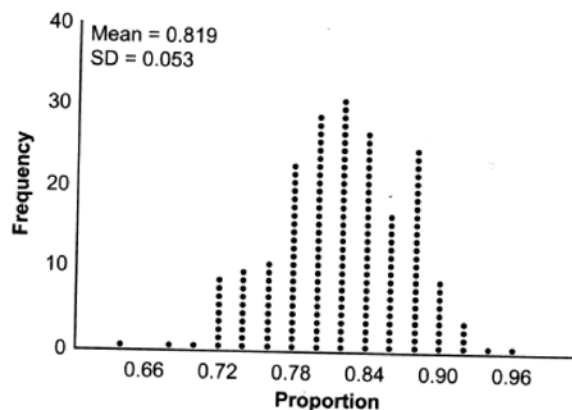


Bonnie purchased a bag of J& B's candy and counted 24 blue candies. What inference can be made regarding a bag of J& B's with only 24 blue candies?

- 1) The company is not meeting their production standard.
  - 2) Bonnie's bag was a rarity and the company should not be concerned.
  - 3) The company should change their claim to 37% blue candies are produced.
  - 4) Bonnie's bag is within the middle 95% of the simulated data supporting the company's claim.
- 37 A function is defined as  $a_n = a_{n-1} + \log_{n+1}(n-1)$ , where  $a_1 = 8$ . What is the value of  $a_3$ ?
- 1) 8
  - 2) 8.5
  - 3) 9.2
  - 4) 10

- 38 According to a study, 45% of Americans have type O blood. If a random number generator produces three-digit values from 000 to 999, which values would represent those having type O blood?
- 1) between 000 and 045, inclusive
  - 2) between 000 and 444, inclusive
  - 3) between 000 and 449, inclusive
  - 4) between 000 and 450, inclusive

- 39 State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.



Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the *nearest thousandth*. The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials' claim.



- 44 In a survey of people who recently bought a laptop, 45% said they were looking for a large screen, 31% said they were looking for a fast processor, and 58% said they wanted a large screen or a fast processor. If a survey respondent is selected at random, what is the probability that the respondent wanted both a large screen and a fast processor?
- 1) 76%
  - 2) 14%
  - 3) 77%
  - 4) 18%

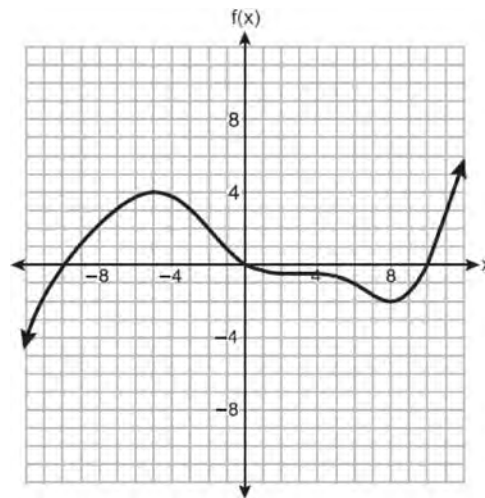
- 45 Write a recursive formula for the sequence 189, 63, 21, 7, . . . .

- 46 Given  $f(x) = 3x^3 - 4x^2 + 2x - 1$  and  $g(x) = x - 4$ , state the quotient and remainder of  $\frac{f(x)}{g(x)}$ , in the form  $q(x) + \frac{r(x)}{g(x)}$ . Is  $x = 4$  a root of  $f(x)$ ? Explain your answer.

- 47 The element Americium has a half-life of 25 minutes. Given an initial amount,  $A_0$ , which expression could be used to determine the amount of Americium remaining after  $t$  minutes?

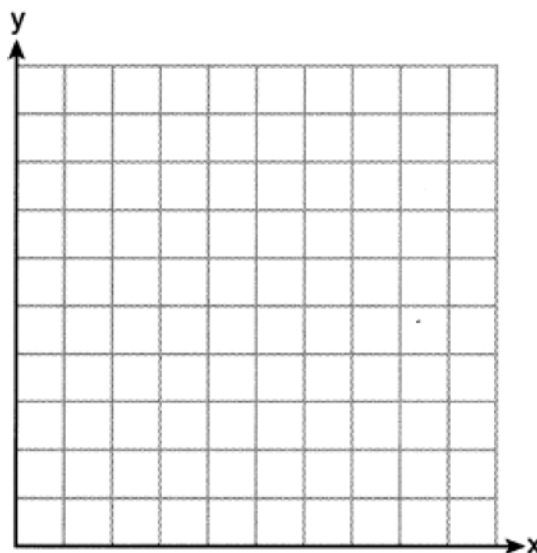
- 1)  $A_0 \left(\frac{1}{2}\right)^{\frac{t}{25}}$
- 2)  $A_0(25)^{\frac{t}{2}}$
- 3)  $25 \left(\frac{1}{2}\right)^t$
- 4)  $A_0 \left(\frac{1}{2}\right)^{25t}$

- 48 The graph of the function  $f(x)$  is shown below.



In which interval is  $f(x)$  always positive?

- 1)  $(-2, 4)$
  - 2)  $(0, 10)$
  - 3)  $(-12, -5)$
  - 4)  $(-10, 0)$
- 49 Graph  $y = 2 \cos\left(\frac{1}{2}x\right) + 5$  on the interval  $[0, 2\pi]$ , using the axes below.





50 According to the USGS, an agency within the Department of Interior of the United States, the frog population in the U.S. is decreasing at the rate of 3.79% per year. A student created a model,  $P = 12,150(0.962)^t$ , to estimate the population in a pond after  $t$  years. The student then created a model that would predict the population after  $d$  decades. This model is best represented by

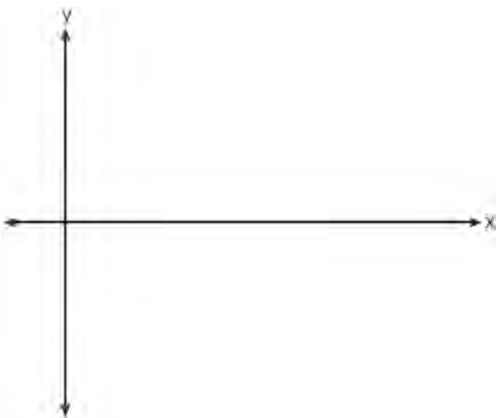
- 1)  $P = 12,150(0.461)^d$
- 2)  $P = 12,150(0.679)^d$
- 3)  $P = 12,150(0.996)^d$
- 4)  $P = 12,150(0.998)^d$

51 Algebraically determine the solution set for the system of equations below.

$$y = 2x^2 - 7x + 4$$

$$y = 11 - 2x$$

52 On the coordinate plane below, sketch *at least one* cycle of a cosine function with a midline at  $y = -2$ , an amplitude of 3, and a period of  $\frac{\pi}{2}$ .

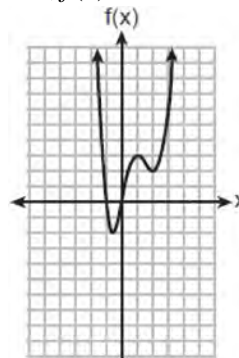


53 For  $x \neq 0$  and  $y \neq 0$ ,  $\sqrt[3]{81x^{15}y^9} = 3^a x^5 y^3$ . Determine the value of  $a$ .

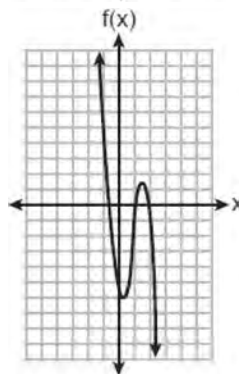
54 The expression  $(x + a)^2 + 5(x + a) + 4$  is equivalent to

- 1)  $(a + 1)(a + 4)$
- 2)  $(x + 1)(x + 4)$
- 3)  $(x + a + 1)(x + a + 4)$
- 4)  $x^2 + a^2 + 5x + 5a + 4$

55 Which function has the characteristic as  $x \rightarrow -\infty, f(x) \rightarrow -\infty$ ?



1)



2)

3)  $f(x) = 5(4)^{-x}$

4)  $f(x) = -\log_5(-x)$

56 Sonja is cutting wire to construct a mobile. She cuts 100 inches for the first piece, 80 inches for the second piece, and 64 inches for the third piece. Assuming this pattern continues, write an explicit equation for  $a_n$ , the length in inches of the  $n$ th piece. Sonja only has 40 feet of wire to use for the project and wants to cut 20 pieces total for the mobile using her pattern. Will she have enough wire? Justify your answer.

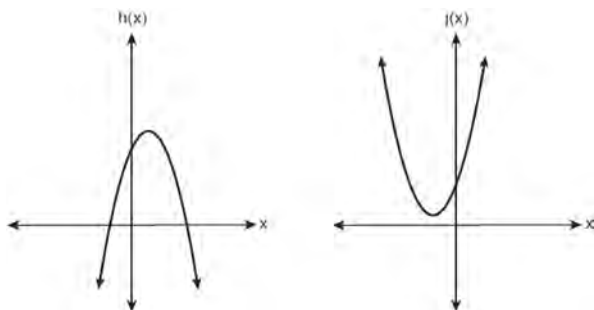
- 57 Sarah is fighting a sinus infection. Her doctor prescribed a nasal spray and an antibiotic to fight the infection. The active ingredients, in milligrams, remaining in the bloodstream from the nasal spray,  $n(t)$ , and the antibiotic,  $a(t)$ , are modeled in the functions below, where  $t$  is the time in hours since the medications were taken.

$$n(t) = \frac{t+1}{t+5} + \frac{18}{t^2 + 8t + 15}$$

$$a(t) = \frac{9}{t+3}$$

Determine which drug is made with a greater initial amount of active ingredient. Justify your answer. Sarah's doctor told her to take both drugs at the same time. Determine algebraically the number of hours after taking the medications when both medications will have the same amount of active ingredient remaining in her bloodstream.

- 58 In the quadratic formula,  $b^2 - 4ac$  is called the discriminant. The function  $f(x)$  has a discriminant value of 8, and  $g(x)$  has a discriminant value of  $-16$ . The quadratic graphs,  $h(x)$  and  $j(x)$ , are shown below.



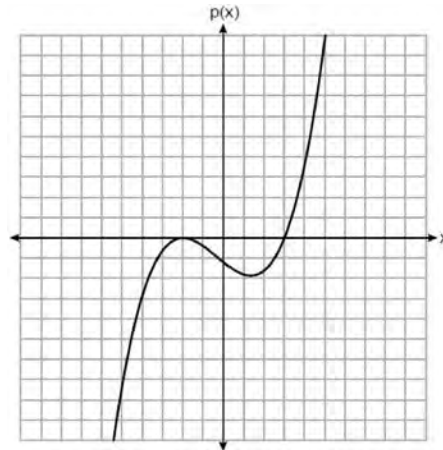
Which quadratic functions have imaginary roots?

- 1)  $g(x)$  and  $h(x)$
- 2)  $g(x)$  and  $j(x)$
- 3)  $f(x)$  and  $h(x)$
- 4)  $f(x)$  and  $j(x)$

- 59 The depth of the water,  $d(t)$ , in feet, on a given day at Thunder Bay,  $t$  hours after midnight is modeled by  $d(t) = 5 \sin\left(\frac{\pi}{6}(t-5)\right) + 7$ . Which statement about the Thunder Bay tide is *false*?
- 1) A low tide occurred at 2 a.m.
  - 2) The maximum depth of the water was 12 feet.
  - 3) The water depth at 9 a.m. was approximately 11 feet.
  - 4) The difference in water depth between high tide and low tide is 14 feet.

- 60 Consider the parabola given by  $y = \frac{1}{4}x^2 + x + 8$  with vertex  $(-2, 7)$  and focus  $(-2, 8)$ . Use this information to explain how to determine the equation of the directrix.

- 61 The graph of a cubic polynomial function  $p(x)$  is shown below.



If  $p(x)$  is written as a product of linear factors, which factor would appear twice?

- 1)  $x - 2$
- 2)  $x + 2$
- 3)  $x - 3$
- 4)  $x + 3$

- 62 A company fired several employees in order to save money. The amount of money the company saved per year over five years following the loss of employees is shown in the table below.

Year	Amount Saved (in dollars)
1	59,000
2	64,900
3	71,390
4	78,529
5	86,381.9

Which expression determines the total amount of money saved by the company over 5 years?

- 1)  $\frac{59,000 - 59,000(1.1)^5}{1 - 1.1}$
- 2)  $\frac{59,000 - 59,000(0.1)^5}{1 - 0.1}$
- 3)  $\sum_{n=1}^5 59,000(1.1)^n$
- 4)  $\sum_{n=1}^5 59,000(0.1)^{n-1}$

- 63 Which equation represents a polynomial identity?

- 1)  $x^3 + y^3 = (x + y)^3$
- 2)  $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$
- 3)  $x^3 + y^3 = (x + y)(x^2 - xy - y^2)$
- 4)  $x^3 + y^3 = (x - y)(x^2 + xy + y^2)$

- 65 Given  $f(x) = 3^{x-1} + 2$ , as  $x \rightarrow -\infty$

- 1)  $f(x) \rightarrow -1$
- 2)  $f(x) \rightarrow 0$
- 3)  $f(x) \rightarrow 2$
- 4)  $f(x) \rightarrow -\infty$

- 64 Which situation best describes conditional probability?

- 1) finding the probability of an event occurring two or more times
- 2) finding the probability of an event occurring only once
- 3) finding the probability of two independent events occurring at the same time
- 4) finding the probability of an event occurring given another event had already occurred

- 66 Which investigation technique is most often used to determine if a single variable has an impact on a given population?

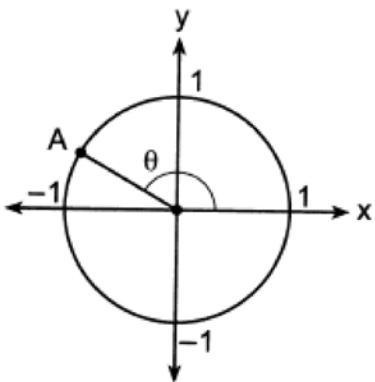
- 1) observational study
- 2) random survey
- 3) controlled experiment
- 4) formal interview

- 67 Which equation has roots of  $3 + i$  and  $3 - i$ ?

- 1)  $x^2 - 6x + 10 = 0$
- 2)  $x^2 + 6x - 10 = 0$
- 3)  $x^2 - 10x + 6 = 0$
- 4)  $x^2 + 10x - 6 = 0$

- 68 What is the solution set of  $x = \sqrt{3x + 40}$ ?
- 1)  $\{-5, 8\}$
  - 2)  $\{8\}$
  - 3)  $\{-4, 10\}$
  - 4)  $\{ \}$

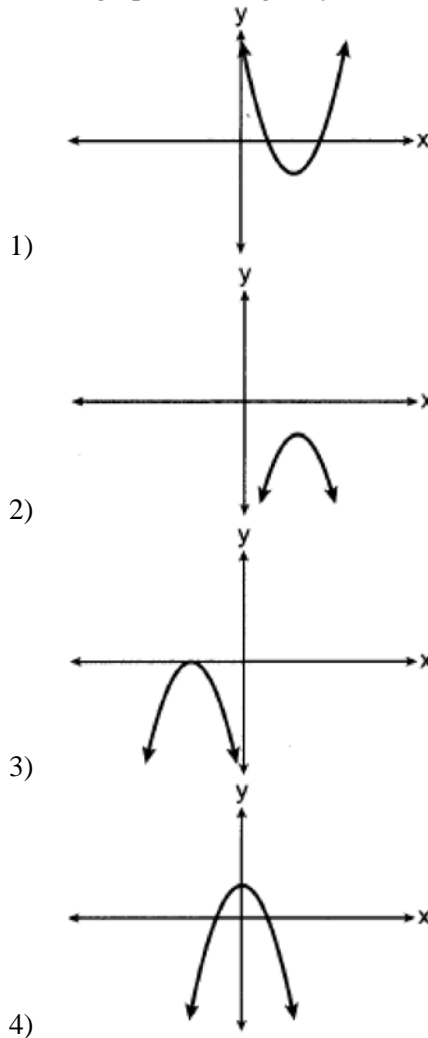
- 69 In the diagram of a unit circle below, point A,  $\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$ , represents the point where the terminal side of  $\theta$  intersects the unit circle.



What is  $m\angle\theta$ ?

- 1)  $30^\circ$
  - 2)  $120^\circ$
  - 3)  $135^\circ$
  - 4)  $150^\circ$
- 70 The monthly high temperature ( $^\circ\text{F}$ ) in Buffalo, New York can be modeled by  $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$ , where  $m$  is the number of the month and January = 1. Find the average rate of change in the monthly high temperature between June and October, to the nearest hundredth. Explain what this value represents in the given context.

- 71 Which graph has imaginary roots?



- 72 The population of bacteria,  $P(t)$ , in hundreds, after  $t$  hours can be modeled by the function  $P(t) = 37e^{0.0532t}$ . Determine whether the population is increasing or decreasing over time. Explain your reasoning.
- 73 Given  $P(A) = \frac{1}{3}$  and  $P(B) = \frac{5}{12}$ , where  $A$  and  $B$  are independent events, determine  $P(A \cap B)$ .

74 Given the polynomial identity  $x^6 + y^6 = (x^2 + y^2)(x^4 - x^2y^2 + y^4)$ , which equation must also be true for all values of  $x$  and  $y$ ?

- 1)  $x^6 + y^6 = x^2(x^4 - x^2y^2 + y^4) + y^2(x^4 - x^2y^2 + y^4)$
- 2)  $x^6 + y^6 = (x^2 + y^2)(x^2 - y^2)(x^2 - y^2)$
- 3)  $(x^3 + y^3)^2 = (x^2 + y^2)(x^4 - x^2y^2 + y^4)$
- 4)  $(x^6 + y^6) - (x^2 + y^2) = x^4 - x^2y^2 + y^4$

75 Which equation is equivalent to  $P = 210x^{\frac{4}{3}}y^{\frac{7}{3}}$

- 1)  $P = \sqrt[3]{210x^4y^7}$
- 2)  $P = 70xy^2\sqrt[3]{xy}$
- 3)  $P = 210xy^2\sqrt[3]{xy}$
- 4)  $P = 210xy^2\sqrt[3]{x^3y^5}$

76 For all values of  $x$  for which the expression is defined, write the expression below in simplest form.

$$\frac{2x^3 + x^2 - 18x - 9}{3x - x^2}$$

77 How many equations below are identities?

- $x^2 + y^2 = (x^2 - y^2) + (2xy)^2$
- $x^3 + y^3 = (x - y) + (x^2 - xy + y^2)$
- $x^4 + y^4 = (x - y)(x - y)(x^2 + y^2)$

- 1) 1
- 2) 2
- 3) 3
- 4) 0

78 Given  $\cos A = \frac{3}{\sqrt{10}}$  and  $\cot A = -3$ , determine the value of  $\sin A$  in radical form.

79 Given that  $\left(\frac{y^{\frac{17}{8}}}{y^{\frac{5}{4}}}\right)^{-4} = y^n$ , where  $y > 0$ , determine the value of  $n$ .

80 A Foucault pendulum can be used to demonstrate that the Earth rotates. The time,  $t$ , in seconds, that it takes for one swing or period of the pendulum

can be modeled by the equation  $t = 2\pi\sqrt{\frac{L}{g}}$  where

$L$  is the length of the pendulum in meters and  $g$  is a constant of  $9.81 \text{ m/s}^2$ . The first Foucault pendulum was constructed in 1851 and has a pendulum length of 67 m. Determine, to the *nearest tenth of a second*, the time it takes this pendulum to complete one swing. Another Foucault pendulum at the United Nations building takes 9.6 seconds to complete one swing. Determine, to the *nearest tenth of a meter*, the length of this pendulum.

81 What is the solution set of the equation

$$\frac{4}{k^2 - 8k + 12} = \frac{k}{k - 2} + \frac{1}{k - 6}?$$

- 1)  $\{-1, 6\}$
- 2)  $\{1, -6\}$
- 3)  $\{-1\}$
- 4)  $\{1\}$

82 Given the inverse function  $f^{-1}(x) = \frac{2}{3}x + \frac{1}{6}$ ,

which function represents  $f(x)$ ?

1)  $f(x) = -\frac{2}{3}x + \frac{1}{6}$

2)  $f(x) = -\frac{3}{2}x + \frac{1}{4}$

3)  $f(x) = \frac{3}{2}x - \frac{1}{4}$

4)  $f(x) = \frac{3}{2}x - \frac{1}{6}$

83 Mrs. Favata's statistics class wants to conduct a survey to see how students feel about changing the school mascot's name. Which plan is the best process for gathering an appropriate sample?

- 1) Survey students in a random sample of senior homerooms.
- 2) Survey every tenth student entering art classes in the school.
- 3) Survey every fourth student entering the cafeteria during each lunch period.
- 4) Survey all members of the school's varsity sports teams.

84 The population, in millions of people, of the United States can be represented by the recursive formula below, where  $a_0$  represents the population in 1910 and  $n$  represents the number of years since 1910.

$$a_0 = 92.2$$

$$a_n = 1.015a_{n-1}$$

Identify the percentage of the annual rate of growth from the equation  $a_n = 1.015a_{n-1}$ . Write an exponential function,  $P$ , where  $P(t)$  represents the United States population in millions of people, and  $t$  is the number of years since 1910. According to this model, determine algebraically the number of years it takes for the population of the United States to be approximately 300 million people. Round your answer to the *nearest year*.

85 Given  $x > 0$ , the expression  $\frac{x^{\frac{1}{5}}}{x^{\frac{1}{2}}}$  can be rewritten as

1)  $\sqrt[3]{x}$

2)  $-\sqrt[10]{x^3}$

3)  $\frac{1}{\sqrt[10]{x^3}}$

4)  $\sqrt[3]{x^{10}}$

86 For all values of  $x$  for which the expression is defined,  $\frac{x^2 + 3x}{x^2 + 5x + 6}$  is equivalent to

1)  $1 - \frac{x}{x+2}$

2)  $\frac{x}{x+2}$

3)  $\frac{3x}{5x+6}$

4)  $1 + \frac{1}{2x+6}$

87 The seventh term of the geometric sequence  $\sqrt{6}, -2\sqrt{3}, 2\sqrt{6}, -4\sqrt{3}, \dots$  is

1)  $6\sqrt{6}$

2)  $-6\sqrt{3}$

3)  $8\sqrt{6}$

4)  $-8\sqrt{3}$

88 If  $f(x) = (x^2 + 3x + 2)(x^2 - 4x + 3)$  and  $g(x) = x^2 - 9$ , then how many real solutions are there to the equation  $f(x) = g(x)$ ?

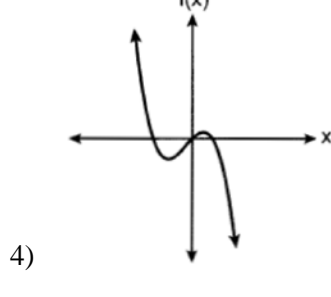
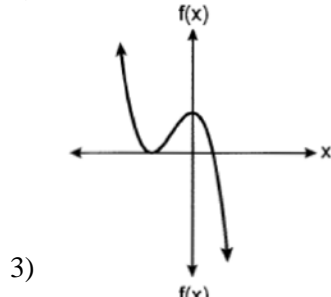
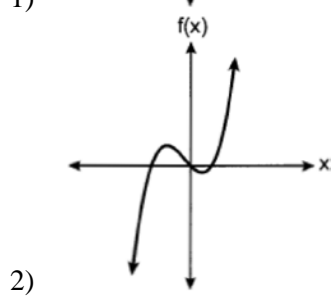
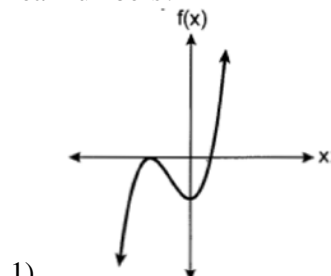
1) 1

2) 2

3) 6

4) 4

89 Which graph best represents the graph of  $f(x) = (x + a)^2(x - b)$ , where  $a$  and  $b$  are positive real numbers?



90 The business office of a local college wishes to determine the methods of payment that will be used by students when buying books at the beginning of a semester. Explain how the office can gather an appropriate sample that minimizes bias.

91 The expression  $\frac{x^2 + 12}{x^2 + 3}$  can be rewritten as

- 1)  $\frac{10}{x^2 + 3}$
- 2)  $1 + \frac{9}{x^2 + 3}$
- 3)  $x + 9$
- 4) 4

92 Which expression is equivalent to  $(x + yi)(x^2 - xyi - y^2)$ , where  $i$  is the imaginary unit?

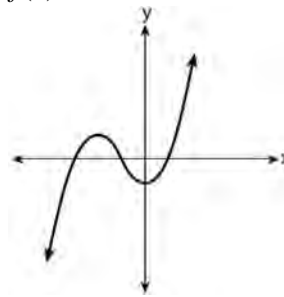
- 1)  $x^3 + y^3i$
- 2)  $x^3 - xy^2 - (xy^2 + y^3)i$
- 3)  $x^3 - 2xy^2 - y^3i$
- 4)  $x^3 - y^3i$

93 Consider the end behavior description below.

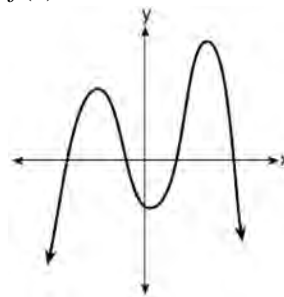
- as  $x \rightarrow -\infty, f(x) \rightarrow \infty$
- as  $x \rightarrow \infty, f(x) \rightarrow -\infty$

Which function satisfies the given conditions?

- 1)  $f(x) = x^4 + 2x^2 + 1$



- 3)  $f(x) = -x^3 + 2x - 6$



94 The population of Austin, Texas from 1850 to 2010 is summarized in the table below.

Year	1850	1870	1890	1910	1930	1950	1970	1990	2010
Population	629	4428	14,575	29,860	53,120	132,459	251,808	494,290	790,390

Over which period of time was the average rate of change in population the greatest?

- 1) 1850 to 1910
- 2) 1990 to 2010
- 3) 1950 to 1970
- 4) 1890 to 1970

95 Given  $x \neq -3$ , which expression is equivalent to

$$\frac{2x^3 + 3x^2 - 4x + 5}{x + 3}?$$

- 1)  $2x^3 + 9x^2 + 23x + 74$
- 2)  $2x^2 - 3x + 5 - \frac{10}{x + 3}$
- 3)  $2x^3 - 3x^2 + 5x - 10$
- 4)  $2x^2 + 9x + 23 + \frac{74}{x + 3}$

96 What are the zeros of

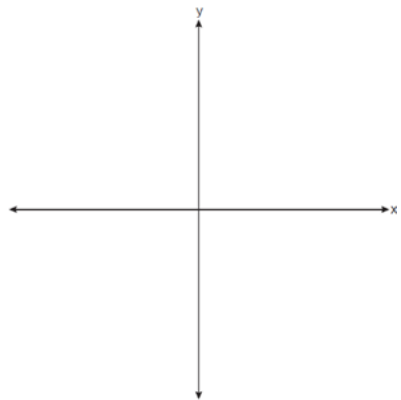
$$s(x) = x^4 - 9x^2 + 3x^3 - 27x - 10x^2 + 90?$$

- 1)  $\{-3, -2, 5\}$
- 2)  $\{-2, 3, 5\}$
- 3)  $\{-3, -2, 3, 5\}$
- 4)  $\{-5, -3, 2, 3\}$

97 Which statement about data collection is most accurate?

- 1) A survey about parenting styles given to every tenth student entering the library will provide unbiased results.
- 2) An observational study allows a researcher to determine the cause of an outcome.
- 3) Margin of error increases as sample size increases.
- 4) A survey collected from a random sample of students in a school can be used to represent the opinions of the school population.

98 Sketch  $p(x) = -\log_2(x + 3) + 2$  on the axes below.



Describe the end behavior of  $p(x)$  as  $x \rightarrow -3$ .  
Describe the end behavior of  $p(x)$  as  $x \rightarrow \infty$

99 The solution set for the equation  $\sqrt{3(x + 6)} = x$  is

- 1)  $\{6, -3\}$
- 2)  $\{-6, 3\}$
- 3)  $\{6\}$
- 4)  $\{-3\}$

100 Given  $y = -2x$  and  $x^2 + y^2 = 5$ , the point of intersection in Quadrant II is

- 1)  $(1, -2)$
- 2)  $(-2, 1)$
- 3)  $(-1, 1)$
- 4)  $(-1, 2)$



101 If  $f(x) = \frac{1}{2}x + 2$ , then the inverse function is

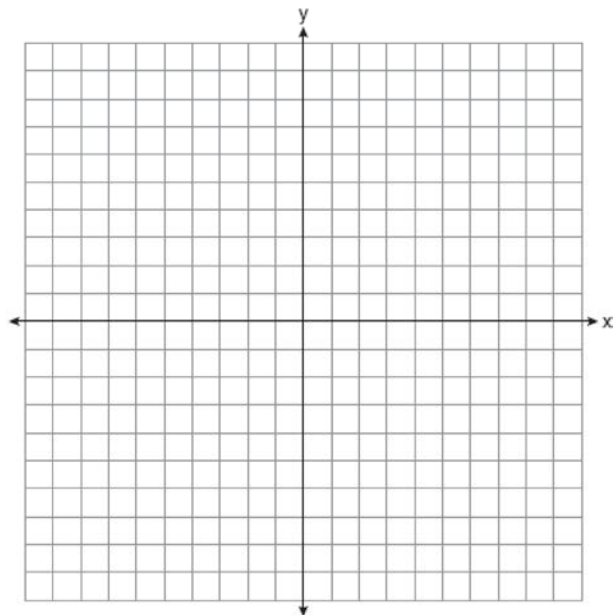
- 1)  $f^{-1}(x) = -\frac{1}{2}x - 2$
- 2)  $f^{-1}(x) = \frac{1}{2}x - 1$
- 3)  $f^{-1}(x) = 2x - 4$
- 4)  $f^{-1}(x) = 2x + 2$

102 The expression  $3i(ai - 6i^2)$  is equivalent to

- 1)  $3a + 18i$
- 2)  $3a - 18i$
- 3)  $-3a + 18i$
- 4)  $-3a - 18i$

103 Graph the following function on the axes below.

$$f(x) = \log_3(2 - x)$$

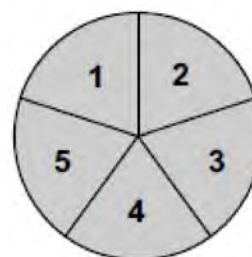


State the domain of  $f$ . State the equation of the asymptote.

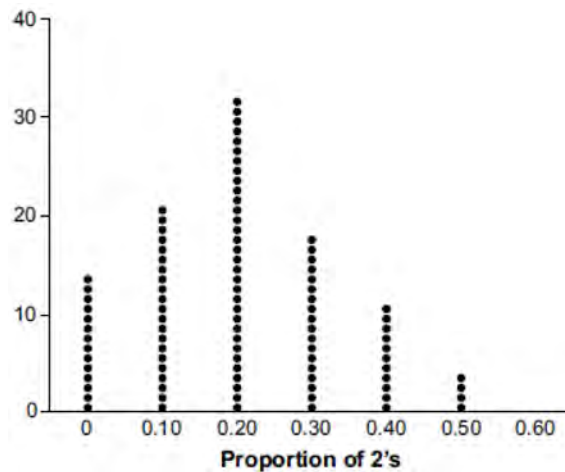
104 What is the total number of points of intersection of the graphs of the equations  $y = e^x$  and  $xy = 20$ ?

- 1) 1
- 2) 2
- 3) 3
- 4) 0

105 Joette is playing a carnival game. To win a prize, one has to correctly guess which of five equally sized regions a spinner will land on, as shown in the diagram below.

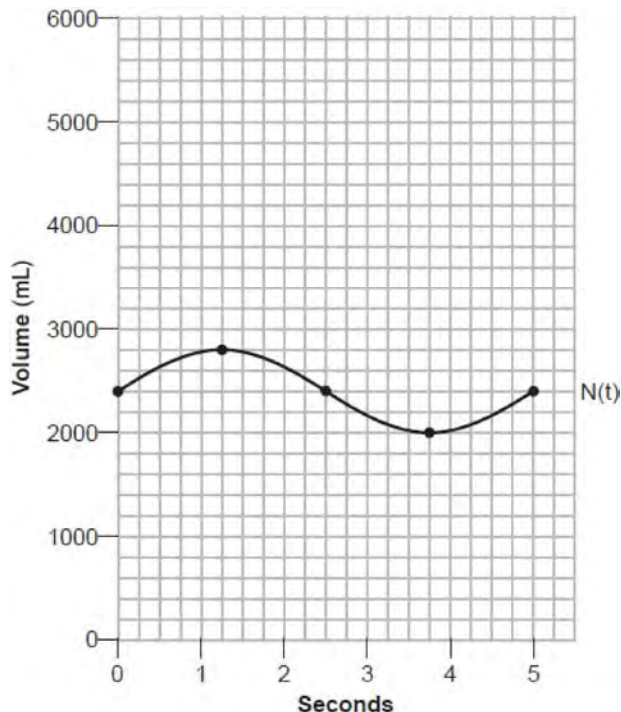


She complains that the game is unfair because her favorite number, 2, has only been spun once in ten times she played the game. State the proportion of 2's that were spun. State the theoretical probability of spinning a 2. The simulation output below shows the results of simulating ten spins of a fair spinner, repeated 100 times.



Does the output indicate that the carnival game was unfair? Explain your answer.

- 106 The volume of air in an average lung during breathing can be modeled by the graph below.



Using the graph, write an equation for  $N(t)$ , in the form  $N(t) = A \sin(Bt) + C$ . That same lung, when engaged in exercise, has a volume that can be modeled by  $E(t) = 2000 \sin(\pi t) + 3200$ , where  $E(t)$  is volume in mL and  $t$  is time in seconds. Graph *at least one* cycle of  $E(t)$  on the same grid as  $N(t)$ . How many times during the 5-second interval will  $N(t) = E(t)$ ?

- 107 Consider a cubic polynomial with the characteristics below.

- exactly one real root
- as  $x \rightarrow \infty, f(x) \rightarrow -\infty$

Given  $a > 0$  and  $b > 0$ , which equation represents a cubic polynomial with these characteristics?

- 1)  $f(x) = (x - a)(x^2 + b)$
- 2)  $f(x) = (a - x)(x^2 + b)$
- 3)  $f(x) = (a - x^2)(x^2 + b)$
- 4)  $f(x) = (x - a)(b - x^2)$

- 108 Given  $a > 0$ , solve the equation  $a^{x+1} = \sqrt[3]{a^2}$  for  $x$  algebraically.

- 109 Given  $f(x) = 2x^2 + 7x - 15$  and  $g(x) = 3 - 2x$ , what is  $\frac{f(x)}{g(x)}$  for all defined values?

- 1)  $-x - 5$
- 2)  $-x + 5$
- 3)  $x - 5$
- 4)  $x + 5$

- 110 Consider the system of equations below?

$$x + 2y - z = 1$$

$$-x - 3y + 2z = 0$$

$$2x - 4y + z = 10$$

What is the solution to the given system of equations?

- 1) (1, 1, 2)
- 2) (3, -1, 0)
- 3) (5, -1, 2)
- 4) (3, 5, 8)

- 111 For which approximate value(s) of  $x$  will

$$\log(x + 5) = |x - 1| - 3?$$

- 1) 5, 1
- 2) -2.41, 0.41
- 3) -2.41, 5
- 4) 5, only

- 112 The initial push of a child on a swing causes the swing to travel a total of 6 feet. Each successive swing travels 80% of the distance of the previous swing. Determine the total distance, to the *nearest hundredth of a foot*, a child travels in the first five swings.

- 113 The equation below can be used to model the height of a tide in feet,  $H(t)$ , on a beach at  $t$  hours.

$$H(t) = 4.8 \sin\left(\frac{\pi}{6}(t+3)\right) + 5.1$$

Using this function, the amplitude of the tide is

- 1)  $\frac{\pi}{6}$
  - 2) 4.8
  - 3) 3
  - 4) 5.1
- 114 The expression  $(x^2 + 3)^2 - 2(x^2 + 3) - 24$  is equivalent to
- 1)  $(x^2 + 9)(x^2 - 1)$
  - 2)  $(x^2 - 3)(x^2 + 7)$
  - 3)  $x^4 - 2x^2 - 21$
  - 4)  $x^4 + 4x^2 - 9$
- 115 A fruit fly population can be modeled by the equation  $P = 10(1.27)^t$ , where  $P$  represents the number of fruit flies after  $t$  days. What is the average rate of change of the population, rounded to the *nearest hundredth*, over the interval  $[0, 10.5]$ ? Include appropriate units in your answer.

- 116 The rational expression  $\frac{2x^4 - 5x^2 + 3x - 2}{x - 3}$  is

equivalent to

- 1)  $2x^3 - 5x - 12 - \frac{38}{x - 3}$
- 2)  $2x^3 + 6x^2 + 13x + 42 + \frac{124}{x - 3}$
- 3)  $2x^3 - 5x + 18 - \frac{56}{x - 3}$
- 4)  $2x^3 - 6x^2 + 13x - 36 + \frac{106}{x - 3}$

- 117 When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.

a) Assuming an initial value of 11,000 bacteria, write a function,  $p(t)$ , that can be used to model the population of bacteria,  $p$ , on a smartphone screen, where  $t$  represents the time in minutes after it is first observed under a microscope.

b) Using  $p(t)$  from part *a*, determine algebraically, to the *nearest hundredth of a minute*, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

- 118 Determine the solution of  $\sqrt{3x+7} = x - 1$  algebraically.

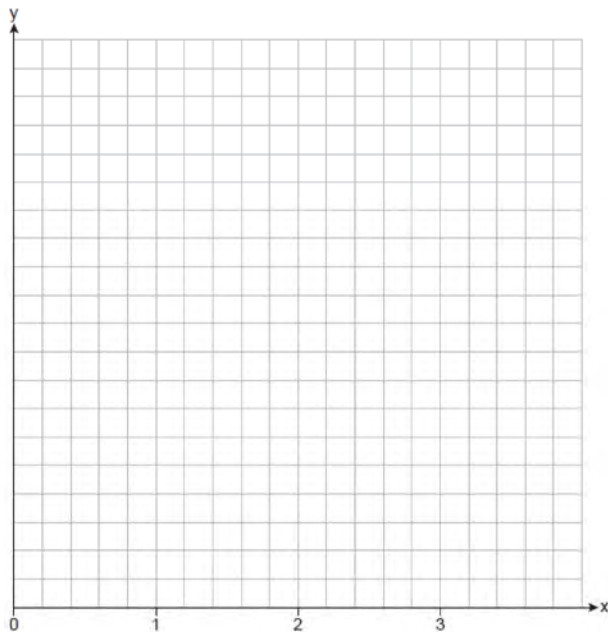
- 119 If  $f(x) = 12x - 4$ , then the inverse function  $f^{-1}(x)$  is

- 1)  $f^{-1}(x) = \frac{x+1}{3}$
- 2)  $f^{-1}(x) = \frac{x}{3} + 1$
- 3)  $f^{-1}(x) = \frac{x+4}{12}$
- 4)  $f^{-1}(x) = \frac{x}{12} + 4$

- 120 A group of high school students wanted to collect information on how many times per week students exercised. If they want the *least* biased results they should survey every fifth student at the school who is

- 1) entering the gym
- 2) in the junior class
- 3) entering the library
- 4) entering the building

- 121 The function  $v(x) = x(3-x)(x+4)$  models the volume, in cubic inches, of a rectangular solid for  $0 \leq x \leq 3$ . Graph  $y = v(x)$  over the domain  $0 \leq x \leq 3$ .



To the *nearest tenth of a cubic inch*, what is the maximum volume of the rectangular solid?

- 122 Solve algebraically for  $n$ :  $\frac{2}{n^2} + \frac{3}{n} = \frac{4}{n^2}$
- 123 Which statement regarding polynomials and their zeros is true?
- 1)  $f(x) = (x^2 - 1)(x + a)$  has zeros of 1 and  $-a$ , only.
  - 2)  $f(x) = x^3 - ax^2 + 16x - 16a$  has zeros of 4 and  $a$ , only.
  - 3)  $f(x) = (x^2 + 25)(x + a)$  has zeros of  $\pm 5$  and  $-a$ .
  - 4)  $f(x) = x^3 - ax^2 - 9x + 9a$  has zeros of  $\pm 3$  and  $a$ .

- 124 The scores on a collegiate mathematics readiness assessment are approximately normally distributed with a mean of 680 and a standard deviation of 120. Determine the percentage of scores between 690 and 900, to the *nearest percent*.

- 125 Given 3 is a root of  $f(x) = x^4 - x^3 - 21x^2 + 45x$ , what are the other unique roots of  $f(x)$ ?
- 1)  $-5$ , only
  - 2)  $-5$  and 0
  - 3)  $-3$ , 1 and 5
  - 4)  $-5$ ,  $-3$  and 0

- 126 Monthly mortgage payments can be found using the formula below, where  $M$  is the monthly payment,  $P$  is the amount borrowed,  $r$  is the annual interest rate, and  $n$  is the total number of monthly payments.

$$M = \frac{P \left( \frac{r}{12} \right) \left( 1 + \frac{r}{12} \right)^n}{\left( 1 + \frac{r}{12} \right)^n - 1}$$

If Adam takes out a 15-year mortgage, borrowing \$240,000 at an annual interest rate of 4.5%, his monthly payment will be

- 1) \$1379.09
  - 2) \$1604.80
  - 3) \$1835.98
  - 4) \$9011.94
- 127 A researcher wants to determine if room-darkening shades cause people to sleep longer. Which method of data collection is most appropriate?
- 1) census
  - 2) survey
  - 3) observation study
  - 4) controlled experiment

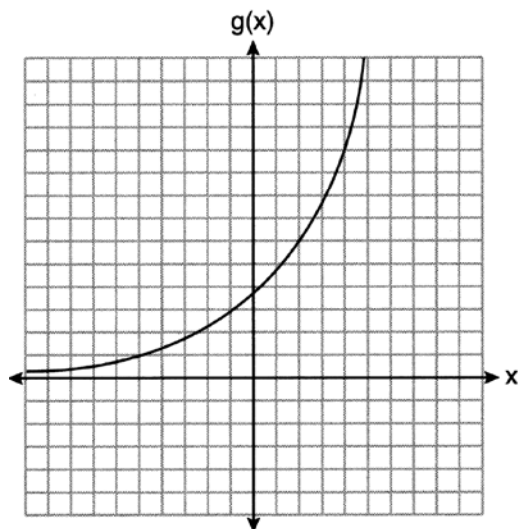
- 128 The Hot and Tasty Coffee chain conducts a survey of its customers at its location at the Staten Island ferry terminal. After the survey is completed, the statistical consultant states that 70% of customers who took the survey said the most important factor in choosing where to get their coffee is how fast they are served. Based on this result, Hot and Tasty Coffee can infer that
- 1) most of its customers in New York State care most about being served quickly
  - 2) coffee drinkers care less about taste and more about being served quickly
  - 3) most of its customers at the Staten Island ferry terminal care most about being served quickly
  - 4) most of its customers at transportation terminals and stations care most about being served quickly
- 129 Which equation represents a parabola with a focus of  $(4, -3)$  and directrix of  $y = 1$ ?
- 1)  $(x - 1)^2 = 4(y + 3)$
  - 2)  $(x - 1)^2 = -8(y - 3)$
  - 3)  $(x + 4)^2 = 4(y - 3)$
  - 4)  $(x - 4)^2 = -8(y + 1)$
- 130 Stone Manufacturing has developed a cost model,  $C(x) = 0.18x^3 + 0.02x^2 + 4x + 180$ , where  $x$  is the number of sprockets sold, in thousands. The sales price can be modeled by  $S(x) = 95.4 - 6x$  and the company's revenue by  $R(x) = x \bullet S(x)$ . The company's profits,  $R(x) - C(x)$ , could be modeled by
- 1)  $0.18x^3 + 6.02x^2 + 91.4x + 180$
  - 2)  $0.18x^3 - 5.98x^2 - 91.4x + 180$
  - 3)  $-0.18x^3 - 6.02x^2 + 91.4x - 180$
  - 4)  $0.18x^3 + 5.98x^2 + 99.4x + 180$
- 131 Solve algebraically for all values of  $x$ :  
 $\sqrt{4x + 1} = 11 - x$
- 132 As  $\theta$  increases from  $-\frac{\pi}{2}$  to 0 radians, the value of  $\cos \theta$  will
- 1) decrease from 1 to 0
  - 2) decrease from 0 to  $-1$
  - 3) increase from  $-1$  to 0
  - 4) increase from 0 to 1
- 133 Which function represents exponential decay?
- 1)  $p(x) = \left(\frac{1}{4}\right)^{-x}$
  - 2)  $q(x) = 1.8^{-x}$
  - 3)  $r(x) = 2.3^{2x}$
  - 4)  $s(x) = 4^{\frac{x}{2}}$
- 134 Given  $p \neq q$ ,  $p = \left(\frac{1}{2}\right)^q$ , expressed in logarithmic form, is equivalent to
- 1)  $\log_p\left(\frac{1}{2}\right) = q$
  - 2)  $\log_q(p) = \frac{1}{2}$
  - 3)  $\log_{\frac{1}{2}}(p) = q$
  - 4)  $\log_{\frac{1}{2}}(q) = p$
- 135 Which expression is equivalent to  $\frac{2x^3 + 2x - 7}{2x + 4}$ ?
- 1)  $x^2 - 2x + 5 - \frac{27}{2x + 4}$
  - 2)  $x^2 - 1 - \frac{3}{2x + 4}$
  - 3)  $x^2 + 2x + 5 + \frac{13}{2x + 4}$
  - 4)  $x^2 + 2x - 3 + \frac{5}{2x + 4}$

136 A cup of coffee is left out on a countertop to cool. The table below represents the temperature,  $F(t)$ , in degrees Fahrenheit, of the coffee after it is left out for  $t$  minutes.

$t$	0	5	10	15	20	25
$F(t)$	180	144	120	104	93.3	86.2

Based on these data, write an exponential regression equation,  $F(t)$ , to model the temperature of the coffee. Round all values to the nearest thousandth.

137 Consider the graph of  $g$  and the table representing  $t$  below.



$x$	$t(x)$
-1	3
0	5
1	2
2	-5
3	-1
4	3

Over the interval  $[2,4]$ , which statement regarding the average rate of change for  $g$  and  $t$  is true?

- 1)  $g$  has a greater average rate of change.
- 2) The average rates of change are equal.
- 3) The average rate of change for  $g$  is twice the average rate of change for  $t$ .
- 4) The average rate of change for  $g$  is half the average rate of change for  $t$ .

138 Algebraically determine the values of  $x$  that satisfy the system of equations below:

$$y = x^2 + 8x - 5$$

$$y = 8x - 4$$

140 Natalia's teacher has given her the following information about angle  $\theta$ .

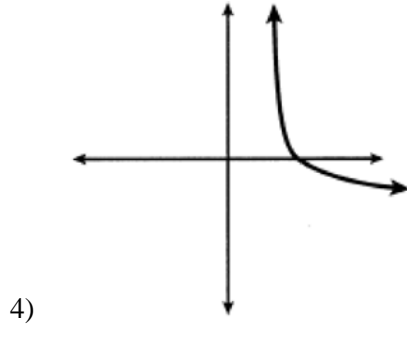
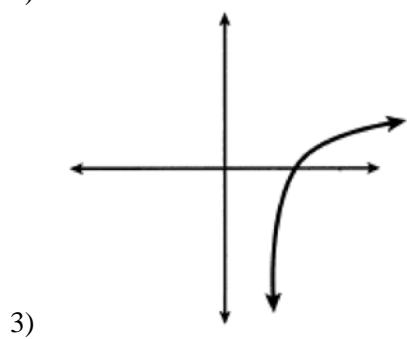
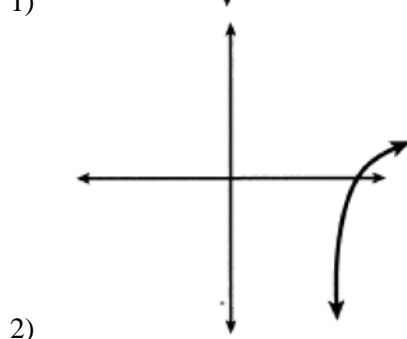
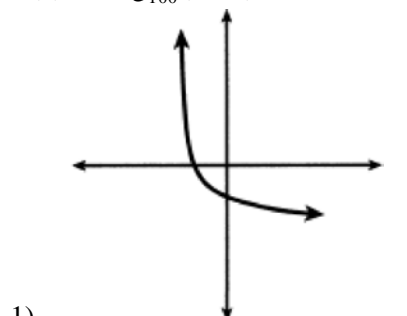
- $\pi < \theta < 2\pi$

- $\cos \theta = \frac{\sqrt{3}}{4}$

Explain how Natalia can determine if the value of  $\tan \theta$  is positive or negative.

139 Given  $i$  is the imaginary unit, simplify  $(5xi^3 - 4i)^2$  as a polynomial in standard form.

141 Which sketch could represent the function  $m(x) = -\log_{100}(x - 2)$ ?

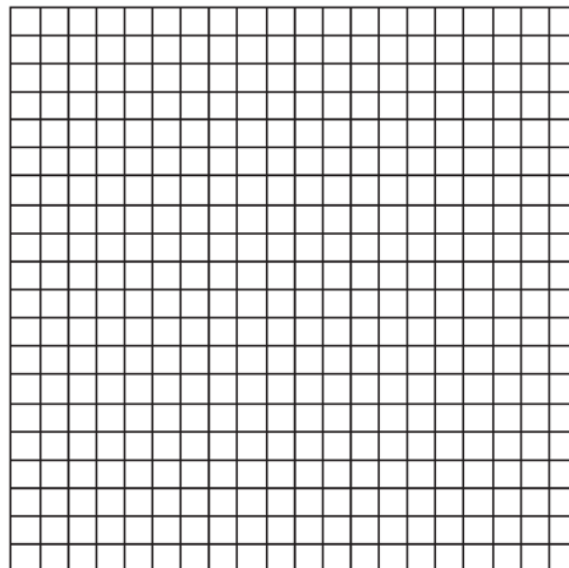


142 The polynomial function  $g(x) = x^3 + ax^2 - 5x + 6$  has a factor of  $(x - 3)$ . Determine the value of  $a$ .

143 Audra is interested in studying the number of students entering kindergarten in the Ahlville Central School District over the next several years. Using data dating back to 2015, she determines that the number of kindergarteners is decreasing at an exponential rate. She creates a formula to model this situation  $y = a(b)^x$ , where  $x$  is the number of years since 2015 and  $y$  is the number of students entering kindergarten. If there were 105 students entering kindergarten in Ahlville in 2015, which statement about Audra's formula is true?

- 1)  $a$  is positive and  $b$  is negative.
- 2)  $a$  is negative and  $b$  is positive.
- 3) Both  $a$  and  $b$  are positive.
- 4) Both  $a$  and  $b$  are negative.

144 The parabola  $y = -\frac{1}{20}(x - 3)^2 + 6$  has its focus at  $(3, 1)$ . Determine and state the equation of the directrix. (The use of the grid below is optional.)

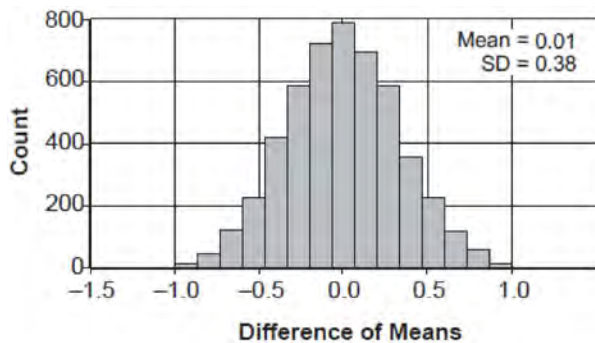


145 The table below gives air pressures in kPa at selected altitudes above sea level measured in kilometers.

<b>x</b>	<b>Altitude (km)</b>	0	1	2	3	4	5
<b>y</b>	<b>Air Pressure (kPa)</b>	101	90	79	70	62	54

Write an exponential regression equation that models these data rounding all values to the *nearest thousandth*. Use this equation to algebraically determine the altitude, to the *nearest hundredth* of a kilometer, when the air pressure is 29 kPa.

146 Two classes of students were entered into an experiment to see whether using an interactive whiteboard leads to better grades. It was observed that the mean grade of students in the class with the interactive whiteboard was 0.6 points higher than the class without it. To determine if the observed difference is statistically significant, the classes were rerandomized 5000 times to study these random differences in the mean grades. The output of the simulation is summarized in the histogram below.



Determine an interval containing the middle 95% of the simulation results. Round your answer to the *nearest hundredth*. Does the interval indicate that the difference between the classes' grades is significant? Explain.

147 Does the equation  $x^2 - 4x + 13 = 0$  have imaginary solutions? Justify your answer.

148 Solve the equation  $\sqrt{49 - 10x} + 5 = 2x$  algebraically.

149 If  $\theta$  is an angle in standard position whose terminal side passes through the point  $(-2, -3)$ , what is the numerical value of  $\tan \theta$ ?

- 1)  $\frac{2}{3}$
- 2)  $\frac{3}{2}$
- 3)  $-\frac{2}{\sqrt{13}}$
- 4)  $-\frac{3}{\sqrt{13}}$

150 Written in simplest form, the fraction  $\frac{x^3 - 9x}{9 - x^2}$ ,

where  $x \neq \pm 3$ , is equivalent to

- 1)  $-x$
- 2)  $x$
- 3)  $\frac{-x(x + 3)}{(3 + x)}$
- 4)  $\frac{x(x - 3)}{(3 - x)}$

151 Factor the expression  $2x^3 - 3x^2 - 18x + 27$  completely.



- 152 Consider the system below.

$$x + y + z = 9$$

$$x - y - z = -1$$

$$x - y + z = 21$$

Which value is *not* in the solution,  $(x, y, z)$ , of the system?

- 1) -8
- 2) -6
- 3) 11
- 4) 4

- 153 A recursive formula for the sequence 64, 48, 36, ... is

- 1)  $a_n = 64(0.75)^{n-1}$

- 2)  $a_1 = 64$

$$a_n = a_{n-1} - 16$$

- 3)  $a_n = 64 + (n-1)(-16)$

- 4)  $a_1 = 64$

$$a_n = 0.75a_{n-1}$$

- 154 John and Margaret deposit \$500 into a savings account for their son on his first birthday. They continue to make a deposit of \$500 on the child's birthday, with the last deposit being made on the child's 21st birthday. If the account pays 4% annual interest, which equation represents the amount of money in the account after the last deposit is made?

- 1)  $S_{21} = 500(1.04)^{21}$

- 2)  $S_{21} = \frac{500(1 - 1.04^{21})}{1 - 1.04}$

- 3)  $S_{21} = 500(1.04)^{20} + 500$

- 4)  $S_{21} = \frac{500(1 - 0.04^{21})}{1 - 1.04}$

- 155 Chet has \$1200 invested in a bank account modeled by the function
- $P(n) = 1200(1.002)^n$
- , where
- $P(n)$
- is the value of his account, in dollars, after
- $n$
- months. Chet's debt is modeled by the function
- $Q(n) = 100n$
- , where
- $Q(n)$
- is the value of debt, in dollars, after
- $n$
- months. After
- $n$
- months, which function represents Chet's net worth,
- $R(n)$
- ?

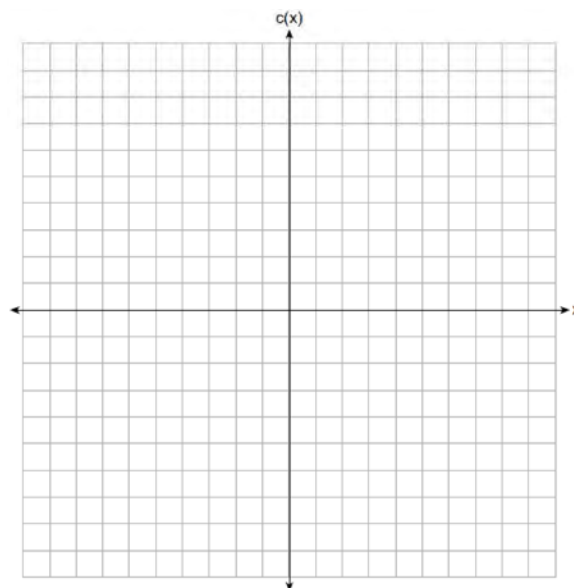
- 1)  $R(n) = 1200(1.002)^n + 100n$

- 2)  $R(n) = 1200(1.002)^{12n} + 100n$

- 3)  $R(n) = 1200(1.002)^n - 100n$

- 4)  $R(n) = 1200(1.002)^{12n} - 100n$

- 156 Graph
- $c(x) = -9(3)^{x-4} + 2$
- on the axes below.



Describe the end behavior of  $c(x)$  as  $x$  approaches positive infinity. Describe the end behavior of  $c(x)$  as  $x$  approaches negative infinity.

- 157 The sum of the first 20 terms of the series

$$-2 + 6 - 18 + 54 - \dots$$

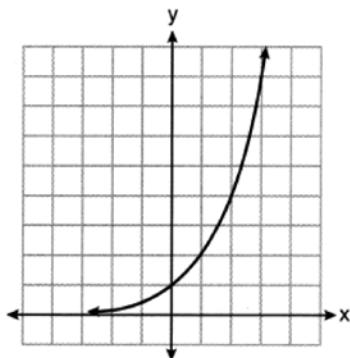
- 1) -610

- 2) -59

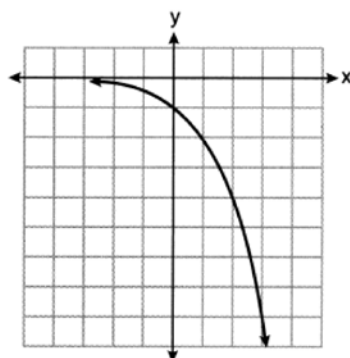
- 3) 1,743,392,200

- 4) 2,324,522,934

- 158 Consider the function  $y = h(x)$ , defined by the graph below.



Which equation could be used to represent the graph shown below?



- 1)  $y = h(x) - 2$
- 2)  $y = h(x - 2)$
- 3)  $y = -h(x)$
- 4)  $y = h(-x)$

- 159 Which expression is equivalent to

$$(x + 2)^2 - 5(x + 2) + 6?$$

- 1)  $x(x - 1)$
- 2)  $(x - 3)(x - 2)$
- 3)  $(x - 4)(x + 3)$
- 4)  $(x - 6)(x + 1)$

- 160 The growth of a \$500 investment can be modeled by the function  $P(t) = 500(1.03)^t$ , where  $t$  represents time in years. In terms of the monthly rate of growth, the value of the investment can be best approximated by

- 1)  $P(t) = 500(1.00247)^{12t}$
- 2)  $P(t) = 500(1.00247)^t$
- 3)  $P(t) = 500(1.03)^{12t}$
- 4)  $P(t) = 500(1.03)^{\frac{t}{12}}$

- 161 A company wishes to determine the cooking time for one pound of spaghetti. The company's technicians cooked one pound of spaghetti and recorded the time needed for the spaghetti to be ready to eat. Repeating this process 35 times resulted in an approximately normal distribution, with a mean of 9.82 minutes and a standard deviation of 1.4 minutes. In which interval should the middle 95% of cooking times fall?

- 1) (8.42, 11.22)
- 2) (7.02, 12.62)
- 3) (9.35, 10.29)
- 4) (6.82, 11.32)

- 162 A tree farm initially has 150 trees. Each year, 20% of the trees are cut down and 80 seedlings are planted. Which recursive formula models the number of trees,  $a_n$ , after  $n$  years?

- 1)  $a_1 = 150$   
 $a_n = a_{n-1}(0.2) + 80$
- 2)  $a_1 = 150$   
 $a_n = a_{n-1}(0.8) + 80$
- 3)  $a_n = 150(0.2)^n + 80$
- 4)  $a_n = 150(0.8)^n + 80$

- 163 For all real values of  $x$ , if  $f(x) = (x - 3)^2$  and  $g(x) = (x + 3)^2$ , what is  $f(x) - g(x)$ ?
- 1)  $-18$
  - 2)  $0$
  - 3)  $-12x$
  - 4)  $2x^2 - 12x - 18$

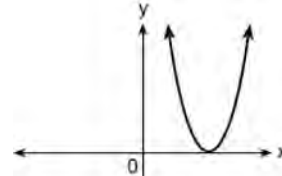
- 164 The solution set of  $\frac{x+3}{x-5} + \frac{6}{x+2} = \frac{6+10x}{(x-5)(x+2)}$  is
- 1)  $\{-6\}$
  - 2)  $\{5\}$
  - 3)  $\{-6, 5\}$
  - 4)  $\{-5, 6\}$

- 165 Given  $f(x) = x^4 - x^3 - 6x^2$ , for what values of  $x$  will  $f(x) > 0$ ?
- 1)  $x < -2$ , only
  - 2)  $x < -2$  or  $x > 3$
  - 3)  $x < -2$  or  $0 \leq x \leq 3$
  - 4)  $x > 3$ , only

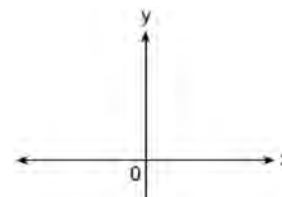
- 166 A local university has a current enrollment of 12,000 students. The enrollment is increasing continuously at a rate of 2.5% each year. Which logarithm is equal to the number of years it will take for the population to increase to 15,000 students?
- 1)  $\frac{\ln 1.25}{0.25}$
  - 2)  $\frac{\ln 3000}{0.025}$
  - 3)  $\frac{\ln 1.25}{2.5}$
  - 4)  $\frac{\ln 1.25}{0.025}$

- 167 The roots of the equation  $x^2 - 4x = -13$  are
- 1)  $2 \pm 3i$
  - 2)  $2 \pm 6i$
  - 3)  $2 \pm \sqrt{17}$
  - 4)  $2 \pm \sqrt{13}$

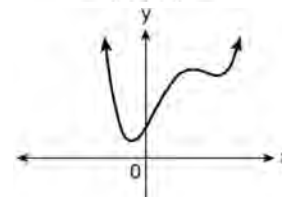
- 168 Which graph shows a quadratic function with two imaginary zeros?



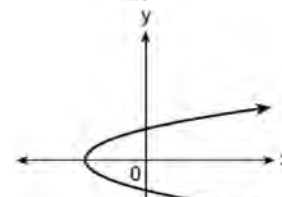
1)



2)

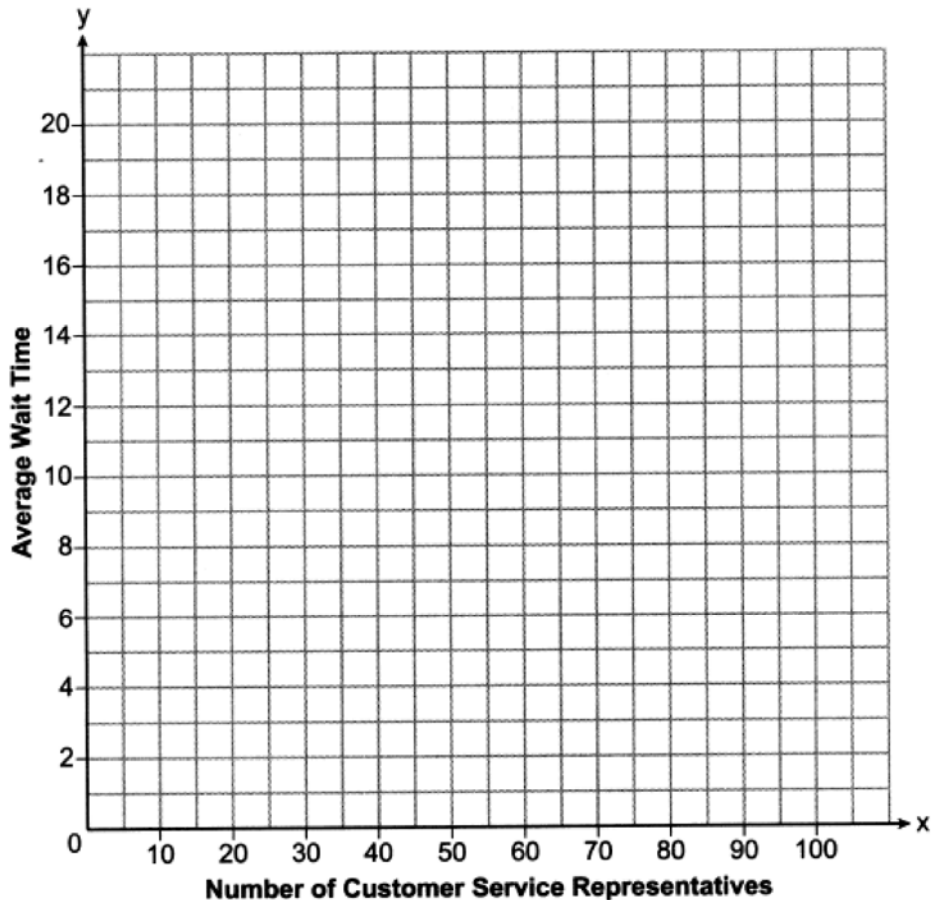


3)



4)

169 A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function  $A(x) = 15.7(0.98)^x$  and plan B can be modeled by the function  $B(x) = 11(0.99)^x$  where  $x$  is the number of customer service representatives employed by the company and  $A(x)$  and  $B(x)$  represent the average wait time, in minutes, of each customer. Graph  $A(x)$  and  $B(x)$  in the interval  $0 \leq x \leq 100$  on the set of axes below.



To the *nearest integer*, solve the equation  $A(x) = B(x)$ . Determine, to the *nearest minute*,  $B(100) - A(100)$ . Explain what this value represents in the given context.

170 A population is normally distributed with a mean of 23 and a standard deviation of 1.2. The percentage of the population that falls below 21, to the *nearest hundredth*, is

- 1) 0.05
- 2) 4.78
- 3) 8.29
- 4) 91.30

171 Solve the following system of equations algebraically for  $x$ ,  $y$ , and  $z$ .

$$2x + 4y - 3z = 12$$

$$3x - 2y + 2z = -9$$

$$-x + y - 3z = 0$$



177 Consider the data in the table below.

<b>x</b>	1	2	3	4	5	6
<b>y</b>	3.9	6	11	18.1	28	40.3

State an exponential regression equation to model these data, rounding all values to the *nearest thousandth*.

178 The heights of the students at Central High School can be modeled by a normal distribution with a mean of 68.1 and a standard deviation of 3.4 inches. According to this model, approximately what percent of the students would have a height less than 60 inches or greater than 75 inches?

- 1) 0.86%
- 2) 1.26%
- 3) 2.12%
- 4) 2.98%

179 The George family would like to borrow \$45,000 to purchase a new boat. They qualified for a loan with an annual interest rate of 6.75%. The monthly loan payment can be found using the formula below.

$$M = \frac{P\left(\frac{r}{12}\right)\left(1 + \frac{r}{12}\right)^n}{\left(1 + \frac{r}{12}\right)^n - 1}$$

$M$  = monthly payment

$P$  = amount borrowed

$r$  = annual interest rate

$n$  = number of monthly payments

What is the monthly payment if they would like to pay off the loan in five years?

- 1) \$262.99
- 2) \$252.13
- 3) \$915.24
- 4) \$885.76

180 The Manford family started savings accounts for their twins, Abby and Brett, on the day they were born. They invested \$8000 in an account for each child. Abby's account pays 4.2% annual interest compounded quarterly. Brett's account pays 3.9% annual interest compounded continuously. Write a function,  $A(t)$ , for Abby's account and a function,  $B(t)$ , for Brett's account that calculates the value of each account after  $t$  years. Determine who will have more money in their account when the twins turn 18 years old, and find the difference in the amounts in the accounts to the *nearest cent*. Algebraically determine, to the *nearest tenth of a year*, how long it takes for Brett's account to triple in value.

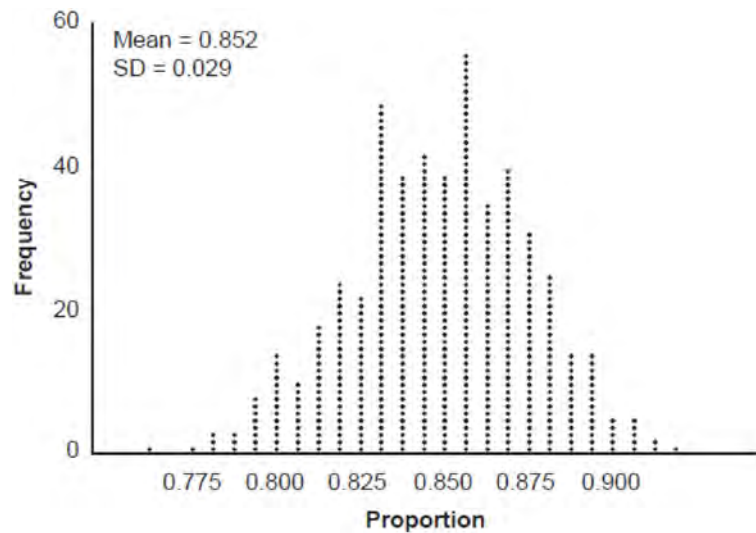
181 The equations  $y = 3t + 6$  and  $y = (1.82)^t$  approximately model the growth of two separate populations where  $t > 0$ . What is the best approximation of the time,  $t$ , at which the populations are the same?

- 1) -1.9
- 2) 0.3
- 3) 5.1
- 4) 21.3

182 A parabola has a directrix of  $y = 3$  and a vertex at  $(2, 1)$ . Which ordered pair is the focus of the parabola?

- 1)  $(2, -1)$
- 2)  $(2, 0)$
- 3)  $(2, 2)$
- 4)  $(2, 5)$

- 183 An app design company believes that the proportion of high school students who have purchased apps on their smartphones in the past 3 months is 0.85. A simulation of 500 samples of 150 students was run based on this proportion and the results are shown below.



Suppose a sample of 150 students from your high school showed that 88% of students had purchased apps on their smartphones in the past 3 months. Based on the simulation, would the results from your high school give the app design company reason to believe their assumption is *incorrect*? Explain.

- 184 A cafeteria food manager studied the lunchtime eating habits of a group of employees in their office building. The purpose of the study was to determine the proportion of employees who purchased lunch in the cafeteria, brought their lunch from home, or purchased lunch from an outside vendor. This collection of data would best be classified as
- 1) a census
  - 2) an experiment
  - 3) an observational study
  - 4) a simulation

- 186 The equation of the parabola that has its focus at the point  $(-3, 2)$  and directrix at  $y = 0$  is

- 1)  $y = \frac{1}{4}(x + 3)^2 + 1$
- 2)  $y = \frac{1}{4}(x - 3)^2 + 1$
- 3)  $y = \frac{1}{8}(x + 3)^2 + 1$
- 4)  $y = \frac{1}{8}(x - 3)^2 + 1$

- 185 Write  $\frac{x\sqrt{x^3}}{\sqrt[3]{x^5}}$  as a single term in simplest form, with a rational exponent.

- 187 Factor the expression  $x^3 - 2x^2 - 9x + 18$  completely.





- 194 The relative frequency table shows the proportion of a population who have a given eye color and the proportion of the same population who wear glasses.

	<b>Wear Glasses</b>	<b>Don't Wear Glasses</b>
<b>Blue Eyes</b>	0.14	0.26
<b>Brown Eyes</b>	0.11	0.24
<b>Green Eyes</b>	0.10	0.15

Given the data, are the events of having blue eyes and wearing glasses independent? Justify your answer.

- 195 The expression  $\frac{x^4 - 5x^2 + 4x + 14}{x + 2}$  is equivalent to

- 1)  $x^3 - 2x^2 - x + 6 + \frac{2}{x + 2}$
- 2)  $x^3 - 5x + 4 - \frac{14}{x + 2}$
- 3)  $x^3 + 2x^2 - x + 2 + \frac{18}{x + 2}$
- 4)  $x^3 + 2x^2 - 9x + 22 - \frac{30}{x + 2}$

- 196 Given  $x$  and  $y$  are positive, which expressions are equivalent to  $\frac{x^3}{y}$ ?

I.  $\left(\frac{y}{x^3}\right)^{-1}$     II.  $\sqrt[3]{x^9}(y^{-1})$     III.  $\frac{x^{64}\sqrt{y^8}}{x^3y^3}$

- 1) I and II, only
- 2) I and III, only
- 3) II and III, only
- 4) I, II, and III

- 197 What is the solution for the system of equations below?

$$\begin{aligned}x + y + z &= 2 \\x - 2y - z &= -4 \\x - 9y + z &= -18\end{aligned}$$

- 1)  $(-2, 2, 2)$
- 2)  $(-2, -2, 6)$
- 3)  $(0, 2, 0)$
- 4)  $(0, 2, 4)$

- 198 If  $f(t) = 50(.5)^{\frac{t}{5715}}$  represents a mass, in grams, of carbon-14 remaining after  $t$  years, which statement(s) must be true?

I. The mass of the carbon-14 is decreasing by half each year.

II. The mass of the original sample is 50 g.

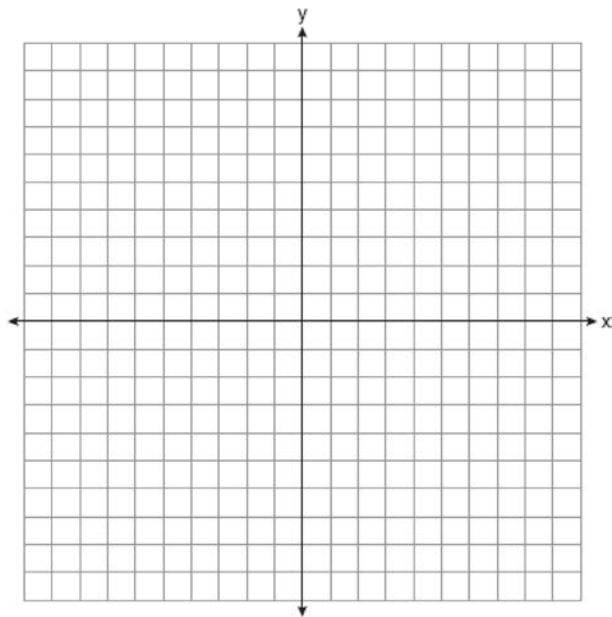
- 1) I, only
- 2) II, only
- 3) I and II
- 4) neither I nor II

- 199 Luminescence is the emission of light that is not caused by heat. A luminescent substance decays according to the function below.

$$I = I_0 e^{3\left(-\frac{t}{0.6}\right)}$$

This function can be best approximated by

- 1)  $I = I_0 e^{\left(-\frac{t}{0.18}\right)}$
  - 2)  $I = I_0 e^{5t}$
  - 3)  $I = I_0 (0.0067)^t$
  - 4)  $I = I_0 (0.0497)^{0.6t}$
- 200 Graph  $y = x^3 - 4x^2 + 2x + 7$  on the set of axes below.



- 201 Mia has a student loan that is in deferment, meaning that she does not need to make payments right now. The balance of her loan account during her deferment can be represented by the function  $f(x) = 35,000(1.0325)^x$ , where  $x$  is the number of years since the deferment began. If the bank decides to calculate her balance showing a monthly growth rate, an approximately equivalent function would be

- 1)  $f(x) = 35,000(1.0027)^{12x}$
- 2)  $f(x) = 35,000(1.0027)^{\frac{x}{12}}$
- 3)  $f(x) = 35,000(1.0325)^{12x}$
- 4)  $f(x) = 35,000(1.0325)^{\frac{x}{12}}$

- 202 What is the value of  $\tan \theta$  when  $\sin \theta = \frac{2}{5}$  and  $\theta$  is in quadrant II?

- 1)  $-\frac{\sqrt{21}}{5}$
- 2)  $-\frac{\sqrt{21}}{2}$
- 3)  $\frac{-2}{\sqrt{21}}$
- 4)  $\frac{2}{\sqrt{21}}$

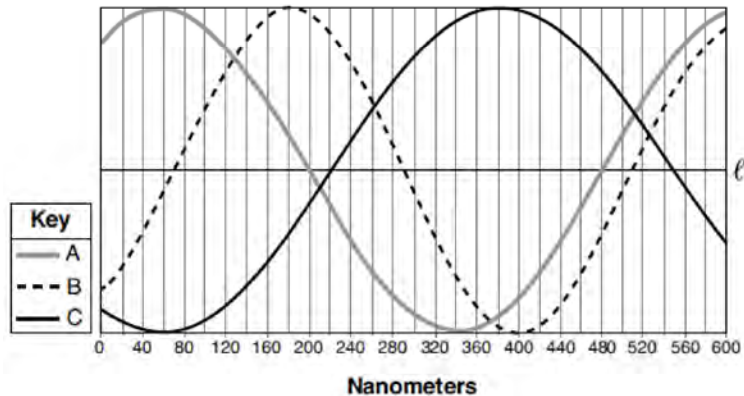
- 203 How many real solutions exist for the system of equations below?

$$y = \frac{1}{4}x - 8$$

$$y = \frac{1}{2}x^2 + 2x$$

- 1) 1
- 2) 2
- 3) 3
- 4) 0

204 Visible light can be represented by sinusoidal waves. Three visible light waves are shown in the graph below. The midline of each wave is labeled  $\ell$ .



Based on the graph, which light wave has the longest period? Justify your answer.

205 The expression  $\sqrt[4]{81x^8y^6}$  is equivalent to

- 1)  $3x^2y^{\frac{3}{2}}$
- 2)  $3x^4y^2$
- 3)  $9x^2y^{\frac{3}{2}}$
- 4)  $9x^4y^2$

208 For  $f(x) = \cos x$ , which statement is true?

- 1)  $2f(x)$  and  $f(2x)$  are even functions.
- 2)  $f(2x)$  and  $f(x) + 2$  are odd functions.
- 3)  $2f(x)$  and  $f\left(x + \frac{\pi}{2}\right)$  are odd functions.
- 4)  $f(x) + 2$  is an odd function and  $f\left(x + \frac{\pi}{2}\right)$  is an even function.

206 The expression  $\left(a^3\sqrt{2b^2}\right)\left(\sqrt[3]{4a^2b}\right)$  is equivalent

to

- 1)  $2ab^3\sqrt{a^2}$
- 2)  $2ab$
- 3)  $2ab^3\sqrt{2a^2}$
- 4)  $2a^2b^3\sqrt{2b}$

209 What is the solution of  $2(3^{x+4}) = 56$ ?

- 1)  $x = \log_3(28) - 4$
- 2)  $x = -1$
- 3)  $x = \log(25) - 4$
- 4)  $x = \frac{\log(56)}{\log(6)} - 4$

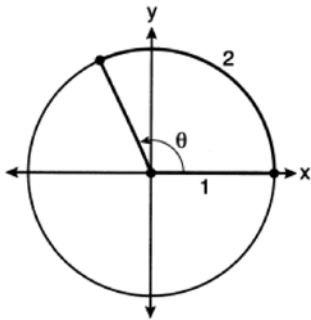
207 Solve for  $x$  algebraically:

$$\frac{1}{x-6} + \frac{x}{x-2} = \frac{4}{x^2 - 8x + 12}$$

210 Algebraically solve the system:

$$\begin{aligned} (x-2)^2 + (y-3)^2 &= 20 \\ y &= -2x + 7 \end{aligned}$$

- 211 An angle,  $\theta$ , is rotated counterclockwise on the unit circle, with its terminal side in the second quadrant, as shown in the diagram below.



Which value represents the radian measure of angle  $\theta$ ?

- 1) 1
  - 2) 2
  - 3) 65.4
  - 4) 114.6
- 212 Which value, to the nearest tenth, is the *smallest* solution of  $f(x) = g(x)$  if  $f(x) = 3 \sin\left(\frac{1}{2}x\right) - 1$  and  $g(x) = x^3 - 2x + 1$ ?
- 1) -3.6
  - 2) -2.1
  - 3) -1.8
  - 4) 1.4
- 213 The amount of a substance,  $A(t)$ , in grams, remaining after  $t$  days is modeled by

$$A(t) = 50(0.5)^{\frac{t}{3}}$$

- Which statement is false?
- 1) In 20 days, there is no substance remaining.
  - 2) After two half-lives, there is 25% of the substance remaining.
  - 3) The amount of the substance remaining can also be modeled by

$$A(t) = 50(2)^{\frac{-t}{3}}$$

- 4) After one week, there is less than 10g of the substance remaining.

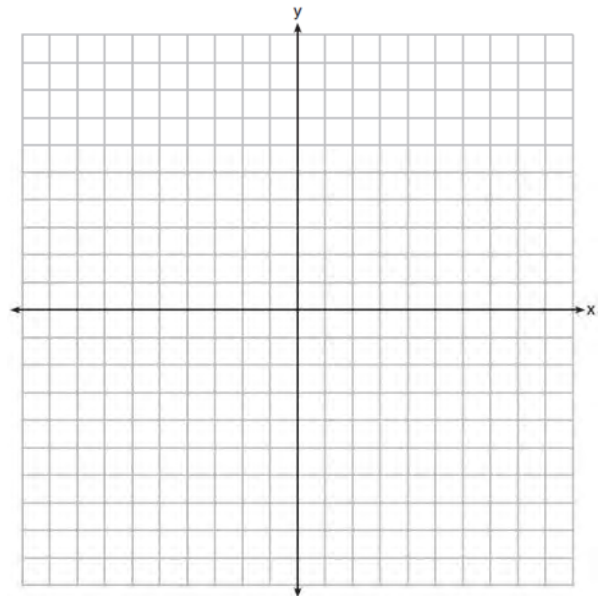
- 214 Consider the function  $f(x) = 2x^3 + x^2 - 18x - 9$ . Which statement is true?

- 1)  $2x - 1$  is a factor of  $f(x)$ .
- 2)  $x - 3$  is a factor of  $f(x)$ .
- 3)  $f(3) \neq f\left(-\frac{1}{2}\right)$
- 4)  $f\left(\frac{1}{2}\right) = 0$

- 215 On the set of axes below, graph  $y = f(x)$  and  $y = g(x)$  for the given functions.

$$f(x) = x^3 - 3x^2$$

$$g(x) = 2x - 5$$



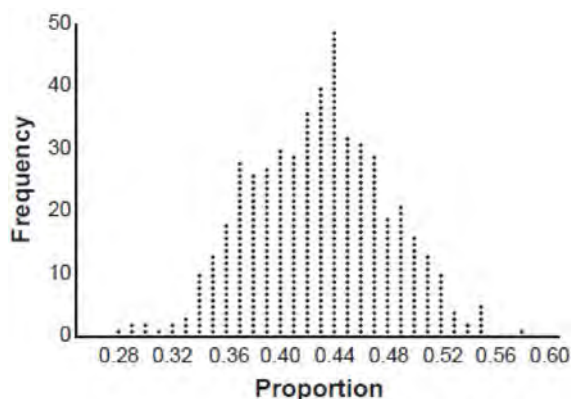
State the number of solutions to the equation  $f(x) = g(x)$ .

- 216 Solve the system of equations algebraically.

$$x^2 + y^2 = 25$$

$$y + 5 = 2x$$

- 217 Marissa and Sydney are trying to determine if there is enough interest in their school to put on a senior musical. They randomly surveyed 100 members of the senior class and 43% of them said they would be interested in being in a senior musical. Marissa and Sydney then conducted a simulation of 500 more surveys, each of 100 seniors, assuming that 43% of the senior class would be interested in being in the musical. The output of the simulation is shown below.



The standard deviation of the simulation is closest to

- 1) 0.02
  - 2) 0.05
  - 3) 0.09
  - 4) 0.43
- 218 On a certain tropical island, there are currently 500 palm trees and 200 flamingos. Suppose the palm tree population is decreasing at an annual rate of 3% per year and the flamingo population is growing at a continuous rate of 2% per year. Write two functions,  $P(x)$  and  $F(x)$ , that represent the number of palm trees and flamingos on this island, respectively,  $x$  years from now. State the solution to the equation  $P(x) = F(x)$ , rounded to the *nearest year*. Interpret the meaning of this value within the given context.

- 219 The value of an automobile  $t$  years after it was purchased is given by the function  $V = 38,000(0.84)^t$ . Which statement is true?
- 1) The value of the car increases 84% each year.
  - 2) The value of the car decreases 84% each year.
  - 3) The value of the car increases 16% each year.
  - 4) The value of the car decreases 16% each year.

- 220 Which expression is *not* equivalent to  $36x^6 - 25y^4$ ?
- 1)  $6^2(x^3)^2 - 5^2(y^2)^2$
  - 2)  $(6x^3 - 5y^2)(6x^3 + 5y^2)$
  - 3)  $(6x^6 - 5y^4)(6x^6 + 5y^4)$
  - 4)  $(3 \cdot 2x^3 - 5y^2)(3 \cdot 2x^3 + 5y^2)$

- 221 A retailer advertises that items will be discounted by 10% every Monday until they are sold. In how many weeks will an item costing \$50 first be sold for under half price?

- 1) 7
- 2) 6
- 3) 5
- 4) 4

- 222 What is the solution set of the equation

$$\frac{x+2}{x} + \frac{x}{3} = \frac{2x^2+6}{3x}?$$

- 1)  $\{-3\}$
- 2)  $\{-3, 0\}$
- 3)  $\{3\}$
- 4)  $\{0, 3\}$

- 223 In a group of 40 people, 20 have brown hair, 22 have blue eyes, and 15 have both brown hair and blue eyes. How many people have neither brown hair nor blue eyes?

- 1) 0
- 2) 13
- 3) 27
- 4) 32

- 224 The table below shows the results of gender and music preference. Based on these data, determine if the events "the person is female" and "the person prefers classic rock" are independent of each other. Justify your answer.

	Rap	Techno	Classic Rock	Classical
Male	39	17	42	12
Female	17	37	36	15

- 225 If  $\cos A = \frac{\sqrt{5}}{3}$  and  $\tan A < 0$ , what is the value of

$\sin A$ ?

- 1)  $\frac{2}{3}$
  - 2)  $-\frac{\sqrt{5}}{3}$
  - 3)  $-\frac{2}{3}$
  - 4)  $\frac{3}{\sqrt{5}}$
- 226 In watching auditions for lead singer in a band, Liem became curious as to whether there is an association between how animated the lead singer is and the amount of applause from the audience. He decided to watch each singer and rate the singer on a scale of 1 to 5, where 1 is the least animated and 5 is the most animated. He did this for all 5 nights of auditions and found that the more animated singers did receive louder applause. The study Liem conducted would be best described as
- 1) experimental
  - 2) observational
  - 3) a sample survey
  - 4) a random assignment

- 227 Which function has the greatest y-intercept?

- 1)  $f(x) = 4 \sin(2x)$
- 2)  $g(x) = 3x^4 + 2x^3 + 7$
- 3)  $h(x) = 5e^{2x} + 3$
- 4)  $j(x) = 6 \log_2(3x + 4)$

- 228 The amount of a substance,  $A(t)$ , that remains after  $t$  days can be given by the equation

$A(t) = A_0(0.5)^{\frac{t}{0.0803}}$ , where  $A_0$  represents the initial amount of the substance. An equivalent form of this equation is

- 1)  $A(t) = A_0(0.000178)^t$
- 2)  $A(t) = A_0(0.945861)^t$
- 3)  $A(t) = A_0(0.04015)^t$
- 4)  $A(t) = A_0(1.08361)^t$

- 229 A parabola that has a vertex at  $(2, 1)$  and a focus of  $(2, -3)$  has an equation of

- 1)  $y = \frac{1}{16}(x - 2)^2 + 1$
- 2)  $y = -\frac{1}{16}(x + 2)^2 - 1$
- 3)  $y = -\frac{1}{16}(x - 2)^2 + 1$
- 4)  $y = -\frac{1}{16}(x - 2)^2 - 3$

- 230 If  $f(x) = 2x^4 - x^3 - 16x + 8$ , then  $f\left(\frac{1}{2}\right)$

- 1) equals 0 and  $2x + 1$  is a factor of  $f(x)$
- 2) equals 0 and  $2x - 1$  is a factor of  $f(x)$
- 3) does not equal 0 and  $2x + 1$  is not a factor of  $f(x)$
- 4) does not equal 0 and  $2x - 1$  is a factor of  $f(x)$

- 231 Emmeline is working on one side of a polynomial identity proof used to form Pythagorean triples.

Her work is shown below:

$$(5x)^2 + (5x^2 - 5)^2$$

Step 1:  $25x^2 + (5x^2 - 5)^2$

Step 2:  $25x^2 + 25x^2 + 25$

Step 3:  $50x^2 + 25$

Step 4:  $75x^2$

What statement is true regarding Emmeline's work?

- 1) Emmeline's work is entirely correct.
  - 2) There is a mistake in step 2, only.
  - 3) There are mistakes in step 2 and step 4.
  - 4) There is a mistake in step 4, only.
- 232 A public radio station held a fund-raiser. The table below summarizes the donor category and method of donation.

		Donor Category	
		Supporter	Patron
Method of Donation	Phone calls	400	672
	Online	1200	2016

To the *nearest thousandth*, find the probability that a randomly selected donor was categorized as a supporter, given that the donation was made online. Do these data indicate that being a supporter is independent of donating online? Justify your answer.

- 233 For the polynomial  $p(x)$ , if  $p(3) = 0$ , it can be concluded that
- 1)  $x + 3$  is a factor of  $p(x)$
  - 2)  $x - 3$  is a factor of  $p(x)$
  - 3) when  $p(x)$  is divided by 3, the remainder is zero
  - 4) when  $p(x)$  is divided by  $-3$ , the remainder is zero

- 234 If a solution of  $2(2x - 1) = 5x^2$  is expressed in simplest  $a + bi$  form, the value of  $b$  is

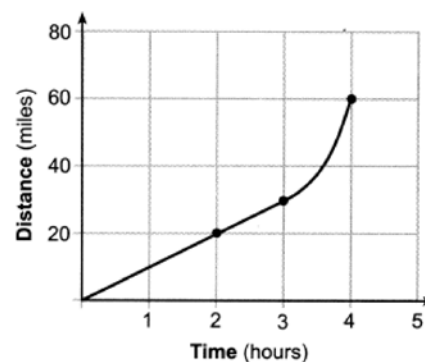
1)  $\frac{\sqrt{6}}{5}i$

2)  $\frac{\sqrt{6}}{5}$

3)  $\frac{1}{5}i$

4)  $\frac{1}{5}$

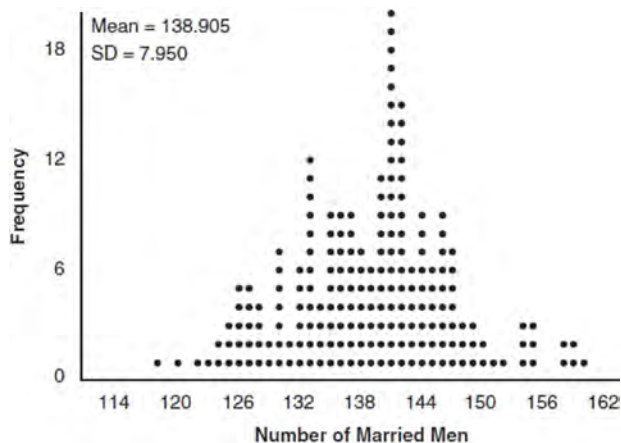
- 235 Determine the average rate of change, in mph, from 2 to 4 hours on the graph shown below.



- 236 Brian deposited 1 cent into an empty non-interest bearing bank account on the first day of the month. He then additionally deposited 3 cents on the second day, 9 cents on the third day, and 27 cents on the fourth day. What would be the total amount of money in the account at the end of the 20th day if the pattern continued?
- 1) \$11,622,614.67
  - 2) \$17,433,922.00
  - 3) \$116,226,146.80
  - 4) \$1,743,392,200.00

**Algebra II Regents at Random Worksheets**

- 237 In a random sample of 250 men in the United States, age 21 or older, 139 are married. The graph below simulated samples of 250 men, 200 times, assuming that 139 of the men are married.



- a) Based on the simulation, create an interval in which the middle 95% of the number of married men may fall. Round your answer to the *nearest integer*.
- b) A study claims "50 percent of men 21 and older in the United States are married." Do your results from part a contradict this claim? Explain.
- 238 The hours of daylight,  $y$ , in Utica in days,  $x$ , from January 1, 2013 can be modeled by the equation  $y = 3.06 \sin(0.017x - 1.40) + 12.23$ . How many hours of daylight, to the *nearest tenth*, does this model predict for February 14, 2013?
- 1) 9.4
  - 2) 10.4
  - 3) 12.1
  - 4) 12.2
- 239 Write  $-\frac{1}{2}i^3(\sqrt{-9} - 4) - 3i^2$  in simplest  $a + bi$  form.

- 240 A 7-year lease for office space states that the annual rent is \$85,000 for the first year and will increase by 6% each additional year of the lease. What will the total rent expense be for the entire 7-year lease?
- 1) \$42,809.63
  - 2) \$90,425.53
  - 3) \$595,000.00
  - 4) \$713,476.20
- 241 Researchers in a local area found that the population of rabbits with an initial population of 20 grew continuously at the rate of 5% per month. The fox population had an initial value of 30 and grew continuously at the rate of 3% per month. Find, to the *nearest tenth of a month*, how long it takes for these populations to be equal.
- 242 Which function's graph has a period of 8 and reaches a maximum height of 1 if at least one full period is graphed?
- 1)  $y = -4 \cos\left(\frac{\pi}{4}x\right) - 3$
  - 2)  $y = -4 \cos\left(\frac{\pi}{4}x\right) + 5$
  - 3)  $y = -4 \cos(8x) - 3$
  - 4)  $y = -4 \cos(8x) + 5$
- 243 A researcher randomly divides 50 bean plants into two groups. He puts one group by a window to receive natural light and the second group under artificial light. He records the growth of the plants weekly. Which data collection method is described in this situation?
- 1) observational study
  - 2) controlled experiment
  - 3) survey
  - 4) systematic sample



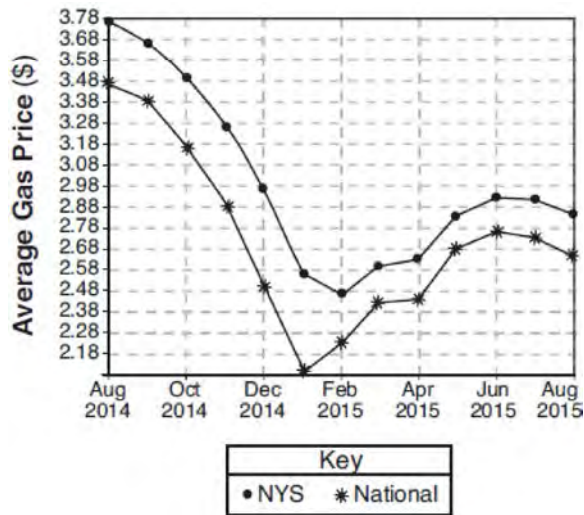
244 The populations of two small towns at the beginning of 2018 and their annual population growth rate are shown in the table below.

Town	Population	Annual Population Growth Rate
Jonesville	1240	6% increase
Williamstown	890	11% increase

Assuming the trend continues, approximately how many years after the beginning of 2018 will it take for the populations to be equal?

- 1) 7
- 2) 20
- 3) 68
- 4) 125

245 The graph below represents national and New York State average gas prices.



If New York State's gas prices are modeled by  $G(x)$  and  $C > 0$ , which expression best approximates the national average  $x$  months from August 2014?

- 1)  $G(x + C)$
- 2)  $G(x) + C$
- 3)  $G(x - C)$
- 4)  $G(x) - C$

246 There are 440 students at Thomas Paine High School enrolled in U.S. History. On the April report card, the students' grades are approximately normally distributed with a mean of 79 and a standard deviation of 7. Students who earn a grade less than or equal to 64.9 must attend summer school. The number of students who must attend summer school for U.S. History is closest to

- 1) 3
- 2) 5
- 3) 10
- 4) 22

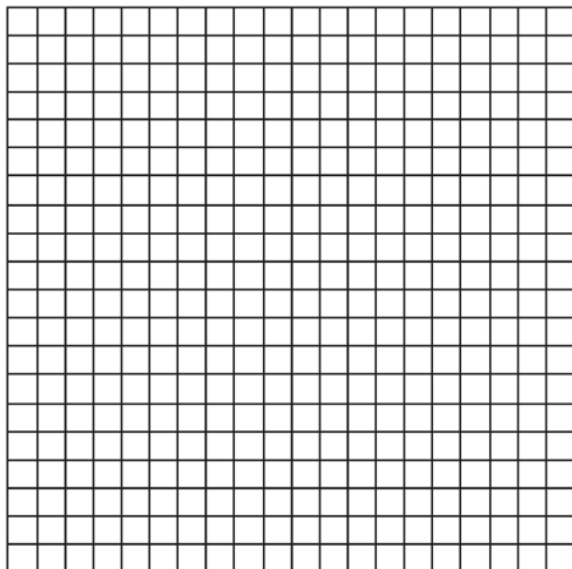
247 The solutions to  $x + 3 - \frac{4}{x-1} = 5$  are

- 1)  $\frac{3}{2} \pm \frac{\sqrt{17}}{2}$
- 2)  $\frac{3}{2} \pm \frac{\sqrt{17}}{2} i$
- 3)  $\frac{3}{2} \pm \frac{\sqrt{33}}{2}$
- 4)  $\frac{3}{2} \pm \frac{\sqrt{33}}{2} i$

- 248 The height above ground for a person riding a Ferris wheel after  $t$  seconds is modeled by
- $$h(t) = 150 \sin\left(\frac{\pi}{45} t + 67.5\right) + 160$$
- feet. How many seconds does it take to go from the bottom of the wheel to the top of the wheel?
- 1) 10
  - 2) 45
  - 3) 90
  - 4) 150

- 249 The graphs of the equations  $y = x^2 + 4x - 1$  and  $y + 3 = x$  are drawn on the same set of axes. One solution of this system is
- 1)  $(-5, -2)$
  - 2)  $(-1, -4)$
  - 3)  $(1, 4)$
  - 4)  $(-2, -1)$

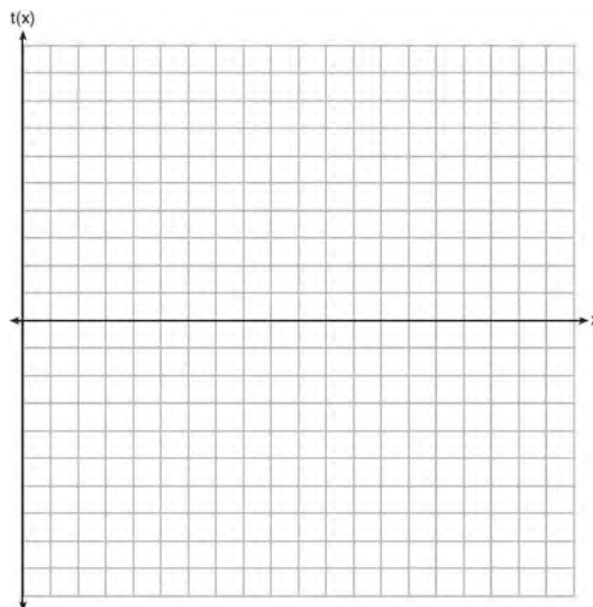
- 250 The zeros of a quartic polynomial function  $h$  are  $-1, \pm 2,$  and  $3$ . Sketch a graph of  $y = h(x)$  on the grid below.



- 251 The parabola described by the equation  $y = \frac{1}{12}(x - 2)^2 + 2$  has the directrix at  $y = -1$ . The focus of the parabola is
- 1)  $(2, -1)$
  - 2)  $(2, 2)$
  - 3)  $(2, 3)$
  - 4)  $(2, 5)$

- 252 Factor completely over the set of integers:  $16x^4 - 81$ . Sara graphed the polynomial  $y = 16x^4 - 81$  and stated "All the roots of  $y = 16x^4 - 81$  are real." Is Sara correct? Explain your reasoning.

- 253 Graph  $t(x) = 3 \sin(2x) + 2$  over the domain  $[0, 2\pi]$  on the set of axes below.



- 254 A runner is using a nine-week training app to prepare for a "fun run." The table below represents the amount of the program completed,  $A$ , and the distance covered in a session,  $D$ , in miles.

<b>A</b>	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{6}{9}$	$\frac{8}{9}$	1
<b>D</b>	2	2	2.25	3	3.25

Based on these data, write an exponential regression equation, rounded to the *nearest thousandth*, to model the distance the runner is able to complete in a session as she continues through the nine-week program.

- 255 The weights of bags of Graseck's Chocolate Candies are normally distributed with a mean of 4.3 ounces and a standard deviation of 0.05 ounces. What is the probability that a bag of these chocolate candies weighs less than 4.27 ounces?
- 1) 0.2257
  - 2) 0.2743
  - 3) 0.7257
  - 4) 0.7757
- 256 After examining the functions  $f(x) = \ln(x + 2)$  and  $g(x) = e^{x-1}$  over the interval  $(-2, 3]$ , Lexi determined that the correct number of solutions to the equation  $f(x) = g(x)$  is
- 1) 1
  - 2) 2
  - 3) 3
  - 4) 0
- 257 Carla wants to start a college fund for her daughter Lila. She puts \$63,000 into an account that grows at a rate of 2.55% per year, compounded monthly. Write a function,  $C(t)$ , that represents the amount of money in the account  $t$  years after the account is opened, given that no more money is deposited into or withdrawn from the account. Calculate algebraically the number of years it will take for the account to reach \$100,000, to the *nearest hundredth of a year*.
- 258 If  $ae^{bt} = c$ , where  $a$ ,  $b$ , and  $c$  are positive, then  $t$  equals
- 1)  $\ln\left(\frac{c}{ab}\right)$
  - 2)  $\ln\left(\frac{cb}{a}\right)$
  - 3)  $\frac{\ln\left(\frac{c}{a}\right)}{b}$
  - 4)  $\frac{\ln\left(\frac{c}{a}\right)}{\ln b}$
- 259 Stephanie found that the number of white-winged cross bills in an area can be represented by the formula  $C = 550(1.08)^t$ , where  $t$  represents the number of years since 2010. Which equation correctly represents the number of white-winged cross bills in terms of the monthly rate of population growth?
- 1)  $C = 550(1.00643)^t$
  - 2)  $C = 550(1.00643)^{12t}$
  - 3)  $C = 550(1.00643)^{\frac{t}{12}}$
  - 4)  $C = 550(1.00643)^{t+12}$

- 260 A formula for work problems involving two people is shown below.

$$\frac{1}{t_1} + \frac{1}{t_2} = \frac{1}{t_b}$$

$t_1$  = the time taken by the first person to complete the job

$t_2$  = the time taken by the second person to complete the job

$t_b$  = the time it takes for them working together to complete the job

Fred and Barney are carpenters who build the same model desk. It takes Fred eight hours to build the desk while it only takes Barney six hours. Write an equation that can be used to find the time it would take both carpenters working together to build a desk. Determine, to the *nearest tenth of an hour*, how long it would take Fred and Barney working together to build a desk.

- 261 Given the following polynomials

$$x = (a + b + c)^2$$

$$y = a^2 + b^2 + c^2$$

$$z = ab + bc + ac$$

Which identity is true?

- 1)  $x = y - z$
  - 2)  $x = y + z$
  - 3)  $x = y - 2z$
  - 4)  $x = y + 2z$
- 262 If  $f(x) = \log_3 x$  and  $g(x)$  is the image of  $f(x)$  after a translation five units to the left, which equation represents  $g(x)$ ?
- 1)  $g(x) = \log_3(x + 5)$
  - 2)  $g(x) = \log_3 x + 5$
  - 3)  $g(x) = \log_3(x - 5)$
  - 4)  $g(x) = \log_3 x - 5$

- 263 For  $x \geq 0$ , which equation is *false*?

1)  $(x^{\frac{3}{2}})^2 = \sqrt[4]{x^3}$

2)  $(x^3)^{\frac{1}{4}} = \sqrt[4]{x^3}$

3)  $(x^{\frac{3}{2}})^{\frac{1}{2}} = \sqrt[4]{x^3}$

4)  $(x^{\frac{2}{3}})^2 = \sqrt[3]{x^4}$

- 264 Elizabeth tried to find the product of  $(2 + 4i)$  and  $(3 - i)$ , and her work is shown below.

$$(2 + 4i)(3 - i)$$

$$= 6 - 2i + 12i - 4i^2$$

$$= 6 + 10i - 4i^2$$

$$= 6 + 10i - 4(1)$$

$$= 6 + 10i - 4$$

$$= 2 + 10i$$

Identify the error in the process shown and determine the correct product of  $(2 + 4i)$  and  $(3 - i)$ .

- 265 Justify why  $\frac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}}$  is equivalent to  $x^{\frac{-1}{12}} y^{\frac{2}{3}}$  using

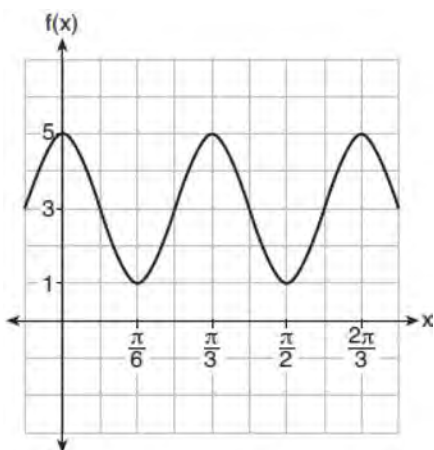
properties of rational exponents, where  $x \neq 0$  and  $y \neq 0$ .

- 266 The function  $N(t) = 100e^{-0.023t}$  models the number of grams in a sample of cesium-137 that remain after  $t$  years. On which interval is the sample's average rate of decay the fastest?
- 1)  $[1, 10]$
  - 2)  $[10, 20]$
  - 3)  $[15, 25]$
  - 4)  $[1, 30]$

- 267 The average monthly high temperature in Buffalo, in degrees Fahrenheit, can be modeled by the function

$B(t) = 25.29 \sin(0.4895t - 1.9752) + 55.2877$ , where  $t$  is the month number (January = 1). State, to the nearest tenth, the average monthly rate of temperature change between August and November. Explain its meaning in the given context.

- 268 The function  $f(x) = a \cos bx + c$  is plotted on the graph shown below.



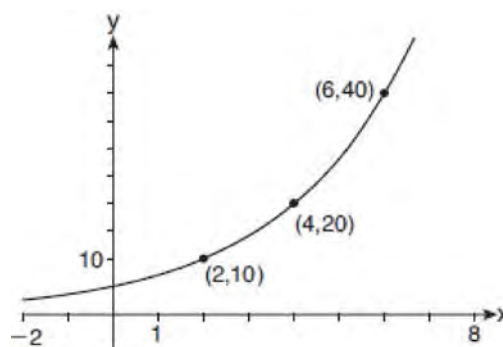
What are the values of  $a$ ,  $b$ , and  $c$ ?

- 1)  $a = 2, b = 6, c = 3$
  - 2)  $a = 2, b = 3, c = 1$
  - 3)  $a = 4, b = 6, c = 5$
  - 4)  $a = 4, b = \frac{\pi}{3}, c = 3$
- 269 What is the quotient when  $10x^3 - 3x^2 - 7x + 3$  is divided by  $2x - 1$ ?
- 1)  $5x^2 + x + 3$
  - 2)  $5x^2 - x + 3$
  - 3)  $5x^2 - x - 3$
  - 4)  $5x^2 + x - 3$

- 270 What is the inverse of  $f(x) = \frac{x}{x+2}$ , where  $x \neq -2$ ?

- 1)  $f^{-1}(x) = \frac{2x}{x-1}$
- 2)  $f^{-1}(x) = \frac{-2x}{x-1}$
- 3)  $f^{-1}(x) = \frac{x}{x-2}$
- 4)  $f^{-1}(x) = \frac{-x}{x-2}$

- 271 The graph of  $y = f(x)$  is shown below.



Which expression defines  $f(x)$ ?

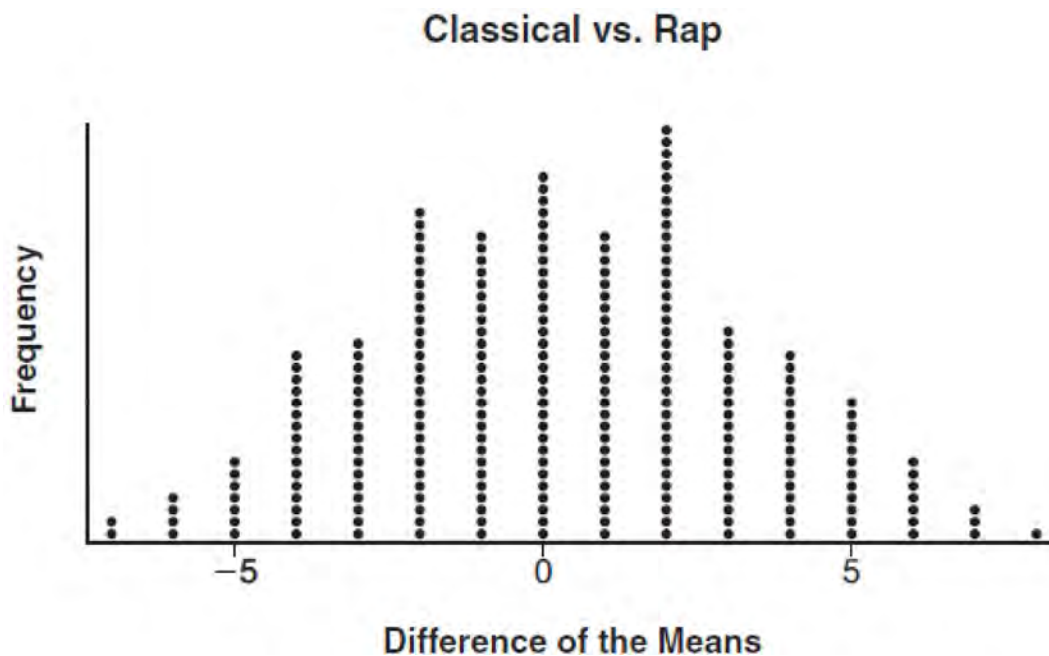
- 1)  $2x$
  - 2)  $5(2^x)$
  - 3)  $5(2^{\frac{x}{2}})$
  - 4)  $5(2^{2x})$
- 272 For which values of  $x$ , rounded to the nearest hundredth, will  $|x^2 - 9| - 3 = \log_3 x$ ?
- 1) 2.29 and 3.63
  - 2) 2.37 and 3.54
  - 3) 2.84 and 3.17
  - 4) 2.92 and 3.06

273 To determine if the type of music played while taking a quiz has a relationship to results, 16 students were randomly assigned to either a room softly playing classical music or a room softly playing rap music. The results on the quiz were as follows:

Classical: 74, 83, 77, 77, 84, 82, 90, 89

Rap: 77, 80, 78, 74, 69, 72, 78, 69

John correctly rounded the difference of the means of his experimental groups as 7. How did John obtain this value and what does it represent in the given context? Justify your answer. To determine if there is any significance in this value, John rerandomized the 16 scores into two groups of 8, calculated the difference of the means, and simulated this process 250 times as shown below.



Does the simulation support the theory that there may be a significant difference in quiz scores? Explain.

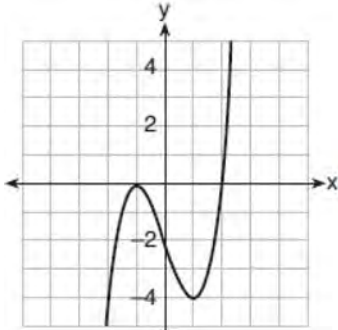
274 Which equation represents a parabola with a focus of  $(-2, 5)$  and a directrix of  $y = 9$ ?

- 1)  $(y - 7)^2 = 8(x + 2)$
- 2)  $(y - 7)^2 = -8(x + 2)$
- 3)  $(x + 2)^2 = 8(y - 7)$
- 4)  $(x + 2)^2 = -8(y - 7)$

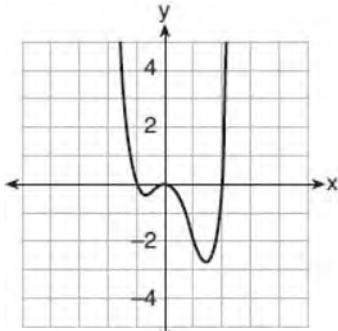
275 At her job, Pat earns \$25,000 the first year and receives a raise of \$1000 each year. The explicit formula for the  $n$ th term of this sequence is  $a_n = 25,000 + (n - 1)1000$ . Which rule best represents the equivalent recursive formula?

- 1)  $a_n = 24,000 + 1000n$
- 2)  $a_n = 25,000 + 1000n$
- 3)  $a_1 = 25,000, a_n = a_{n-1} + 1000$
- 4)  $a_1 = 25,000, a_n = a_{n+1} + 1000$

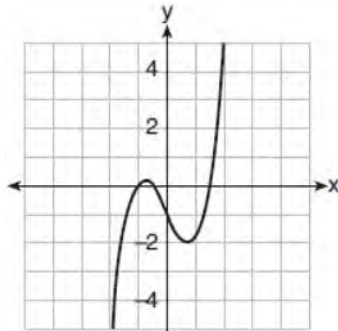
276 Which graph represents a polynomial function that contains  $x^2 + 2x + 1$  as a factor?



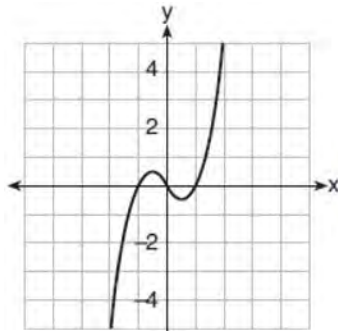
1)



2)



3)



4)

277 An estimate of the number of milligrams of a medication in the bloodstream  $t$  hours after 400 mg has been taken can be modeled by the function below.

$$I(t) = 0.5t^4 + 3.45t^3 - 96.65t^2 + 347.7t,$$

where  $0 \leq t \leq 6$

Over what time interval does the amount of medication in the bloodstream strictly increase?

- 1) 0 to 2 hours
- 2) 0 to 3 hours
- 3) 2 to 6 hours
- 4) 3 to 6 hours

278 The expression  $2 - \frac{x-1}{x+2}$  is equivalent to

- 1)  $1 - \frac{3}{x+2}$
- 2)  $1 + \frac{3}{x+2}$
- 3)  $1 - \frac{1}{x+2}$
- 4)  $1 + \frac{1}{x+2}$

279 Kenzie believes that for  $x \geq 0$ , the expression  $\left(\sqrt[7]{x^2}\right)\left(\sqrt[5]{x^3}\right)$  is equivalent to  $\sqrt[35]{x^6}$ . Is she correct? Justify your response algebraically.

280 Determine, to the *nearest tenth of a year*, how long it would take an investment to double at a  $3\frac{3}{4}\%$  interest rate, compounded continuously.

- 281 After Roger's surgery, his doctor administered pain medication in the following amounts in milligrams over four days.

Day (n)	1	2	3	4
Dosage (m)	2000	1680	1411.2	1185.4

How can this sequence best be modeled recursively?

- 1)  $m_1 = 2000$   
 $m_n = m_{n-1} - 320$
- 2)  $m_n = 2000(0.84)^{n-1}$
- 3)  $m_1 = 2000$   
 $m_n = (0.84)m_{n-1}$
- 4)  $m_n = 2000(0.84)^{n+1}$
- 282 What is the inverse of  $f(x) = x^3 - 2$ ?
- 1)  $f^{-1}(x) = \sqrt[3]{x} + 2$   
 2)  $f^{-1}(x) = \pm \sqrt[3]{x} + 2$   
 3)  $f^{-1}(x) = \sqrt[3]{x+2}$   
 4)  $f^{-1}(x) = \pm \sqrt[3]{x+2}$
- 284 Algebraically solve for  $x$ :  $\frac{-3}{x+3} + \frac{1}{2} = \frac{x}{6} - \frac{1}{2}$
- 285 The Wells family is looking to purchase a home in a suburb of Rochester with a 30-year mortgage that has an annual interest rate of 3.6%. The house the family wants to purchase is \$152,500 and they will make a \$15,250 down payment and borrow the remainder. Use the formula below to determine their monthly payment, to the nearest dollar.

$$M = \frac{P \left( \frac{r}{12} \right) \left( 1 + \frac{r}{12} \right)^n}{\left( 1 + \frac{r}{12} \right)^n - 1}$$

$M$  = monthly payment

$P$  = amount borrowed

$r$  = annual interest rate

$n$  = total number of monthly payments

- 283 The Fahrenheit temperature,  $F(t)$ , of a heated object at time  $t$ , in minutes, can be modeled by the function below.  $F_s$  is the surrounding temperature,  $F_0$  is the initial temperature of the object, and  $k$  is a constant.

$$F(t) = F_s + (F_0 - F_s)e^{-kt}$$

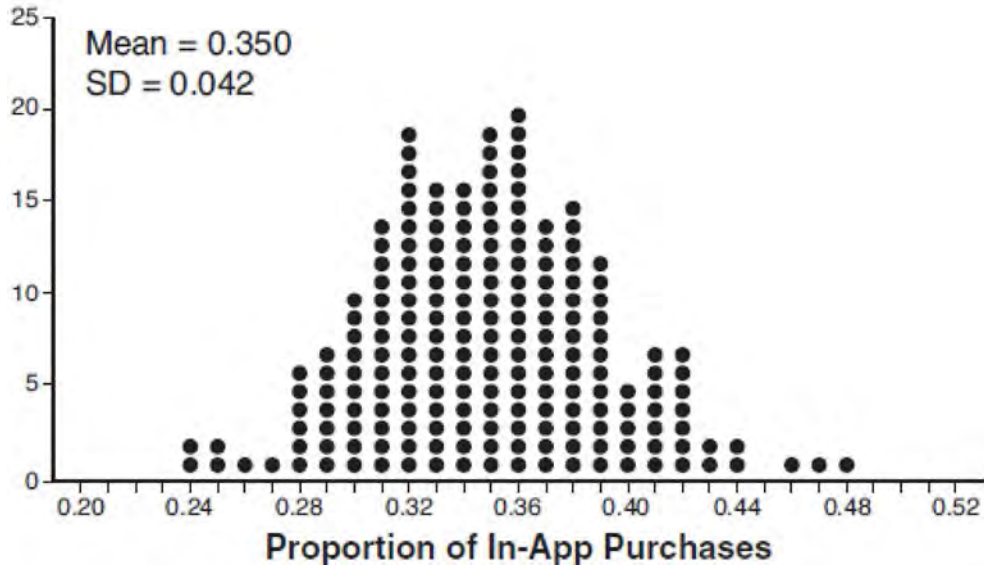
Coffee at a temperature of 195°F is poured into a container. The room temperature is kept at a constant 68°F and  $k = 0.05$ . Coffee is safe to drink when its temperature is, at most, 120°F. To the nearest minute, how long will it take until the coffee is safe to drink?

- 1) 7  
 2) 10  
 3) 11  
 4) 18

- 286 If  $f(x)$  is an even function, which function must also be even?
- 1)  $f(x - 2)$   
 2)  $f(x) + 3$   
 3)  $f(x + 1)$   
 4)  $f(x + 1) + 3$



287 Some smart-phone applications contain "in-app" purchases, which allow users to purchase special content within the application. A random sample of 140 users found that 35 percent made in-app purchases. A simulation was conducted with 200 samples of 140 users assuming 35 percent of the samples make in-app purchases. The approximately normal results are shown below.



Considering the middle 95% of the data, determine the margin of error, to the *nearest hundredth*, for the simulated results. In the given context, explain what this value represents.

288 Selected values for the functions  $f$  and  $g$  are shown in the tables below.

$x$	$f(x)$		$x$	$g(x)$
-3.12	-4.88		-2.01	-1.01
0	-6		0	0.58
1.23	-4.77		8.52	2.53
8.52	2.53		13.11	3.01
9.01	3.01		16.52	3.29

A solution to the equation  $f(x) = g(x)$  is

- 1) 0
- 2) 2.53
- 3) 3.01
- 4) 8.52

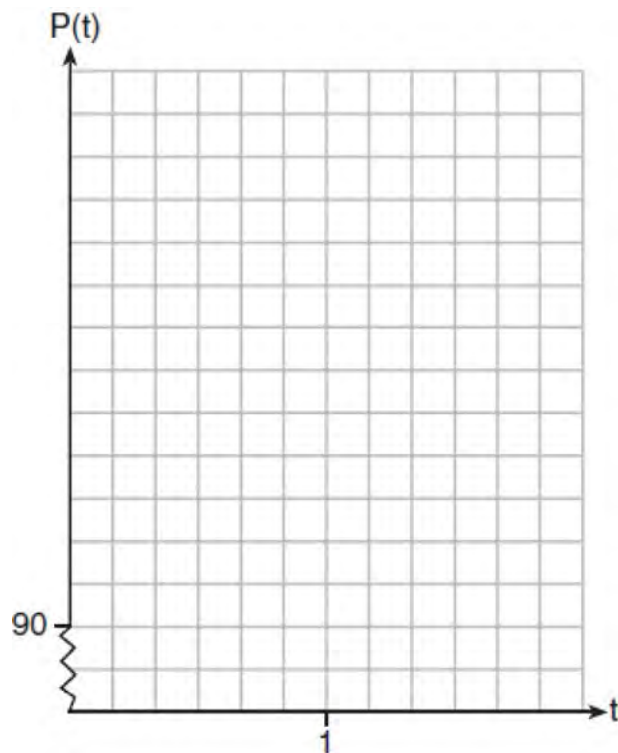
289 Given:  $f(x) = 2x^2 + x - 3$  and  $g(x) = x - 1$   
 Express  $f(x) \cdot g(x) - [f(x) + g(x)]$  as a polynomial in standard form.

290 Solve the given equation algebraically for all values of  $x$ .  $3\sqrt{x} - 2x = -5$

- 291 The resting blood pressure of an adult patient can be modeled by the function  $P$  below, where  $P(t)$  is the pressure in millimeters of mercury after time  $t$  in seconds.

$$P(t) = 24 \cos(3\pi t) + 120$$

On the set of axes below, graph  $y = P(t)$  over the domain  $0 \leq t \leq 2$ .



Determine the period of  $P$ . Explain what this value represents in the given context. Normal resting blood pressure for an adult is 120 over 80. This means that the blood pressure oscillates between a maximum of 120 and a minimum of 80. Adults with high blood pressure (above 140 over 90) and adults with low blood pressure (below 90 over 60) may be at risk for health disorders. Classify the given patient's blood pressure as low, normal, or high and explain your reasoning.

- 292 Write a recursive formula for the sequence 6, 9, 13.5, 20.25, ...

- 293 A study of black bears in the Adirondacks reveals that their population can be represented by the function  $P(t) = 3500(1.025)^t$ , where  $t$  is the number of years since the study began. Which function is correctly rewritten to reveal the monthly growth rate of the black bear population?

1)  $P(t) = 3500(1.00206)^{12t}$

2)  $P(t) = 3500(1.00206)^{\frac{t}{12}}$

3)  $P(t) = 3500(1.34489)^{12t}$

4)  $P(t) = 3500(1.34489)^{\frac{t}{12}}$

- 294 A person's lung capacity can be modeled by the function  $C(t) = 250 \sin\left(\frac{2\pi}{5}t\right) + 2450$ , where  $C(t)$  represents the volume in mL present in the lungs after  $t$  seconds. State the maximum value of this function over one full cycle, and explain what this value represents.

- 295 What is the inverse of the function  $y = 4x + 5$ ?

1)  $x = \frac{1}{4}y - \frac{5}{4}$

2)  $y = \frac{1}{4}x - \frac{5}{4}$

3)  $y = 4x - 5$

4)  $y = \frac{1}{4x + 5}$

- 296 The expression  $(x + a)(x + b)$  can *not* be written as

1)  $a(x + b) + x(x + b)$

2)  $x^2 + abx + ab$

3)  $x^2 + (a + b)x + ab$

4)  $x(x + a) + b(x + a)$

- 297 The recursive formula to describe a sequence is shown below.

$$a_1 = 3$$

$$a_n = 1 + 2a_{n-1}$$

State the first four terms of this sequence. Can this sequence be represented using an explicit geometric formula? Justify your answer.

- 298 For positive values of  $x$ , which expression is

equivalent to  $\sqrt{16x^2} \cdot x^{\frac{2}{3}} + \sqrt[3]{8x^5}$

- 1)  $6\sqrt[5]{x^3}$
- 2)  $6\sqrt[3]{x^5}$
- 3)  $4\sqrt[3]{x^2} + 2\sqrt[3]{x^5}$
- 4)  $4\sqrt{x^3} + 2\sqrt[5]{x^3}$

- 299 Which description could represent the graph of

$f(x) = 4x^2(x + a) - x - a$ , if  $a$  is an integer?

- 1) As  $x \rightarrow -\infty, f(x) \rightarrow \infty$ , as  $x \rightarrow \infty, f(x) \rightarrow \infty$ , and the graph has 3  $x$ -intercepts.
- 2) As  $x \rightarrow -\infty, f(x) \rightarrow -\infty$ , as  $x \rightarrow \infty, f(x) \rightarrow \infty$ , and the graph has 3  $x$ -intercepts.
- 3) As  $x \rightarrow -\infty, f(x) \rightarrow \infty$ , as  $x \rightarrow \infty, f(x) \rightarrow -\infty$ , and the graph has 4  $x$ -intercepts.
- 4) As  $x \rightarrow -\infty, f(x) \rightarrow -\infty$ , as  $x \rightarrow \infty, f(x) \rightarrow \infty$ , and the graph has 4  $x$ -intercepts.

- 300 On July 21, 2016, the water level in Puget Sound, WA reached a high of 10.1 ft at 6 a.m. and a low of -2 ft at 12:30 p.m. Across the country in Long Island, NY, Shinnecock Bay's water level reached a high of 2.5 ft at 10:42 p.m. and a low of -0.1 ft at 5:31 a.m. The water levels of both locations are affected by the tides and can be modeled by sinusoidal functions. Determine the difference in amplitudes, in feet, for these two locations.

- 301 Which expression is equivalent to  $(2x - i)^2 - (2x - i)(2x + 3i)$  where  $i$  is the imaginary unit and  $x$  is a real number?

- 1)  $-4 - 8xi$
- 2)  $-4 - 4xi$
- 3)  $2$
- 4)  $8x - 4i$

- 302 For a given time,  $x$ , in seconds, an electric current,  $y$ , can be represented by  $y = 2.5(1 - 2.7^{-10x})$ .

Which equation is *not* equivalent?

- 1)  $y = 2.5 - 2.5(2.7^{-10x})$
- 2)  $y = 2.5 - 2.5\left((2.7^2)^{-0.05x}\right)$
- 3)  $y = 2.5 - 2.5\left(\frac{1}{2.7^{10x}}\right)$
- 4)  $y = 2.5 - 2.5(2.7^{-2})(2.7^{0.05x})$

- 303 Which expression is equivalent to  $x^6y^4(x^4 - 16) - 9(x^4 - 16)$ ?

- 1)  $x^{10}y^4 - 16x^6y^4 - 9x^4 - 144$
- 2)  $(x^6y^4 - 9)(x + 2)^3(x - 2)$
- 3)  $(x^3y^2 + 3)(x^3y^2 - 3)(x + 2)^2(x - 2)^2$
- 4)  $(x^3y^2 + 3)(x^3y^2 - 3)(x^2 + 4)(x^2 - 4)$

- 304 The terminal side of  $\theta$ , an angle in standard

position, intersects the unit circle at  $P\left(-\frac{1}{3}, -\frac{\sqrt{8}}{3}\right)$ .

What is the value of  $\sec \theta$ ?

- 1)  $-3$
- 2)  $-\frac{3\sqrt{8}}{8}$
- 3)  $-\frac{1}{3}$
- 4)  $-\frac{\sqrt{8}}{3}$

305 Judith puts \$5000 into an investment account with interest compounded continuously. Which approximate annual rate is needed for the account to grow to \$9110 after 30 years?

- 1) 2%
- 2) 2.2%
- 3) 0.02%
- 4) 0.022%

306 Which expression is equivalent to

$$\frac{2x^4 + 8x^3 - 25x^2 - 6x + 14}{x + 6}?$$

- 1)  $2x^3 + 4x^2 + x - 12 + \frac{86}{x + 6}$
- 2)  $2x^3 - 4x^2 - x + 14$
- 3)  $2x^3 - 4x^2 - x + \frac{14}{x + 6}$
- 4)  $2x^3 - 4x^2 - x$

307 Given  $c(m) = m^3 - 2m^2 + 4m - 8$ , the solution of  $c(m) = 0$  is

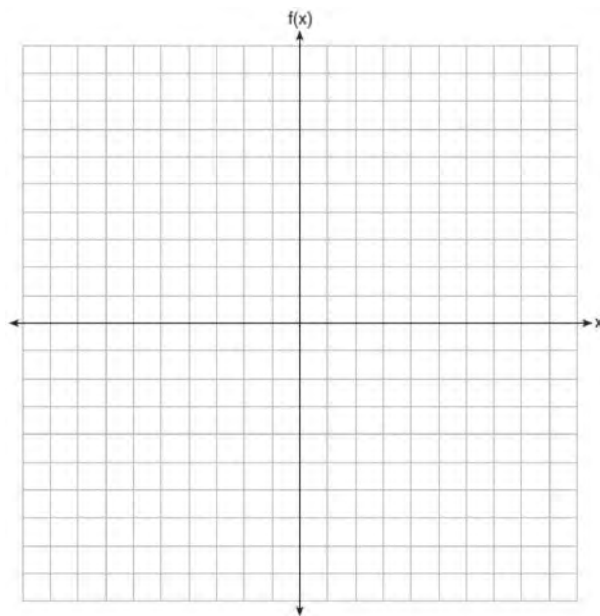
- 1)  $\pm 2$
- 2) 2, only
- 3)  $2i, 2$
- 4)  $\pm 2i, 2$

308 The temperature,  $F$ , in degrees Fahrenheit, after  $t$  hours of a roast put into an oven is given by the equation  $F = 325 - 185e^{-0.4t}$ . What was the temperature of the roast when it was put into the oven?

- 1) 325
- 2) 200
- 3) 185
- 4) 140

309 Determine if  $x + 4$  is a factor of  $2x^3 + 10x^2 + 4x - 16$ . Explain your answer.

310 Graph  $f(x) = \log_2(x + 6)$  on the set of axes below.



311 Erin and Christa were working on cubing binomials for math homework. Erin believed they could save time with a shortcut. She wrote down the rule below for Christa to follow.

$$(a + b)^3 = a^3 + b^3$$

Does Erin's shortcut always work? Justify your result algebraically.

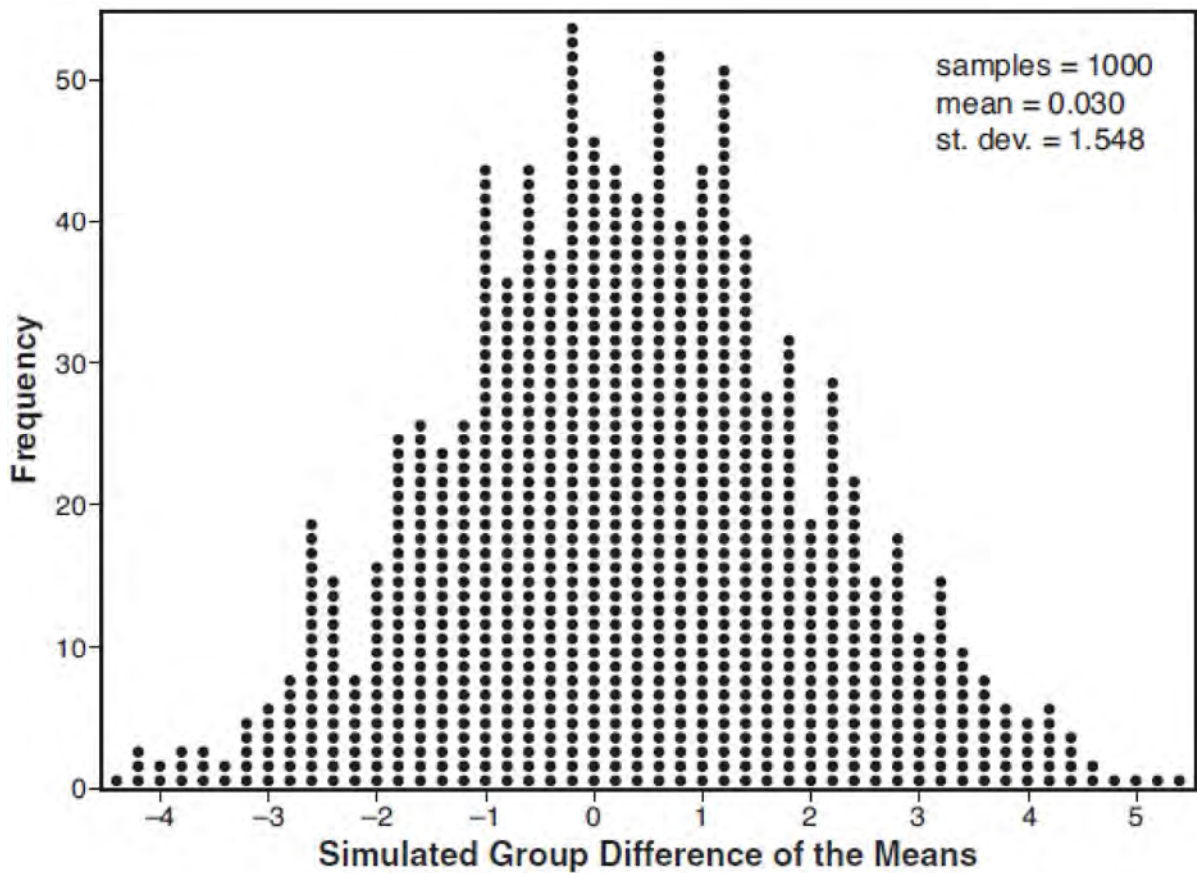
312 The temperature, in degrees Fahrenheit, in Times Square during a day in August can be predicted by the function  $T(x) = 8 \sin(0.3x - 3) + 74$ , where  $x$  is the number of hours after midnight. According to this model, the predicted temperature, to the nearest degree Fahrenheit, at 7 P.M. is

- 1) 68
- 2) 74
- 3) 77
- 4) 81

313 Joseph was curious to determine if scent improves memory. A test was created where better memory is indicated by higher test scores. A controlled experiment was performed where one group was given the test on scented paper and the other group was given the test on unscented paper. The summary statistics from the experiment are given below.

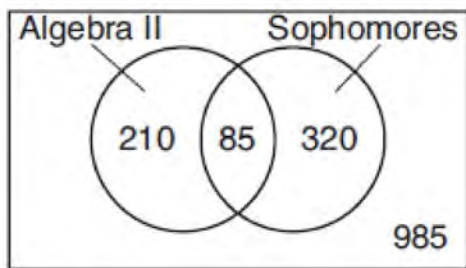
	Scented Paper	Unscented Paper
$\bar{x}$	23	18
$s_x$	2.898	2.408

Calculate the difference in means in the experimental test grades (scented -unscented). A simulation was conducted in which the subjects' scores were rerandomized into two groups 1000 times. The differences of the group means were calculated each time. The results are shown below.



Use the simulation results to determine the interval representing the middle 95% of the difference in means, to the nearest hundredth. Is the difference in means in Joseph's experiment statistically significant based on the simulation? Explain.

- 314 Data for the students enrolled in a local high school are shown in the Venn diagram below.



If a student from the high school is selected at random, what is the probability that the student is a sophomore given that the student is enrolled in Algebra II?

- 1)  $\frac{85}{210}$
  - 2)  $\frac{85}{295}$
  - 3)  $\frac{85}{405}$
  - 4)  $\frac{85}{1600}$
- 315 Which statement is true about the graph of  $f(x) = \left(\frac{1}{8}\right)^x$ ?
- 1) The graph is always increasing.
  - 2) The graph is always decreasing.
  - 3) The graph passes through  $(1,0)$ .
  - 4) The graph has an asymptote,  $x = 0$ .
- 316 Suppose events  $A$  and  $B$  are independent and  $P(A \text{ and } B)$  is 0.2. Which statement could be true?
- 1)  $P(A) = 0.4, P(B) = 0.3, P(A \text{ or } B) = 0.5$
  - 2)  $P(A) = 0.8, P(B) = 0.25$
  - 3)  $P(A|B) = 0.2, P(B) = 0.2$
  - 4)  $P(A) = 0.15, P(B) = 0.05$

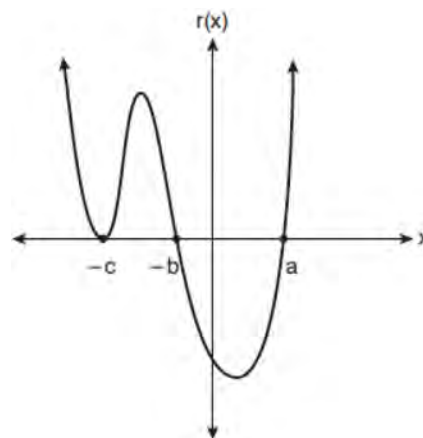
- 317 If  $p(x) = 2\ln(x) - 1$  and  $m(x) = \ln(x + 6)$ , then what is the solution for  $p(x) = m(x)$ ?

- 1) 1.65
- 2) 3.14
- 3) 5.62
- 4) no solution

- 318 If  $A = -3 + 5i$ ,  $B = 4 - 2i$ , and  $C = 1 + 6i$ , where  $i$  is the imaginary unit, then  $A - BC$  equals

- 1)  $5 - 17i$
- 2)  $5 + 27i$
- 3)  $-19 - 17i$
- 4)  $-19 + 27i$

- 319 A sketch of  $r(x)$  is shown below.

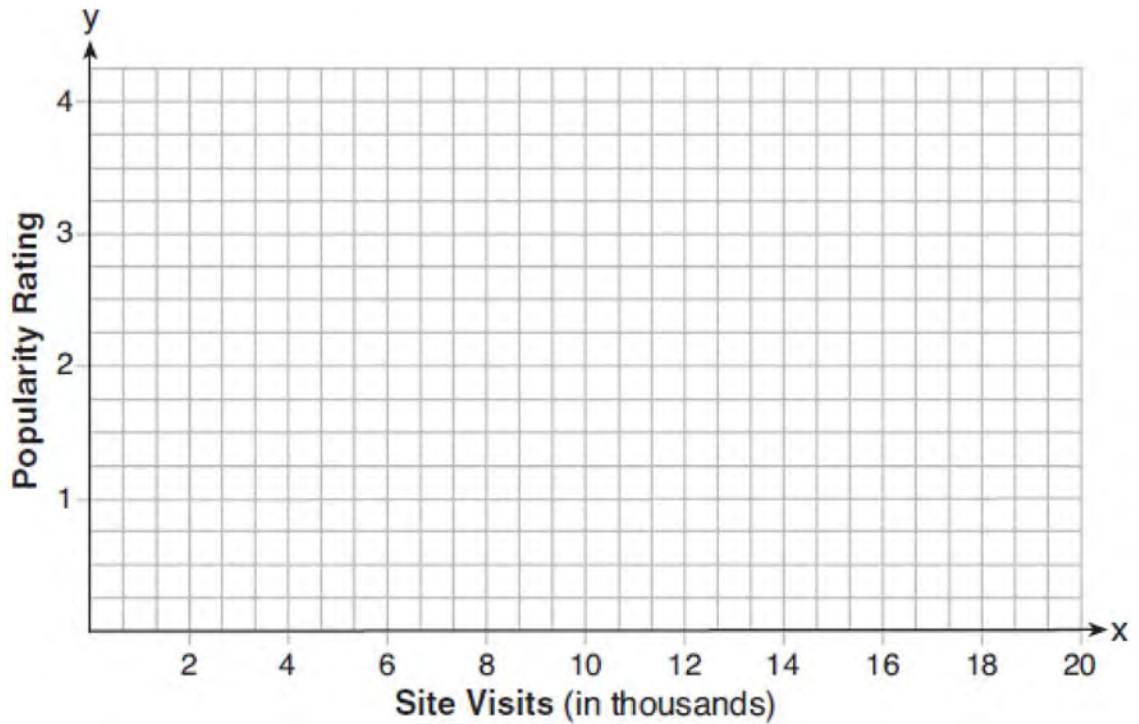


An equation for  $r(x)$  could be

- 1)  $r(x) = (x - a)(x + b)(x + c)$
- 2)  $r(x) = (x + a)(x - b)(x - c)^2$
- 3)  $r(x) = (x + a)(x - b)(x - c)$
- 4)  $r(x) = (x - a)(x + b)(x + c)^2$

- 320 The scores of a recent test taken by 1200 students had an approximately normal distribution with a mean of 225 and a standard deviation of 18. Determine the number of students who scored between 200 and 245.

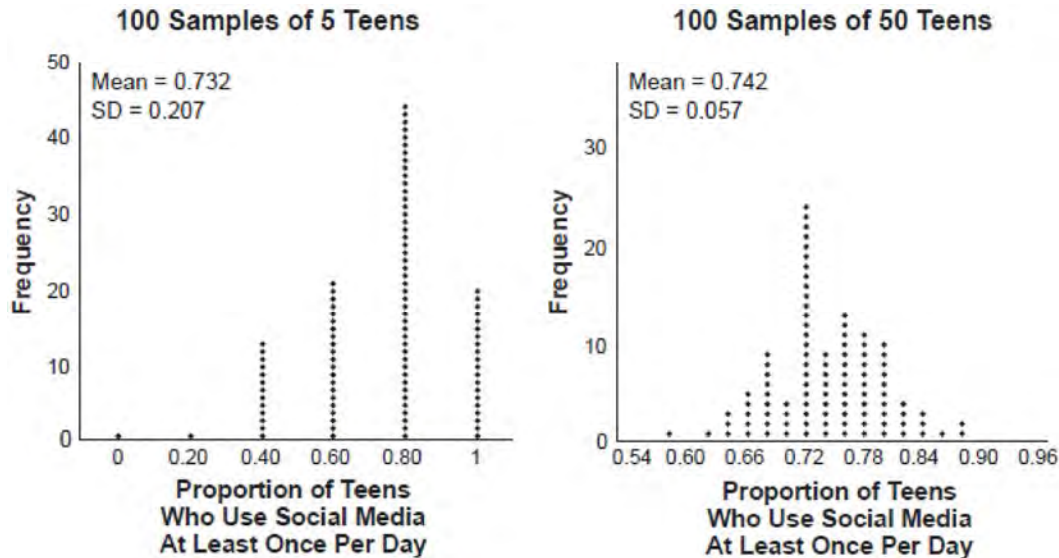
- 321 Website popularity ratings are often determined using models that incorporate the number of visits per week a website receives. One model for ranking websites is  $P(x) = \log(x - 4)$ , where  $x$  is the number of visits per week in thousands and  $P(x)$  is the website's popularity rating. According to this model, if a website is visited 16,000 times in one week, what is its popularity rating, rounded to the *nearest tenth*? Graph  $y = P(x)$  on the axes below.



An alternative rating model is represented by  $R(x) = \frac{1}{2}x - 6$ , where  $x$  is the number of visits per week in thousands. Graph  $R(x)$  on the same set of axes. For what number of weekly visits will the two models provide the same rating?

- 322 Beginning July 1, 2019, Michelle deposited \$250 into an account that yields 0.15% each month. She continued to make \$250 deposits into this account on the first of each month for 3 years. Which expression represents the amount of money that was in the account after her last deposit was made on June 1, 2022?
- |                       |  |
|-----------------------|--|
| 1) $250(1.0015)^3$    | 3) $\frac{250 - 250(1.0015)^3}{1 - 1.0015}$    |
| 2) $250(1.0015)^{36}$ | 4) $\frac{250 - 250(1.0015)^{36}}{1 - 1.0015}$ |

323 Two surveys were conducted to estimate the proportion of teens who use social media at least once per day.



Based on these results, it was determined that approximately 75% of teens use social media at least once per day. What is the best explanation of the difference in the results between the two surveys?

- 1) The smaller sample size of five teens resulted in a smaller margin of error and should provide a more accurate estimate.
- 2) The smaller sample size of five teens resulted in a bigger margin of error and should provide a more accurate estimate.
- 3) The larger sample size of 50 teens resulted in a smaller margin of error and should provide a more accurate estimate.
- 4) The larger sample size of 50 teens resulted in a bigger margin of error and should provide a more accurate estimate.

324 Which expression can be rewritten as  $(x + 7)(x - 1)$ ?

- 1)  $(x + 3)^2 - 16$
- 2)  $(x + 3)^2 - 10(x + 3) - 2(x + 3) + 20$
- 3)  $\frac{(x - 1)(x^2 - 6x - 7)}{(x + 1)}$
- 4)  $\frac{(x + 7)(x^2 + 4x + 3)}{(x + 3)}$

325 Given  $a(x) = x^4 + 2x^3 + 4x - 10$  and  $b(x) = x + 2$ , determine  $\frac{a(x)}{b(x)}$  in the form  $q(x) + \frac{r(x)}{b(x)}$ . Is  $b(x)$  a factor of  $a(x)$ ? Explain.

326 The half-life of iodine-131 is 8 days. The percent of the isotope left in the body  $d$  days after being

introduced is  $I = 100\left(\frac{1}{2}\right)^{\frac{d}{8}}$ . When this equation is

written in terms of the number  $e$ , the base of the natural logarithm, it is equivalent to  $I = 100e^{kd}$ . What is the approximate value of the constant,  $k$ ?

- 1) -0.087
- 2) 0.087
- 3) -11.542
- 4) 11.542



327 The table below shows the number of hours of daylight on the first day of each month in Rochester, NY.

Month	Hours of Daylight
Jan.	9.4
Feb.	10.6
March	11.9
April	13.9
May	14.7
June	15.4
July	15.1
Aug.	13.9
Sept.	12.5
Oct.	11.1
Nov.	9.7
Dec.	9.0

Given the data, what is the average rate of change in hours of daylight per month from January 1st to April 1st? Interpret what this means in the context of the problem.

328 On average, college seniors graduating in 2012 could compute their growing student loan debt using the function  $D(t) = 29,400(1.068)^t$ , where  $t$  is time in years. Which expression is equivalent to  $29,400(1.068)^t$  and could be used by students to identify an approximate daily interest rate on their loans?

- 1)  $29,400 \left( 1.068^{\frac{1}{365}} \right)^t$
- 2)  $29,400 \left( \frac{1.068}{365} \right)^{365t}$
- 3)  $29,400 \left( 1 + \frac{0.068}{365} \right)^t$
- 4)  $29,400 \left( 1.068^{\frac{1}{365}} \right)^{365t}$

329 A certain pain reliever is taken in 220 mg dosages and has a half-life of 12 hours. The function

$$A = 220 \left( \frac{1}{2} \right)^{\frac{t}{12}}$$

can be used to model this situation,

where  $A$  is the amount of pain reliever in milligrams remaining in the body after  $t$  hours.

According to this function, which statement is true?

- 1) Every hour, the amount of pain reliever remaining is cut in half.
- 2) In 12 hours, there is no pain reliever remaining in the body.
- 3) In 24 hours, there is no pain reliever remaining in the body.
- 4) In 12 hours, 110 mg of pain reliever is remaining.

330 Algebraically solve for  $x$ :  $\frac{7}{2x} - \frac{2}{x+1} = \frac{1}{4}$

- 331 The mean intelligence quotient (IQ) score is 100, with a standard deviation of 15, and the scores are normally distributed. Given this information, the approximate percentage of the population with an IQ greater than 130 is closest to
- 1) 2%
  - 2) 31%
  - 3) 48%
  - 4) 95%
- 332 A sociologist reviews randomly selected surveillance videos from a public park over a period of several years and records the amount of time people spent on a smartphone. The statistical procedure the sociologist used is called
- 1) a census
  - 2) an experiment
  - 3) an observational study
  - 4) a sample survey
- 333 The first term of a geometric sequence is 8 and the fourth term is 216. What is the sum of the first 12 terms of the corresponding series?
- 1) 236,192
  - 2) 708,584
  - 3) 2,125,760
  - 4) 6,377,288
- 334 What is the solution set of the following system of equations?
- $$y = 3x + 6$$
- $$y = (x + 4)^2 - 10$$
- 1)  $\{(-5, -9)\}$
  - 2)  $\{(5, 21)\}$
  - 3)  $\{(0, 6), (-5, -9)\}$
  - 4)  $\{(0, 6), (5, 21)\}$
- 335 A population of 950 bacteria grows continuously at a rate of 4.75% per day. Write an exponential function,  $N(t)$ , that represents the bacterial population after  $t$  days and explain the reason for your choice of base. Determine the bacterial population after 36 hours, to the nearest bacterium.
- 336 What is the solution set of the equation
- $$\frac{10}{x^2 - 2x} + \frac{4}{x} = \frac{5}{x - 2}?$$
- 1)  $\{0, 2\}$
  - 2)  $\{0\}$
  - 3)  $\{2\}$
  - 4)  $\{ \}$
- 337 Robert is buying a car that costs \$22,000. After a down payment of \$4000, he borrows the remainder from a bank, a six year loan at 6.24% annual interest rate. The following formula can be used to calculate his monthly loan payment.
- $$R = \frac{(P)(i)}{1 - (1 + i)^{-t}}$$
- $R$  = monthly payment  
 $P$  = loan amount  
 $i$  = monthly interest rate  
 $t$  = time, in months
- Robert's monthly payment will be
- 1) \$298.31
  - 2) \$300.36
  - 3) \$307.35
  - 4) \$367.10
- 338 Given  $P(x) = x^3 - 3x^2 - 2x + 4$ , which statement is true?
- 1)  $(x - 1)$  is a factor because  $P(-1) = 2$ .
  - 2)  $(x + 1)$  is a factor because  $P(-1) = 2$ .
  - 3)  $(x + 1)$  is a factor because  $P(1) = 0$ .
  - 4)  $(x - 1)$  is a factor because  $P(1) = 0$ .

339 What is the solution set of the equation

$$\frac{2}{3x+1} = \frac{1}{x} - \frac{6x}{3x+1}?$$

1)  $\left\{-\frac{1}{3}, \frac{1}{2}\right\}$

2)  $\left\{-\frac{1}{3}\right\}$

3)  $\left\{\frac{1}{2}\right\}$

4)  $\left\{\frac{1}{3}, -2\right\}$

340 A student is chosen at random from the student body at a given high school. The probability that the student selects Math as the favorite subject is  $\frac{1}{4}$ . The probability that the student chosen is a junior is  $\frac{116}{459}$ . If the probability that the student selected is a junior or that the student chooses Math as the favorite subject is  $\frac{47}{108}$ , what is the exact probability that the student selected is a junior whose favorite subject is Math? Are the events "the student is a junior" and "the student's favorite subject is Math" independent of each other? Explain your answer.

341 The average depreciation rate of a new boat is approximately 8% per year. If a new boat is purchased at a price of \$75,000, which model is a recursive formula representing the value of the boat  $n$  years after it was purchased?

1)  $a_n = 75,000(0.08)^n$

2)  $a_0 = 75,000$

$$a_n = (0.92)^n$$

3)  $a_n = 75,000(1.08)^n$

4)  $a_0 = 75,000$

$$a_n = 0.92(a_{n-1})$$

342 Which equation represents the equation of the parabola with focus  $(-3, 3)$  and directrix  $y = 7$ ?

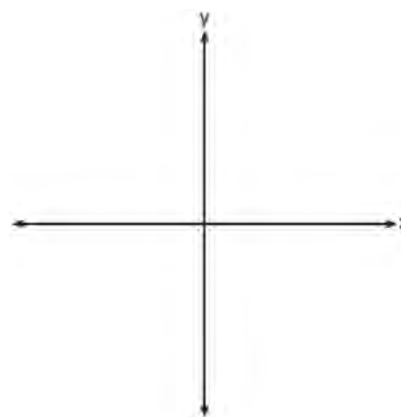
1)  $y = \frac{1}{8}(x+3)^2 - 5$

2)  $y = \frac{1}{8}(x-3)^2 + 5$

3)  $y = -\frac{1}{8}(x+3)^2 + 5$

4)  $y = -\frac{1}{8}(x-3)^2 + 5$

343 The zeros of a quartic polynomial function are 2,  $-2$ , 4, and  $-4$ . Use the zeros to construct a possible sketch of the function, on the set of axes below.



344 Factor  $x^3 + 4x^2 - 9x - 36$  completely.

345 If  $f(x) = a^x$  where  $a > 1$ , then the inverse of the function is

1)  $f^{-1}(x) = \log_x a$

2)  $f^{-1}(x) = a \log x$

3)  $f^{-1}(x) = \log_a x$

4)  $f^{-1}(x) = x \log a$

346 Kelly-Ann has \$20,000 to invest. She puts half of the money into an account that grows at an annual rate of 0.9% compounded monthly. At the same time, she puts the other half of the money into an account that grows continuously at an annual rate of 0.8%. Which function represents the value of Kelly-Ann's investments after  $t$  years?

- 1)  $f(t) = 10,000(1.9)^t + 10,000e^{0.8t}$
- 2)  $f(t) = 10,000(1.009)^t + 10,000e^{0.008t}$
- 3)  $f(t) = 10,000(1.075)^{12t} + 10,000e^{0.8t}$
- 4)  $f(t) = 10,000(1.00075)^{12t} + 10,000e^{0.008t}$

347 If  $f(x) = x^2 + 9$  and  $g(x) = x + 3$ , which operation would not result in a polynomial expression?

- 1)  $f(x) + g(x)$
- 2)  $f(x) - g(x)$
- 3)  $f(x) \cdot g(x)$
- 4)  $f(x) \div g(x)$

348 Which situation could be modeled using a geometric sequence?

- 1) A cell phone company charges \$30.00 per month for 2 gigabytes of data and \$12.50 for each additional gigabyte of data.
- 2) The temperature in your car is  $79^\circ$ . You lower the temperature of your air conditioning by  $2^\circ$  every 3 minutes in order to find a comfortable temperature.
- 3) David's parents have set a limit of 50 minutes per week that he may play online games during the school year. However, they will increase his time by 5% per week for the next ten weeks.
- 4) Sarah has \$100.00 in her piggy bank and saves an additional \$15.00 each week.

349 Evaluate  $j(-1)$  given

$j(x) = 2x^4 - x^3 - 35x^2 + 16x + 48$ . Explain what your answer tells you about  $x + 1$  as a factor. Algebraically find the remaining zeros of  $j(x)$ .

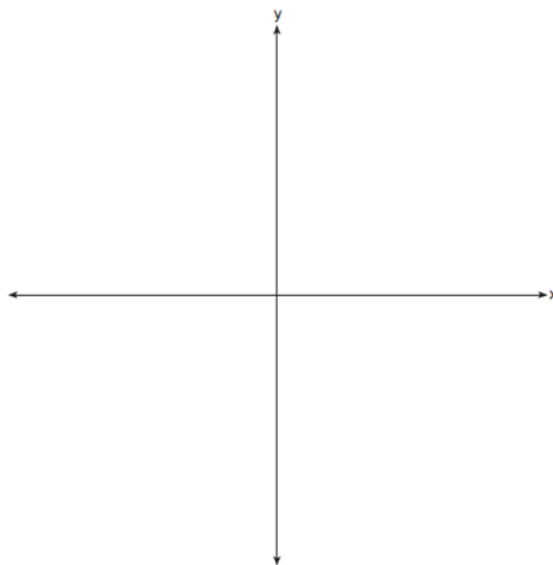
350 Solve the following system of equations algebraically for all values of  $x$ ,  $y$ , and  $z$ :

$$2x + 3y - 4z = -1$$

$$x - 2y + 5z = 3$$

$$-4x + y + z = 16$$

351 Sketch the graphs of  $r(x) = \frac{1}{x}$  and  $a(x) = |x| - 3$  on the set of axes below. Determine, to the *nearest tenth*, the positive solution of  $r(x) = a(x)$ .



352 Given  $\tan \theta = -\frac{4}{3}$  where  $\frac{\pi}{2} < \theta < \pi$ , what is the value of  $\sec \theta$ ?

- 1)  $-\frac{5}{3}$
- 2)  $-\frac{3}{5}$
- 3)  $\frac{4}{5}$
- 4)  $\frac{5}{3}$

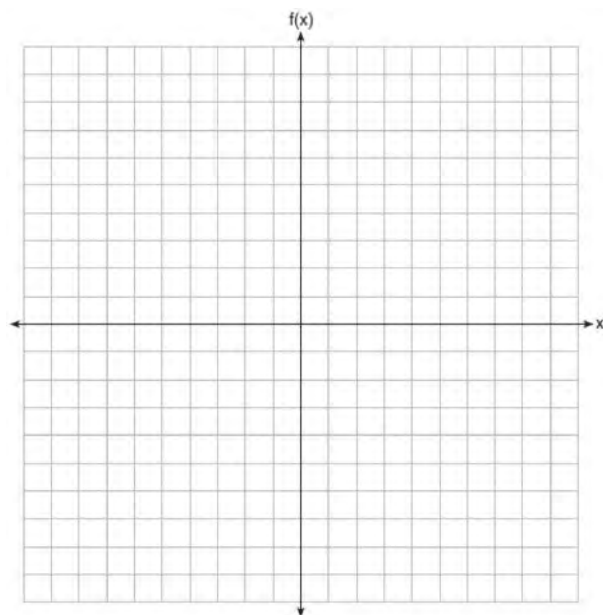
353 If  $(a^3 + 27) = (a + 3)(a^2 + ma + 9)$ , then  $m$  equals

- 1) -9
- 2) -3
- 3) 3
- 4) 6

354 When the expression  $(x + 2)^2 + 4(x + 2) + 3$  is rewritten as the product of two binomials, the result is

- 1)  $(x + 3)(x + 1)$
- 2)  $(x + 5)(x + 3)$
- 3)  $(x + 2)(x + 2)$
- 4)  $(x + 6)(x + 1)$

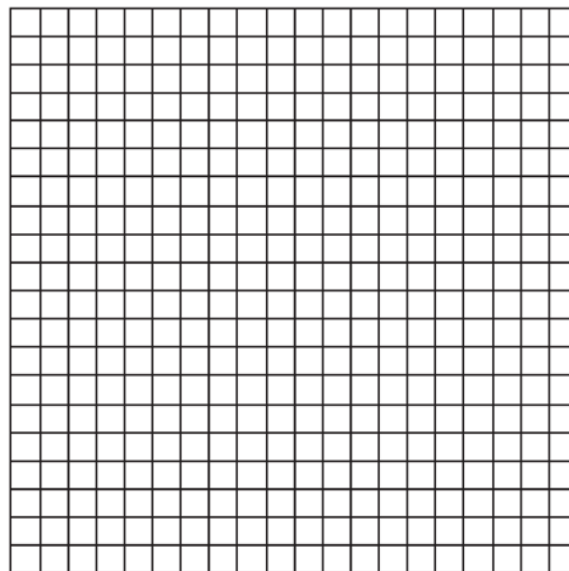
355 On the grid below, graph the function  $f(x) = x^3 - 6x^2 + 9x + 6$  on the domain  $-1 \leq x \leq 4$ .



357 If  $p(x) = 2x^3 - 3x + 5$ , what is the remainder of  $p(x) \div (x - 5)$ ?

- 1) -230
- 2) 0
- 3) 40
- 4) 240

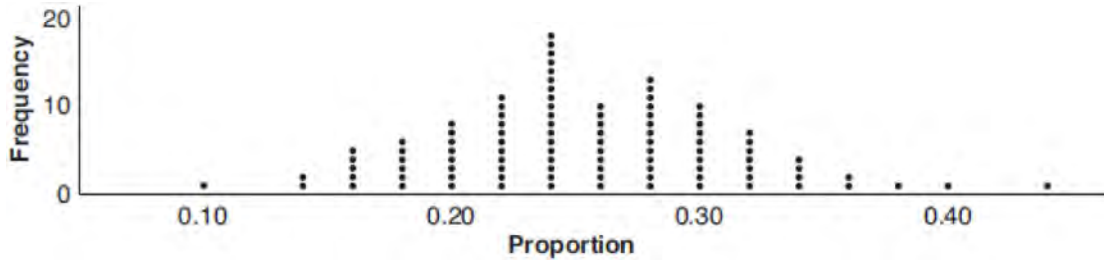
358 Griffin is riding his bike down the street in Churchville, N.Y. at a constant speed, when a nail gets caught in one of his tires. The height of the nail above the ground, in inches, can be represented by the trigonometric function  $f(t) = -13 \cos(0.8\pi t) + 13$ , where  $t$  represents the time (in seconds) since the nail first became caught in the tire. Determine the period of  $f(t)$ . Interpret what the period represents in this context. On the grid below, graph *at least one* cycle of  $f(t)$  that includes the y-intercept of the function.



Does the height of the nail ever reach 30 inches above the ground? Justify your answer.

356 Solve the equation  $2x^2 + 5x + 8 = 0$ . Express the answer in  $a + bi$  form.

359 A group of students was trying to determine the proportion of candies in a bag that are blue. The company claims that 24% of candies in bags are blue. A simulation was run 100 times with a sample size of 50, based on the premise that 24% of the candies are blue. The approximately normal results of the simulation are shown in the dot plot below.



The simulation results in a mean of 0.254 and a standard deviation of 0.060. Based on this simulation, what is a plausible interval containing the middle 95% of the data?

- 1) (0.194, 0.314)
- 2) (0.134, 0.374)
- 3) (-0.448, 0.568)
- 4) (0.254, 0.374)

360 The probability that a resident of a housing community opposes spending money for community improvement on plumbing issues is 0.8. The probability that a resident favors spending money on improving walkways given that the resident opposes spending money on plumbing issues is 0.85. Determine the probability that a randomly selected resident opposes spending money on plumbing issues and favors spending money on walkways.

361 The roots of the equation  $0 = x^2 + 6x + 10$  in simplest  $a + bi$  form are

- 1)  $-3 \pm 2i$
- 2)  $-6 \pm i$
- 3)  $-3 \pm i$
- 4)  $-3 \pm i\sqrt{2}$

362 Completely factor the following expression:  
 $x^2 + 3xy + 3x^3 + y$

363 The solution of  $87e^{0.3x} = 5918$ , to the nearest thousandth, is

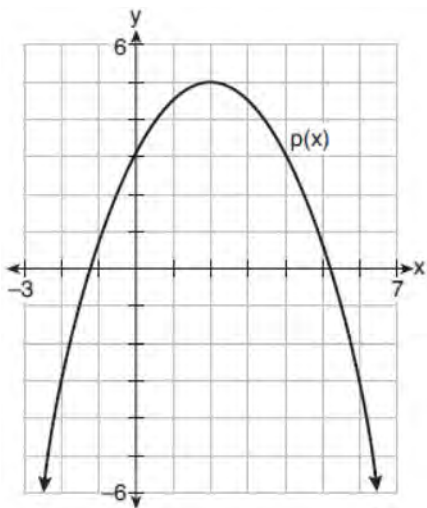
- 1) 0.583
- 2) 1.945
- 3) 4.220
- 4) 14.066

364 What is the solution set of the equation  $\frac{2}{x} - \frac{3x}{x+3} = \frac{x}{x+3}$ ?

- 1) {3}
- 2)  $\left\{\frac{3}{2}\right\}$
- 3) {-2, 3}
- 4)  $\left\{-1, \frac{3}{2}\right\}$

365 Given  $\tan \theta = \frac{7}{24}$ , and  $\theta$  terminates in Quadrant III, determine the value of  $\cos \theta$ .

- 366 Consider  $f(x) = 4x^2 + 6x - 3$ , and  $p(x)$  defined by the graph below.



The difference between the values of the maximum of  $p$  and minimum of  $f$  is

- 1) 0.25
  - 2) 1.25
  - 3) 3.25
  - 4) 10.25
- 367 The equation  $t = \frac{1}{0.0105} \ln\left(\frac{A}{5000}\right)$  relates time,  $t$ , in years, to the amount of money,  $A$ , earned by a \$5000 investment. Which statement accurately describes the relationship between the average rates of change of  $t$  on the intervals  $[6000, 8000]$  and  $[9000, 12,000]$ ?
- 1) A comparison cannot be made because the intervals are different sizes.
  - 2) The average rate of change is equal for both intervals.
  - 3) The average rate of change is larger for the interval  $[6000, 8000]$ .
  - 4) The average rate of change is larger for the interval  $[9000, 12,000]$ .

- 368 What is the equation of the directrix for the parabola  $-8(y - 3) = (x + 4)^2$ ?

- 1)  $y = 5$
- 2)  $y = 1$
- 3)  $y = -2$
- 4)  $y = -6$

- 369 When a ball bounces, the heights of consecutive bounces form a geometric sequence. The height of the first bounce is 121 centimeters and the height of the third bounce is 64 centimeters. To the nearest centimeter, what is the height of the fifth bounce?

- 1) 25
- 2) 34
- 3) 36
- 4) 42

- 370 Which equation does *not* represent an identity?

- 1)  $x^2 - y^2 = (x + y)(x - y)$
- 2)  $(x - y)^2 = (x - y)(x - y)$
- 3)  $(x + y)^2 = x^2 + 2xy + y^2$
- 4)  $(x + y)^3 = x^3 + 3xy + y^3$

- 371 Given  $y > 0$ , the expression  $\sqrt{3x^2y} \cdot \sqrt[3]{27x^3y^2}$  is equivalent to

- 1)  $81x^5y^3$
- 2)  $3^{1.5}x^2y$
- 3)  $3^{\frac{5}{2}}x^2y^{\frac{5}{3}}$
- 4)  $3^{\frac{3}{2}}x^2y^{\frac{7}{6}}$

- 372 An angle,  $\theta$ , is in standard position and its terminal side passes through the point  $(2, -1)$ . Find the exact value of  $\sin \theta$ .

- 373 The world population was 2560 million people in 1950 and 3040 million in 1960 and can be modeled by the function  $p(t) = 2560e^{0.017185t}$ , where  $t$  is time in years after 1950 and  $p(t)$  is the population in millions. Determine the average rate of change of  $p(t)$  in millions of people per year, from  $4 \leq t \leq 8$ . Round your answer to the nearest hundredth.

- 374 The value(s) of  $x$  that satisfy

$$\sqrt{x^2 - 4x - 5} = 2x - 10$$

- 1) {5}
- 2) {7}
- 3) {5, 7}
- 4) {3, 5, 7}

- 375 If  $x - 1$  is a factor of  $x^3 - kx^2 + 2x$ , what is the value of  $k$ ?

- 1) 0
- 2) 2
- 3) 3
- 4) -3

- 376 a) Algebraically determine the roots, in simplest  $a + bi$  form, to the equation below.

$$x^2 - 2x + 7 = 4x - 10$$

- b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$

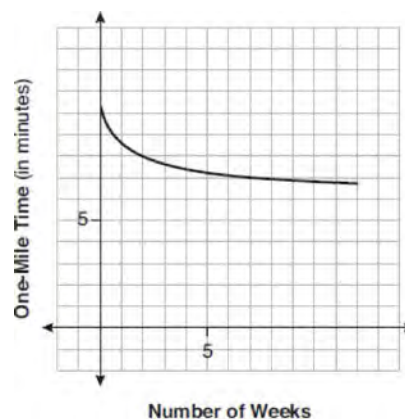
$$y = 4x - 10$$

The graph of this system confirms the solution from part a is imaginary. Explain why.

- 377 If the function  $g(x) = ab^x$  represents exponential growth, which statement about  $g(x)$  is false?

- 1)  $a > 0$  and  $b > 1$
- 2) The  $y$ -intercept is  $(0, a)$ .
- 3) The asymptote is  $y = 0$ .
- 4) The  $x$ -intercept is  $(b, 0)$ .

- 378 Irma initially ran one mile in over ten minutes. She then began a training program to reduce her one-mile time. She recorded her one-mile time once a week for twelve consecutive weeks, as modeled in the graph below.



Which statement regarding Irma's one-mile training program is correct?

- 1) Her one-mile speed increased as the number of weeks increased.
- 2) Her one-mile speed decreased as the number of weeks increased.
- 3) If the trend continues, she will run under a six-minute mile by week thirteen.
- 4) She reduced her one-mile time the most between weeks ten and twelve.

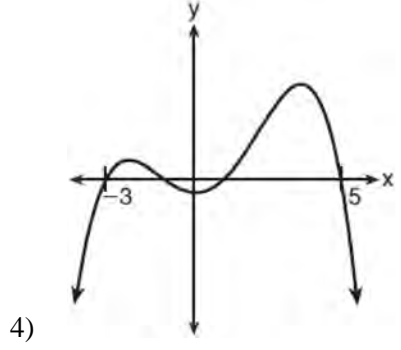
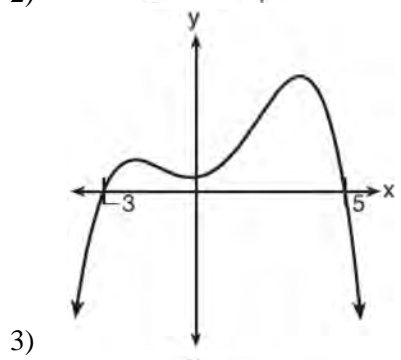
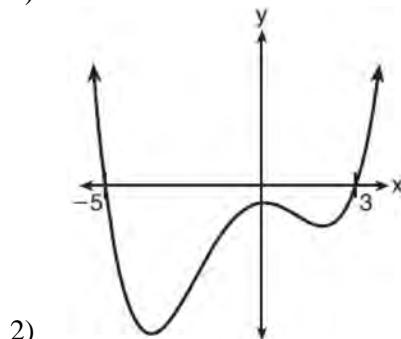
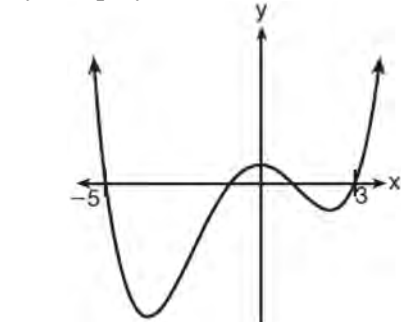
- 379 Written in simplest form,  $\frac{c^2 - d^2}{d^2 + cd - 2c^2}$  where

$c \neq d$ , is equivalent to

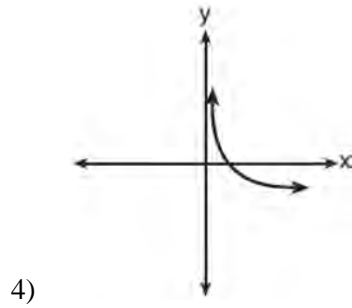
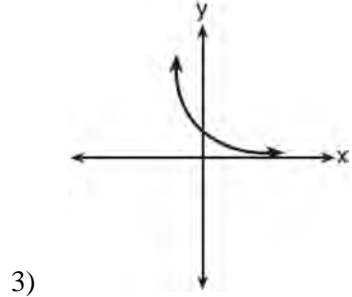
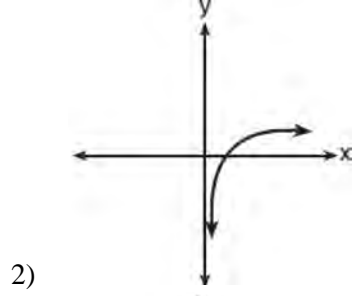
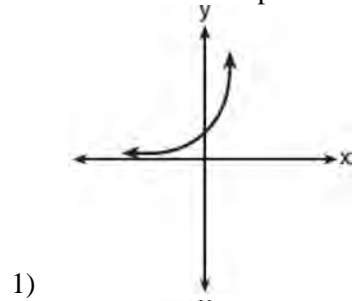
- 1)  $\frac{c + d}{d + 2c}$
- 2)  $\frac{c - d}{d + 2c}$
- 3)  $\frac{-c - d}{d + 2c}$
- 4)  $\frac{-c + d}{d + 2c}$



380 A 4th degree polynomial has zeros  $-5, 3, i,$  and  $-i$ . Which graph could represent the function defined by this polynomial?



381 Which sketch best represents the graph of  $x = 3^y$ ?



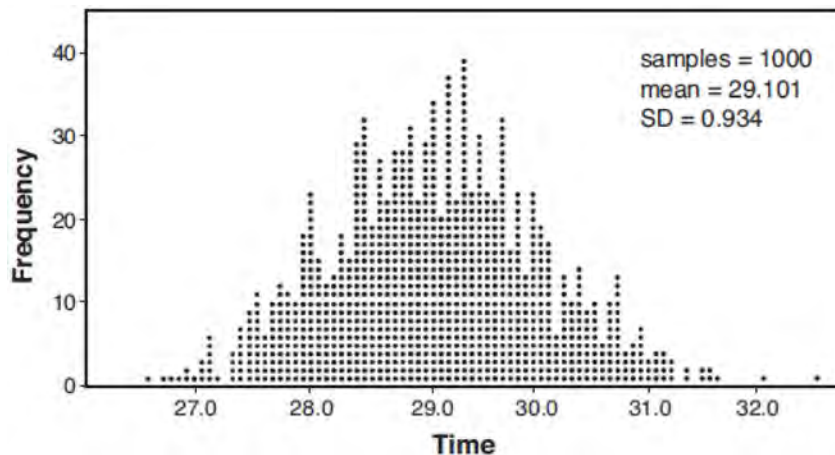
382 Explain what a rational exponent, such as  $\frac{5}{2}$  means.

Use this explanation to evaluate  $9^{\frac{5}{2}}$ .

- 383 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

$\bar{x}$	29.11
$s_x$	20.718

A simulation was run 1000 times based upon the results of the survey. The results of the simulation appear below.



Based on the simulation results, is the claim that commuters listen to the station on average 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

- 384 Determine for which polynomial(s)  $(x + 2)$  is a factor. Explain your answer.

$$P(x) = x^4 - 3x^3 - 16x - 12$$

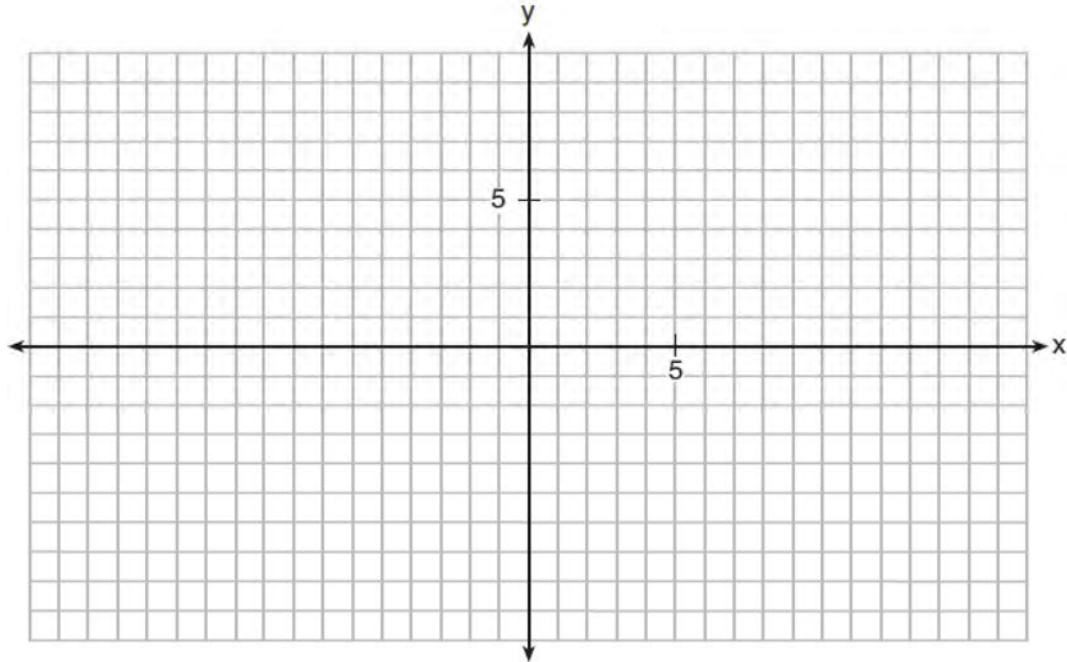
$$Q(x) = x^3 - 3x^2 - 16x - 12$$

- 385 At Andrew Jackson High School, students are only allowed to enroll in AP U.S. History if they have already taken AP World History or AP European History. Out of 825 incoming seniors, 165 took AP World History, 66 took AP European History, and 33 took both. Given this information, determine the probability a randomly selected incoming senior is allowed to enroll in AP U.S. History.

- 386 Camryn puts \$400 into a savings account that earns 6% annually. The amount in her account can be modeled by  $C(t) = 400(1.06)^t$  where  $t$  is the time in years. Which expression best approximates the amount of money in her account using a weekly growth rate?

- 1)  $400(1.001153846)^t$
- 2)  $400(1.001121184)^t$
- 3)  $400(1.001153846)^{52t}$
- 4)  $400(1.001121184)^{52t}$

387 On the grid below, graph the function  $y = \log_2(x - 3) + 1$



388 A survey about television-viewing preferences was given to randomly selected freshmen and seniors at Fairport High School. The results are shown in the table below.

Favorite Type of Program			
	Sports	Reality Show	Comedy Series
Senior	83	110	67
Freshmen	119	103	54

A student response is selected at random from the results. State the *exact* probability the student response is from a freshman, given the student prefers to watch reality shows on television.

389 Solve the following system of equations algebraically for all values of  $a$ ,  $b$ , and  $c$ .

$$a + 4b + 6c = 23$$

$$a + 2b + c = 2$$

$$6b + 2c = a + 14$$

390 What is the solution set for  $x$  in the equation below?

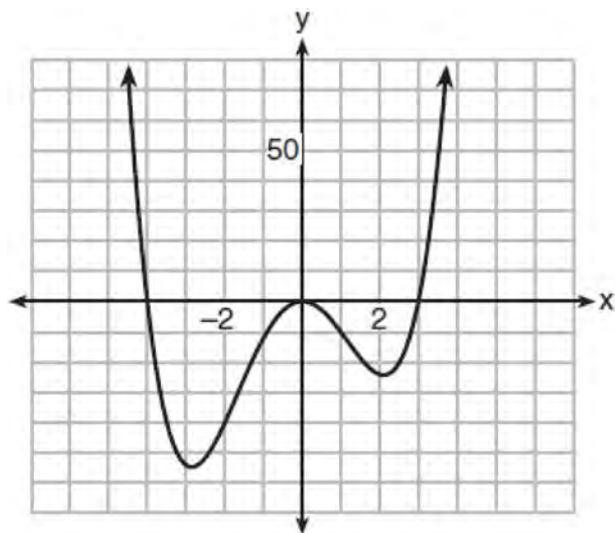
$$\sqrt{x+1} - 1 = x$$

- 1)  $\{1\}$
- 2)  $\{0\}$
- 3)  $\{-1, 0\}$
- 4)  $\{0, 1\}$

391 A manufacturing plant produces two different-sized containers of peanuts. One container weighs  $x$  ounces and the other weighs  $y$  pounds. If a gift set can hold one of each size container, which expression represents the number of gift sets needed to hold 124 ounces?

- 1)  $\frac{124}{16x + y}$
- 2)  $\frac{x + 16y}{124}$
- 3)  $\frac{124}{x + 16y}$
- 4)  $\frac{16x + y}{124}$

392 The graph of  $y = f(x)$  is shown below. The function has a leading coefficient of 1.



Write an equation for  $f(x)$ . The function  $g$  is formed by translating function  $f$  left 2 units. Write an equation for  $g(x)$ .

393 Where  $i$  is the imaginary unit, the expression  $(x + 3i)^2 - (2x - 3i)^2$  is equivalent to

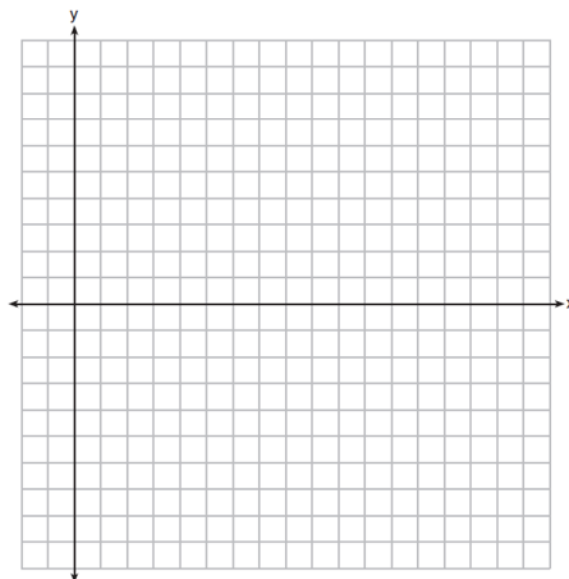
- 1)  $-3x^2$
- 2)  $-3x^2 - 18$
- 3)  $-3x^2 + 18xi$
- 4)  $-3x^2 - 6xi - 18$

394 A major car company analyzes its revenue,  $R(x)$ , and costs  $C(x)$ , in millions of dollars over a fifteen-year period. The company represents its revenue and costs as a function of time, in years,  $x$ , using the given functions.

$$R(x) = 550x^3 - 12,000x^2 + 83,000x + 7000$$

$$C(x) = 880x^3 - 21,000x^2 + 150,000x - 160,000$$

The company's profits can be represented as the difference between its revenue and costs. Write the profit function,  $P(x)$ , as a polynomial in standard form. Graph  $y = P(x)$  on the set of axes below over the domain  $2 \leq x \leq 16$ .



Over the given domain, state when the company was the least profitable and the most profitable, to the nearest year. Explain how you determined your answer.

395 A study of the red tailed hawk population in a given area shows the population,  $H(t)$ , can be represented by the function  $H(t) = 50(1.19)^t$  where  $t$  represents the number of years since the study began. In terms of the monthly rate of growth, the population can be best approximated by the function

- 1)  $H(t) = 50(1.015)^{12t}$
- 2)  $H(t) = 50(1.15)^{\frac{t}{12}}$
- 3)  $H(t) = 50(1.19)^{12t}$
- 4)  $H(t) = 50(1.19)^{\frac{t}{12}}$

396 Julia deposits \$2000 into a savings account that earns 4% interest per year. The exponential function that models this savings account is  $y = 2000(1.04)^t$ , where  $t$  is the time in years. Which equation correctly represents the amount of money in her savings account in terms of the monthly growth rate?

- 1)  $y = 166.67(1.04)^{0.12t}$
- 2)  $y = 2000(1.01)^t$
- 3)  $y = 2000(1.0032737)^{12t}$
- 4)  $y = 166.67(1.0032737)^t$

397 Which expression(s) are equivalent to  $\frac{x^2 - 4x}{2x}$ ,

where  $x \neq 0$ ?

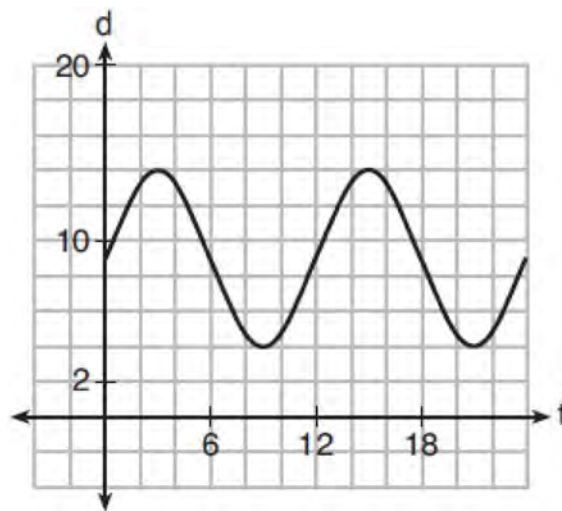
I.  $\frac{x}{2} - 2$     II.  $\frac{x-4}{2}$     III.  $\frac{x-1}{2} - \frac{3}{2}$

- 1) II, only
- 2) I and II
- 3) II and III
- 4) I, II, and III

398 Suppose two sets of test scores have the same mean, but different standard deviations,  $\sigma_1$  and  $\sigma_2$ , with  $\sigma_2 > \sigma_1$ . Which statement best describes the variability of these data sets?

- 1) Data set one has the greater variability.
- 2) Data set two has the greater variability.
- 3) The variability will be the same for each data set.
- 4) No conclusion can be made regarding the variability of either set.

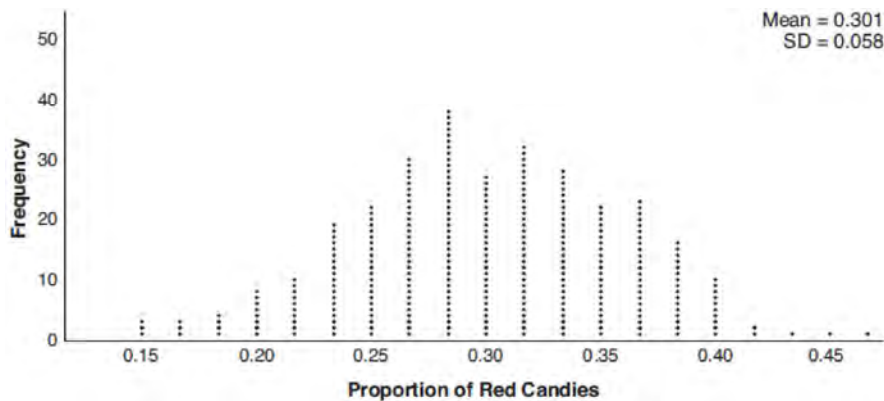
399 The depth of the water at a marker 20 feet from the shore in a bay is depicted in the graph below.



If the depth,  $d$ , is measured in feet and time,  $t$ , is measured in hours since midnight, what is an equation for the depth of the water at the marker?

- 1)  $d = 5 \cos\left(\frac{\pi}{6}t\right) + 9$
- 2)  $d = 9 \cos\left(\frac{\pi}{6}t\right) + 5$
- 3)  $d = 9 \sin\left(\frac{\pi}{6}t\right) + 5$
- 4)  $d = 5 \sin\left(\frac{\pi}{6}t\right) + 9$

400 Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.



Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within. Based on the simulation, is it unusual that Mary’s pack had 14 red candies out of a total of 60? Explain.

401 The solution set for the equation  $b = \sqrt{2b^2 - 64}$  is

- 1)  $\{-8\}$
- 2)  $\{8\}$
- 3)  $\{\pm 8\}$
- 4)  $\{ \}$

402 Savannah just got contact lenses. Her doctor said she can wear them 2 hours the first day, and can then increase the length of time by 30 minutes each day. If this pattern continues, which formula would *not* be appropriate to determine the length of time, in either minutes or hours, she could wear her contact lenses on the  $n$ th day?

- 1)  $a_1 = 120$   
 $a_n = a_{n-1} + 30$
- 2)  $a_n = 90 + 30n$
- 3)  $a_1 = 2$   
 $a_n = a_{n-1} + 0.5$
- 4)  $a_n = 2.5 + 0.5n$

403 The roots of the equation  $3x^2 + 2x = -7$  are

- 1)  $-2, -\frac{1}{3}$
- 2)  $-\frac{7}{3}, 1$
- 3)  $-\frac{1}{3} \pm \frac{2i\sqrt{5}}{3}$
- 4)  $-\frac{1}{3} \pm \frac{\sqrt{11}}{3}$

404 What is the solution when the equation  $wx^2 + w = 0$  is solved for  $x$ , where  $w$  is a positive integer?

- 1)  $-1$
- 2)  $0$
- 3)  $6$
- 4)  $\pm i$

- 405 How many solutions exist for

$$\frac{1}{1-x^2} = -|3x-2| + 5?$$

- 1) 1
- 2) 2
- 3) 3
- 4) 4

- 406 Evan graphed a cubic function,

$f(x) = ax^3 + bx^2 + cx + d$ , and determined the roots of  $f(x)$  to be  $\pm 1$  and 2. What is the value of  $b$ , if  $a = 1$ ?

- 1) 1
- 2) 2
- 3) -1
- 4) -2

- 407 The function below models the average price of gas in a small town since January 1st.

$$G(t) = -0.0049t^4 + 0.0923t^3 - 0.56t^2 + 1.166t + 3.23,$$

where  $0 \leq t \leq 10$ .

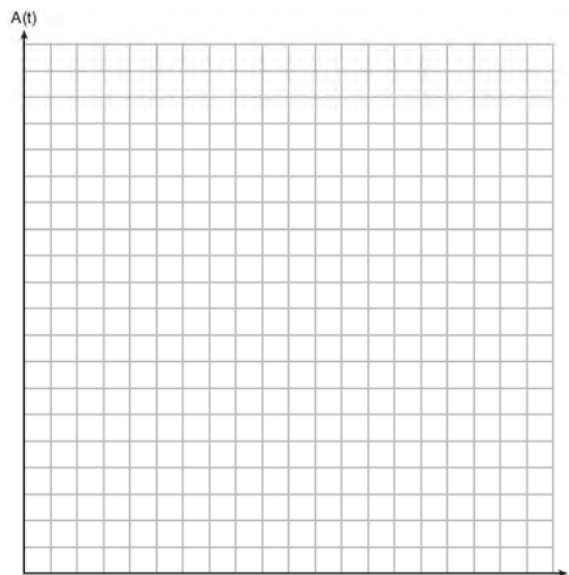
If  $G(t)$  is the average price of gas in dollars and  $t$  represents the number of months since January 1st, the absolute maximum  $G(t)$  reaches over the given domain is about

- 1) \$1.60
- 2) \$3.92
- 3) \$4.01
- 4) \$7.73

- 408 A number, minus twenty times its reciprocal, equals eight. The number is

- 1) 10 or -2
- 2) 10 or 2
- 3) -10 or -2
- 4) -10 or 2

- 409 Tony is evaluating his retirement savings. He currently has \$318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account. Write a function,
- $A(t)$
- , to represent the amount of money that will be in his account in
- $t$
- years. Graph
- $A(t)$
- where
- $0 \leq t \leq 20$
- on the set of axes below.



Tony's goal is to save \$1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal. Explain how your graph of  $A(t)$  confirms your answer.

- 410 What are the solution(s) to the system of equations shown below?

$$x^2 + y^2 = 5$$

$$y = 2x$$

- 1)  $x = 1$  and  $x = -1$
- 2)  $x = 1$
- 3) (1,2) and (-1,-2)
- 4) (1,2), only

- 411 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers,  $B$ , are determined by the equation

$B = 1.69\sqrt{s + 4.45} - 3.49$ , where  $s$  is the speed of the wind in mph, and  $B$  is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale	
Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer. In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a  $B$  value of exactly 15. Algebraically determine the value of  $s$ , to the *nearest mph*. Any  $B$  values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

- 412 Given  $f(x) = x^3 - 3$  and  $f^{-1}(x) = \sqrt[3]{x - 3b}$ , the value of  $b$  is
- 1) 1
  - 2) -1
  - 3) 3
  - 4) -3
- 413 When the function  $p(x)$  is divided by  $x - 1$  the quotient is  $x^2 + 7 + \frac{5}{x - 1}$ . State  $p(x)$  in standard form.
- 414 The average cost of a gallon of milk in the United States between the years of 1995 and 2018 can be modeled by the equation
- $$P(t) = -0.0004t^3 + 0.0114t^2 - 0.0150t + 2.6602,$$
- where  $P(t)$  represents the cost, in dollars, and  $t$  is time in years since January 1995. During this time period, in what year did  $P(t)$  reach its maximum?
- 1) 1995
  - 2) 2013
  - 3) 2014
  - 4) 2018
- 415 Over the set of integers, factor the expression  $x^4 - 4x^2 - 12$ .



- 416 Consider the probability statements regarding events  $A$  and  $B$  below.

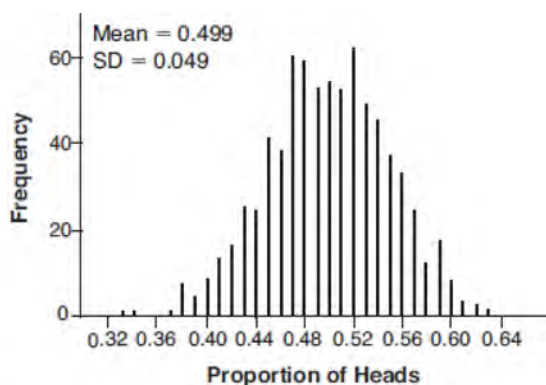
$$P(A \text{ or } B) = 0.3;$$

$$P(A \text{ and } B) = 0.2; \text{ and}$$

$$P(A|B) = 0.8$$

What is  $P(B)$ ?

- 1) 0.1
  - 2) 0.25
  - 3) 0.375
  - 4) 0.667
- 417 Robin flips a coin 100 times. It lands heads up 43 times, and she wonders if the coin is unfair. She runs a computer simulation of 750 samples of 100 fair coin flips. The output of the proportion of heads is shown below.



Do the results of the simulation provide strong evidence that Robin's coin is unfair? Explain your answer.

- 418 To solve the equation  $\frac{7}{x+7} + \frac{4x}{x-7} = \frac{3x+7}{x-7}$ ,

Joan's first step is to multiply both sides by the least common denominator. Which statement is true?

- 1)  $-14$  is an extraneous solution.
- 2)  $7$  and  $-7$  are extraneous solutions.
- 3)  $7$  is an extraneous solution.
- 4) There are no extraneous solutions.

- 419 The profit function,  $p(x)$ , for a company is the cost function,  $c(x)$ , subtracted from the revenue function,  $r(x)$ . The profit function for the Acme Corporation is  $p(x) = -0.5x^2 + 250x - 300$  and the revenue function is  $r(x) = -0.3x^2 + 150x$ . The cost function for the Acme Corporation is

- 1)  $c(x) = 0.2x^2 - 100x + 300$

- 2)  $c(x) = 0.2x^2 + 100x + 300$

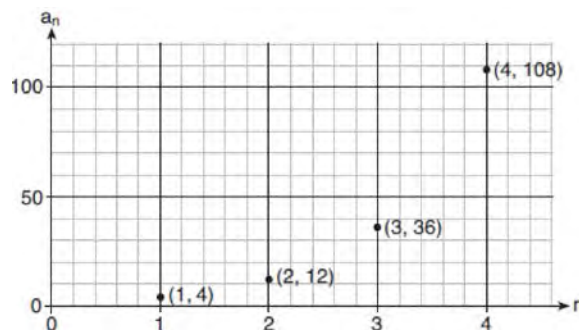
- 3)  $c(x) = -0.2x^2 + 100x - 300$

- 4)  $c(x) = -0.8x^2 + 400x - 300$

- 420 Perry invested in property that cost him \$1500. Five years later it was worth \$3000, and 10 years from his original purchase, it was worth \$6000. Assuming the growth rate remains the same, which type of function could he create to find the value of his investment 30 years from his original purchase?

- 1) exponential function
- 2) linear function
- 3) quadratic function
- 4) trigonometric function

- 421 Write a recursive formula,  $a_n$ , to describe the sequence graphed below.



422 Which table best represents an exponential relationship?

1) 

x	y
1	8
2	4
3	2
4	1
5	$\frac{1}{2}$

2) 

x	y
8	0
4	1
0	2
-4	3
-8	4

3) 

x	y
0	0
1	1
2	4
3	9
4	16

4) 

x	y
1	1
2	8
3	27
4	64
5	125

423 Express the fraction  $\frac{2x^{\frac{3}{2}}}{(16x^4)^{\frac{1}{4}}}$  in simplest radical form.

424 For all values of  $x$  for which the expression is defined,  $\frac{x^3 + 2x^2 - 9x - 18}{x^3 - x^2 - 6x}$ , in simplest form, is

equivalent to

- 1) 3
- 2)  $-\frac{17}{2}$
- 3)  $\frac{x+3}{x}$
- 4)  $\frac{x^2-9}{x(x-3)}$

425 The solutions to the equation  $5x^2 - 2x + 13 = 9$  are

- 1)  $\frac{1}{5} \pm \frac{\sqrt{21}}{5}$
- 2)  $\frac{1}{5} \pm \frac{\sqrt{19}}{5}i$
- 3)  $\frac{1}{5} \pm \frac{\sqrt{66}}{5}i$
- 4)  $\frac{1}{5} \pm \frac{\sqrt{66}}{5}$

426 The completely factored form of  $n^4 - 9n^2 + 4n^3 - 36n - 12n^2 + 108$  is

- 1)  $(n^2 - 9)(n + 6)(n - 2)$
- 2)  $(n + 3)(n - 3)(n + 6)(n - 2)$
- 3)  $(n - 3)(n - 3)(n + 6)(n - 2)$
- 4)  $(n + 3)(n - 3)(n - 6)(n + 2)$

427 Rowan is training to run in a race. He runs 15 miles in the first week, and each week following, he runs 3% more than the week before. Using a geometric series formula, find the total number of miles Rowan runs over the first ten weeks of training, rounded to the *nearest thousandth*.

- 428 If  $n = \sqrt{a^5}$  and  $m = a$ , where  $a > 0$ , an expression for  $\frac{n}{m}$  could be
- 1)  $a^{\frac{5}{2}}$
  - 2)  $a^4$
  - 3)  $\sqrt[3]{a^2}$
  - 4)  $\sqrt{a^3}$
- 429 If  $\cos \theta = -\frac{3}{4}$  and  $\theta$  is in Quadrant III, then  $\sin \theta$  is equivalent to
- 1)  $-\frac{\sqrt{7}}{4}$
  - 2)  $\frac{\sqrt{7}}{4}$
  - 3)  $-\frac{5}{4}$
  - 4)  $\frac{5}{4}$
- 430 On a given school day, the probability that Nick oversleeps is 48% and the probability he has a pop quiz is 25%. Assuming these two events are independent, what is the probability that Nick oversleeps and has a pop quiz on the same day?
- 1) 73%
  - 2) 36%
  - 3) 23%
  - 4) 12%
- 431 Determine the quotient and remainder when  $(6a^3 + 11a^2 - 4a - 9)$  is divided by  $(3a - 2)$ .  
Express your answer in the form  $q(a) + \frac{r(a)}{d(a)}$ .
- 432 The expression  $6 - (3x - 2i)^2$  is equivalent to
- 1)  $-9x^2 + 12xi + 10$
  - 2)  $9x^2 - 12xi + 2$
  - 3)  $-9x^2 + 10$
  - 4)  $-9x^2 + 12xi - 4i + 6$
- 433 Explain why  $81^{\frac{3}{4}}$  equals 27.
- 434 The scores on a mathematics college-entry exam are normally distributed with a mean of 68 and standard deviation 7.2. Students scoring higher than one standard deviation above the mean will not be enrolled in the mathematics tutoring program. How many of the 750 incoming students can be expected to be enrolled in the tutoring program?
- 1) 631
  - 2) 512
  - 3) 238
  - 4) 119
- 435 The average monthly temperature of a city can be modeled by a cosine graph. Melissa has been living in Phoenix, Arizona, where the average annual temperature is 75°F. She would like to move, and live in a location where the average annual temperature is 62°F. When examining the graphs of the average monthly temperatures for various locations, Melissa should focus on the
- 1) amplitude
  - 2) horizontal shift
  - 3) period
  - 4) midline
- 436 Point  $M\left(t, \frac{4}{7}\right)$  is located in the second quadrant on the unit circle. Determine the exact value of  $t$ .

- 437 Jake wants to buy a car and hopes to save at least \$5000 for a down payment. The table below summarizes the amount of money he plans to save each week.

Week	1	2	3	4	5
Money Saved, in Dollars	2	5	12.5	31.25	...

Based on this plan, which expression should he use to determine how much he has saved in  $n$  weeks?

- 1)  $\frac{2 - 2(2.5^n)}{1 - 2.5}$                       3)  $\frac{1 - 2.5^n}{1 - 2.5}$   
 2)  $\frac{2 - 2(2.5^{n-1})}{1 - 2.5}$                       4)  $\frac{1 - 2.5^{n-1}}{1 - 2.5}$
- 438 Consider the system of equations below:

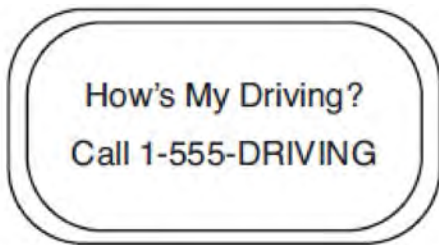
$$x + y - z = 6$$

$$2x - 3y + 2z = -19$$

$$-x + 4y - z = 17$$

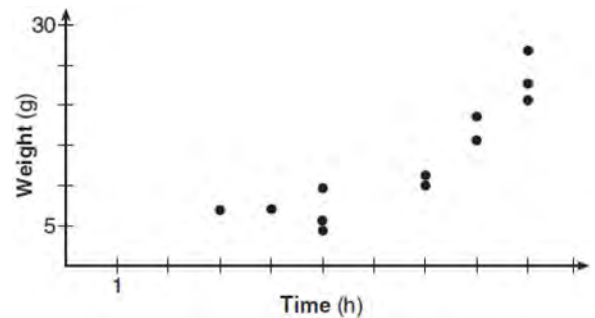
Which number is *not* the value of any variable in the solution of the system?

- 1) -1  
 2) 2  
 3) 3  
 4) -4
- 439 Chuck's Trucking Company has decided to initiate an Employee of the Month program. To determine the recipient, they put the following sign on the back of each truck.



The driver who receives the highest number of positive comments will win the recognition. Explain *one* statistical bias in this data collection method.

- 440 A scatterplot showing the weight,  $w$ , in grams, of each crystal after growing  $t$  hours is shown below.



The relationship between weight,  $w$ , and time,  $t$ , is best modeled by

- 1)  $w = 4^t + 5$   
 2)  $w = (1.4)^t + 2$   
 3)  $w = 5(2.1)^t$   
 4)  $w = 8(.75)^t$
- 441 A random sample of 100 people that would best estimate the proportion of all registered voters in a district who support improvements to the high school football field should be drawn from registered voters in the district at a
- 1) football game  
 2) supermarket  
 3) school fund-raiser  
 4) high school band concert

442 Consider the function  $h(x) = 2\sin(3x) + 1$  and the function  $q$  represented in the table below.

$x$	$q(x)$
-2	-8
-1	0
0	0
1	-2
2	0

Determine which function has the *smaller* minimum value for the domain  $[-2, 2]$ . Justify your answer.

443 Juan and Filipe practice at the driving range before playing golf. The number of wins and corresponding practice times for each player are shown in the table below.

	Juan Wins	Felipe Wins
<b>Short Practice Time</b>	8	10
<b>Long Practice Time</b>	15	12

Given that the practice time was long, determine the exact probability that Filipe wins the next match. Determine whether or not the two events "Filipe wins" and "long practice time" are independent. Justify your answer.

444 The operator of the local mall wants to find out how many of the mall's employees make purchases in the food court when they are working. She hopes to use these data to increase the rent and attract new food vendors. In total, there are 1023 employees who work at the mall. The best method to obtain a random sample of the employees would be to survey

- 1) all 170 employees at each of the larger stores
- 2) 50% of the 90 employees of the food court
- 3) every employee
- 4) every 30th employee entering each mall entrance for one week

445 Solve algebraically for all values of  $x$ :

$$\sqrt{6-2x} + x = 2(x+15) - 9$$

446 There are 400 students in the senior class at Oak Creek High School. All of these students took the SAT. The distribution of their SAT scores is approximately normal. The number of students who scored within 2 standard deviations of the mean is approximately

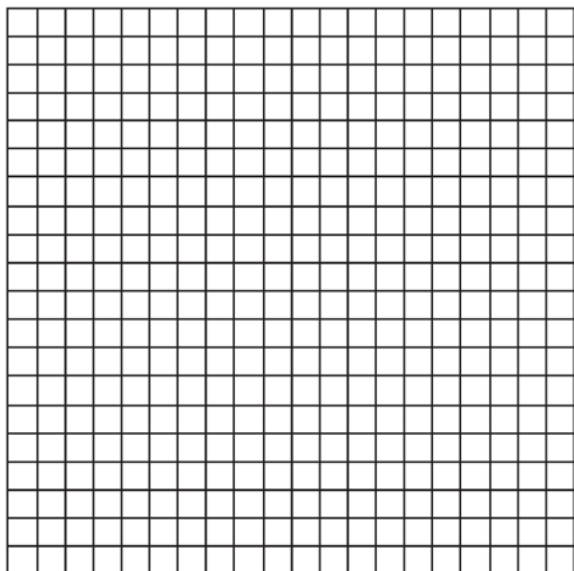
- 1) 75
- 2) 95
- 3) 300
- 4) 380

447 The graph of  $y = \log_2 x$  is translated to the right 1 unit and down 1 unit. The coordinates of the  $x$ -intercept of the translated graph are

- 1) (0,0)
- 2) (1,0)
- 3) (2,0)
- 4) (3,0)

- 448 A veterinary pharmaceutical company plans to test a new drug to treat a common intestinal infection among puppies. The puppies are randomly assigned to two equal groups. Half of the puppies will receive the drug, and the other half will receive a placebo. The veterinarians monitor the puppies. This is an example of which study method?
- 1) census
  - 2) observational study
  - 3) survey
  - 4) controlled experiment

- 449 Determine an equation for the parabola with focus  $(4, -1)$  and directrix  $y = -5$ . (Use of the grid below is optional.)



- 450 What is the inverse of  $f(x) = -6(x - 2)$ ?
- 1)  $f^{-1}(x) = -2 - \frac{x}{6}$
  - 2)  $f^{-1}(x) = 2 - \frac{x}{6}$
  - 3)  $f^{-1}(x) = \frac{1}{-6(x - 2)}$
  - 4)  $f^{-1}(x) = 6(x + 2)$

- 451 Given  $\cos \theta = \frac{7}{25}$ , where  $\theta$  is an angle in standard position terminating in quadrant IV, and  $\sin^2 \theta + \cos^2 \theta = 1$ , what is the value of  $\tan \theta$ ?
- 1)  $-\frac{24}{25}$
  - 2)  $-\frac{24}{7}$
  - 3)  $\frac{24}{25}$
  - 4)  $\frac{24}{7}$

- 452 Given  $f(x) = \frac{1}{2}x + 8$ , which equation represents the inverse,  $g(x)$ ?
- 1)  $g(x) = 2x - 8$
  - 2)  $g(x) = 2x - 16$
  - 3)  $g(x) = -\frac{1}{2}x + 8$
  - 4)  $g(x) = -\frac{1}{2}x - 16$

- 453 A savings account,  $S$ , has an initial value of \$50. The account grows at a 2% interest rate compounded  $n$  times per year,  $t$ , according to the function below.

$$S(t) = 50 \left( 1 + \frac{.02}{n} \right)^{nt}$$

- Which statement about the account is correct?
- 1) As the value of  $n$  increases, the amount of interest per year decreases.
  - 2) As the value of  $n$  increases, the value of the account approaches the function  $S(t) = 50e^{0.02t}$ .
  - 3) As the value of  $n$  decreases to one, the amount of interest per year increases.
  - 4) As the value of  $n$  decreases to one, the value of the account approaches the function  $S(t) = 50(1 - 0.02)^t$ .

454 Sodium iodide-131, used to treat certain medical conditions, has a half-life of 1.8 hours. The data table below shows the amount of sodium iodide-131, rounded to the nearest thousandth, as the dose fades over time.

Number of Half Lives	1	2	3	4	5
Amount of Sodium Iodide-131	139.000	69.500	34.750	17.375	8.688

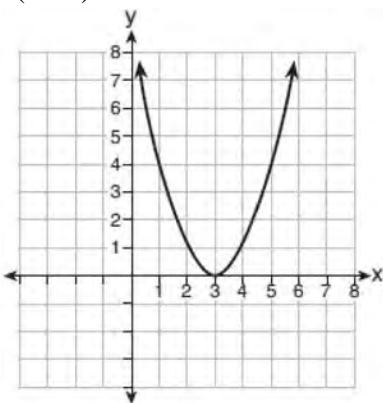
What approximate amount of sodium iodide-131 will remain in the body after 18 hours?

- 1) 0.001
- 2) 0.136
- 3) 0.271
- 4) 0.543

455 Which representation of a quadratic has imaginary roots?

x	y
-2.5	2
-2.0	0
-1.5	-1
-1.0	-1
-0.5	0
0.0	2

- 1)
- 2)  $2(x + 3)^2 = 64$



- 3)
- 4)  $2x^2 + 32 = 0$

456 When factoring to reveal the roots of the equation  $x^3 + 2x^2 - 9x - 18 = 0$ , which equations can be used?

- I.  $x^2(x + 2) - 9(x + 2) = 0$
  - II.  $x(x^2 - 9) + 2(x^2 - 9) = 0$
  - III.  $(x - 2)(x^2 - 9) = 0$
- 1) I and II, only
  - 2) I and III, only
  - 3) II and III, only
  - 4) I, II, and III

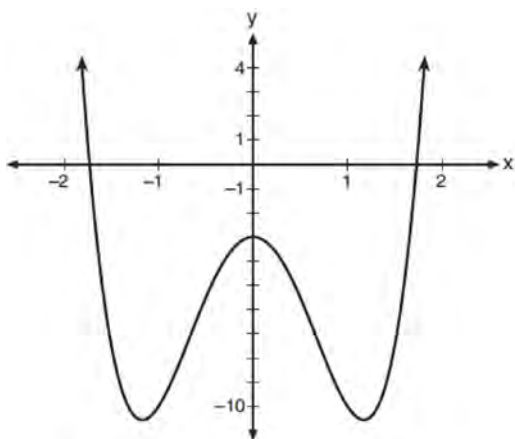
457 Which statement(s) are true for all real numbers?

- I  $(x - y)^2 = x^2 + y^2$
  - II  $(x + y)^3 = x^3 + 3xy + y^3$
- 1) I, only
  - 2) II, only
  - 3) I and II
  - 4) neither I nor II

458 Solve the following system of equations algebraically.  $x^2 + y^2 = 400$

$$y = x - 28$$

- 459 Consider the function  $p(x) = 3x^3 + x^2 - 5x$  and the graph of  $y = m(x)$  below.



Which statement is true?

- 1)  $p(x)$  has three real roots and  $m(x)$  has two real roots.
  - 2)  $p(x)$  has one real root and  $m(x)$  has two real roots.
  - 3)  $p(x)$  has two real roots and  $m(x)$  has three real roots.
  - 4)  $p(x)$  has three real roots and  $m(x)$  has four real roots.
- 460 If \$5000 is put into a savings account that pays 3.5% interest compounded monthly, how much money, to the *nearest ten cents*, would be in that account after 6 years, assuming no money was added or withdrawn?
- 1) \$5177.80
  - 2) \$5941.30
  - 3) \$6146.30
  - 4) \$6166.50

- 461 Which function is even?

- 1)  $f(x) = \sin x$
- 2)  $f(x) = x^2 - 4$
- 3)  $f(x) = |x - 2| + 5$
- 4)  $f(x) = x^4 + 3x^3 + 4$

- 462 A fast-food restaurant analyzes data to better serve its customers. After its analysis, it discovers that the events  $D$ , that a customer uses the drive-thru, and  $F$ , that a customer orders French fries, are independent. The following data are given in a report:

$$P(F) = 0.8$$

$$P(F \cap D) = 0.456$$

Given this information,  $P(F|D)$  is

- 1) 0.344
- 2) 0.3648
- 3) 0.57
- 4) 0.8

- 463 For  $x > 0$ , which expression is equivalent to

$$\frac{\sqrt[3]{x^2} \cdot \sqrt{x^5}}{\sqrt[6]{x}} ?$$

- 1)  $x$
- 2)  $x^{\frac{3}{2}}$
- 3)  $x^3$
- 4)  $x^{10}$

- 464 For the system shown below, what is the value of  $z$ ?

$$y = -2x + 14$$

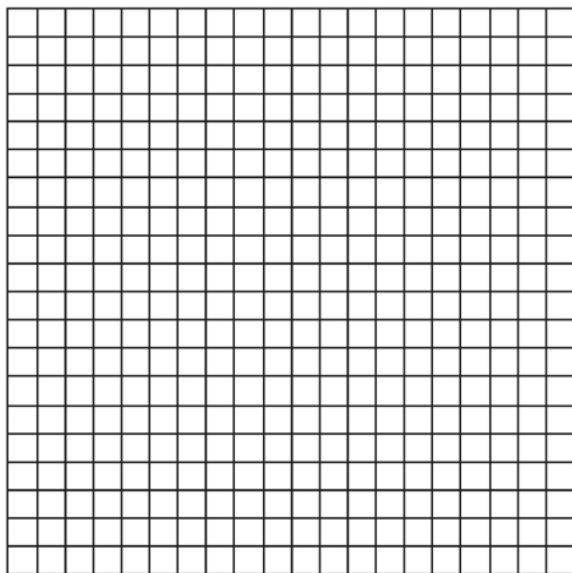
$$3x - 4z = 2$$

$$3x - y = 16$$

- 1) 5
- 2) 2
- 3) 6
- 4) 4



- 465 Write an equation for a sine function with an amplitude of 2 and a period of  $\frac{\pi}{2}$ . On the grid below, sketch the graph of the equation in the interval 0 to  $2\pi$ .

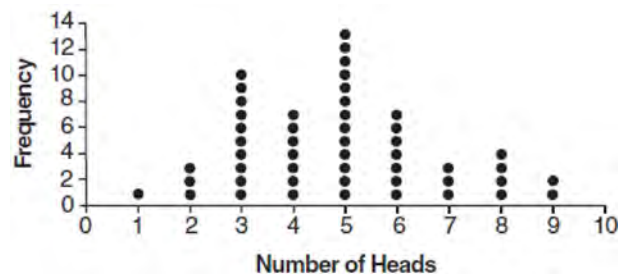


- 466 Tides are a periodic rise and fall of ocean water. On a typical day at a seaport, to predict the time of the next high tide, the most important value to have would be the
- 1) time between consecutive low tides
  - 2) time when the tide height is 20 feet
  - 3) average depth of water over a 24-hour period
  - 4) difference between the water heights at low and high tide

- 467 The expression  $\frac{9x^2 - 2}{3x + 1}$  is equivalent to

- 1)  $3x - 1 - \frac{1}{3x + 1}$
- 2)  $3x - 1 + \frac{1}{3x + 1}$
- 3)  $3x + 1 - \frac{1}{3x + 1}$
- 4)  $3x + 1 + \frac{1}{3x + 1}$

- 468 The results of simulating tossing a coin 10 times, recording the number of heads, and repeating this 50 times are shown in the graph below.



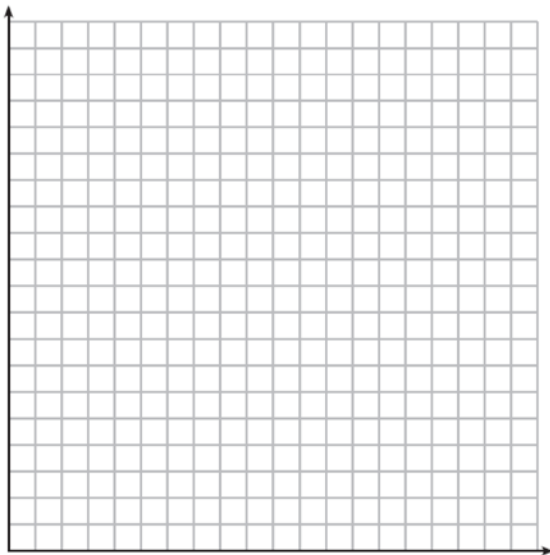
Based on the results of the simulation, which statement is *false*?

- 1) Five heads occurred most often, which is consistent with the theoretical probability of obtaining a heads.
  - 2) Eight heads is unusual, as it falls outside the middle 95% of the data.
  - 3) Obtaining three heads or fewer occurred 28% of the time.
  - 4) Seven heads is not unusual, as it falls within the middle 95% of the data.
- 469 The half-life of a radioactive substance is 15 years. Write an equation that can be used to determine the amount,  $s(t)$ , of 200 grams of this substance that remains after  $t$  years. Determine algebraically, to the *nearest year*, how long it will take for  $\frac{1}{10}$  of this substance to remain.

- 470 The height,  $h(t)$  in cm, of a piston, is given by the equation  $h(t) = 12 \cos\left(\frac{\pi}{3}t\right) + 8$ , where  $t$  represents the number of seconds since the measurements began. Determine the average rate of change, in cm/sec, of the piston's height on the interval  $1 \leq t \leq 2$ . At what value(s) of  $t$ , to the *nearest tenth of a second*, does  $h(t) = 0$  in the interval  $1 \leq t \leq 5$ ? Justify your answer.

**Algebra II Regents at Random Worksheets**

- 471 The value of a certain small passenger car based on its use in years is modeled by  $V(t) = 28482.698(0.684)^t$ , where  $V(t)$  is the value in dollars and  $t$  is the time in years. Zach had to take out a loan to purchase the small passenger car. The function  $Z(t) = 22151.327(0.778)^t$ , where  $Z(t)$  is measured in dollars, and  $t$  is the time in years, models the unpaid amount of Zach's loan over time. Graph  $V(t)$  and  $Z(t)$  over the interval  $0 \leq t \leq 5$ , on the set of axes below.



State when  $V(t) = Z(t)$ , to the *nearest hundredth*, and interpret its meaning in the context of the problem. Zach takes out an insurance policy that requires him to pay a \$3000 deductible in case of a collision. Zach will cancel the collision policy when the value of his car equals his deductible. To the *nearest year*, how long will it take Zach to cancel this policy? Justify your answer.

- 472 In New York State, the minimum wage has grown exponentially. In 1966, the minimum wage was \$1.25 an hour and in 2015, it was \$8.75. Algebraically determine the rate of growth to the *nearest percent*.

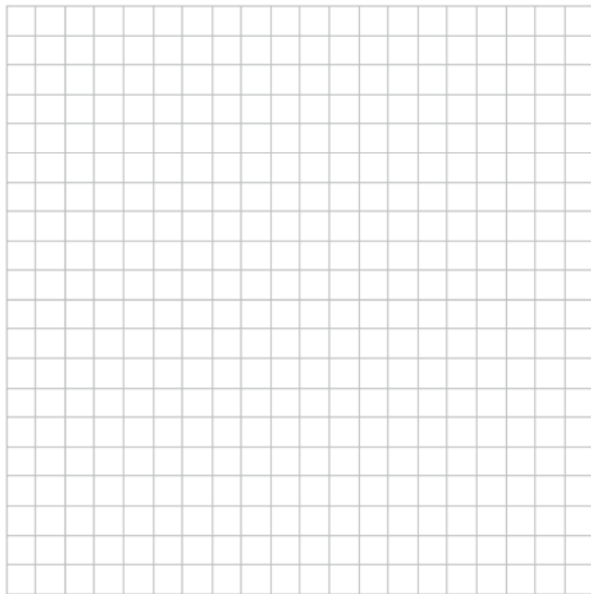
- 473 The completely factored form of  $2d^4 + 6d^3 - 18d^2 - 54d$  is
- 1)  $2d(d^2 - 9)(d + 3)$
  - 2)  $2d(d^2 + 9)(d + 3)$
  - 3)  $2d(d + 3)^2(d - 3)$
  - 4)  $2d(d - 3)^2(d + 3)$
- 474 Mrs. Jones had hundreds of jelly beans in a bag that contained equal numbers of six different flavors. Her student randomly selected four jelly beans and they were all black licorice. Her student complained and said "What are the odds I got all of that kind?" Mrs. Jones replied, "simulate rolling a die 250 times and tell me if four black licorice jelly beans is unusual." Explain how this simulation could be used to solve the problem.
- 475 A survey was given to 1250 randomly selected high school students at the end of their junior year. The survey offered four post-graduation options: two-year college, four-year college, military, or work. Of the 1250 responses, 475 chose a four-year college. State *one* possible conclusion that can be made about the population of high school juniors, based on this survey.
- 476 The Ferris wheel at the landmark Navy Pier in Chicago takes 7 minutes to make one full rotation. The height,  $H$ , in feet, above the ground of one of the six-person cars can be modeled by  $H(t) = 70 \sin\left(\frac{2\pi}{7}(t - 1.75)\right) + 80$ , where  $t$  is time, in minutes. Using  $H(t)$  for one full rotation, this car's minimum height, in feet, is
- 1) 150
  - 2) 70
  - 3) 10
  - 4) 0

477 The results of a survey of the student body at Central High School about television viewing preferences are shown below.

	Comedy Series	Drama Series	Reality Series	Total
Males	95	65	70	230
Females	80	70	110	260
Total	175	135	180	490

Are the events “student is a male” and “student prefers reality series” independent of each other? Justify your answer.

478 On the grid below, sketch a cubic polynomial whose zeros are 1, 3, and -2.



480 What is the inverse of the function  $y = \log_3 x$ ?

- 1)  $y = x^3$
- 2)  $y = \log_x 3$
- 3)  $y = 3^x$
- 4)  $x = 3^y$

481 If the terminal side of angle  $\theta$ , in standard position, passes through point  $(-4, 3)$ , what is the numerical value of  $\sin \theta$ ?

- 1)  $\frac{3}{5}$
- 2)  $\frac{4}{5}$
- 3)  $-\frac{3}{5}$
- 4)  $-\frac{4}{5}$

479 Which binomial is a factor of  $x^4 - 4x^2 - 4x + 8$ ?

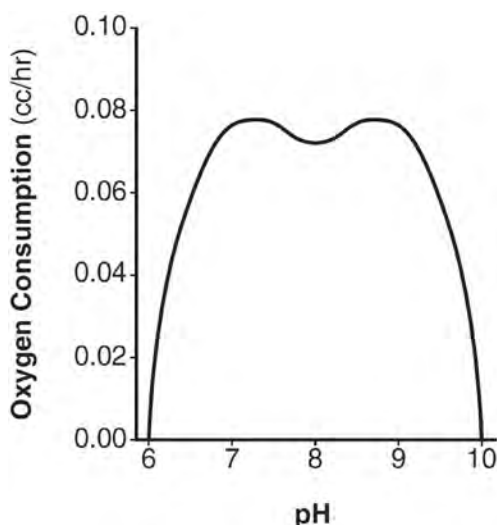
- 1)  $x - 2$
- 2)  $x + 2$
- 3)  $x - 4$
- 4)  $x + 4$

482 A suburban high school has a population of 1376 students. The number of students who participate in sports is 649. The number of students who participate in music is 433. If the probability that a student participates in either sports or music is  $\frac{974}{1376}$ , what is the probability that a student participates in both sports and music?

483 Relative to the graph of  $y = 3 \sin x$ , what is the shift of the graph of  $y = 3 \sin\left(x + \frac{\pi}{3}\right)$ ?

- 1)  $\frac{\pi}{3}$  right
- 2)  $\frac{\pi}{3}$  left
- 3)  $\frac{\pi}{3}$  up
- 4)  $\frac{\pi}{3}$  down

484 There was a study done on oxygen consumption of snails as a function of pH, and the result was a degree 4 polynomial function whose graph is shown below.



Which statement about this function is *incorrect*?

- 1) The degree of the polynomial is even.
- 2) There is a positive leading coefficient.
- 3) At two pH values, there is a relative maximum value.
- 4) There are two intervals where the function is decreasing.

485 A public opinion poll was conducted on behalf of Mayor Ortega's reelection campaign shortly before the election. 264 out of 550 likely voters said they would vote for Mayor Ortega; the rest said they would vote for his opponent. Which statement is *least* appropriate to make, according to the results of the poll?

- 1) There is a 48% chance that Mayor Ortega will win the election.
- 2) The point estimate ( $\hat{p}$ ) of voters who will vote for Mayor Ortega is 48%.
- 3) It is most likely that between 44% and 52% of voters will vote for Mayor Ortega.
- 4) Due to the margin of error, an inference cannot be made regarding whether Mayor Ortega or his opponent is most likely to win the election.

486 A circle centered at the origin has a radius of 10 units. The terminal side of an angle,  $\theta$ , intercepts the circle in Quadrant II at point  $C$ . The y-coordinate of point  $C$  is 8. What is the value of  $\cos \theta$ ?

- 1)  $-\frac{3}{5}$
- 2)  $-\frac{3}{4}$
- 3)  $\frac{3}{5}$
- 4)  $\frac{4}{5}$

487 Mr. Farison gave his class the three mathematical rules shown below to either prove or disprove.

Which rules can be proved for all real numbers?

I  $(m+p)^2 = m^2 + 2mp + p^2$

II  $(x+y)^3 = x^3 + 3xy + y^3$

III  $(a^2 + b^2)^2 = (a^2 - b^2)^2 + (2ab)^2$

- 1) I, only
- 2) I and II
- 3) II and III
- 4) I and III

- 488 For  $x \neq 0$ , which expressions are equivalent to one divided by the sixth root of  $x$ ?

I.  $\frac{\sqrt[6]{x}}{\sqrt[3]{x}}$  II.  $x^{\frac{1}{6}}$  III.  $x^{\frac{-1}{6}}$

- 1) I and II, only  
 2) I and III, only  
 3) II and III, only  
 4) I, II, and III
- 489 The eighth and tenth terms of a sequence are 64 and 100. If the sequence is either arithmetic or geometric, the ninth term can *not* be
- 1) -82  
 2) -80  
 3) 80  
 4) 82

- 490 Monthly mortgage payments can be found using the formula below:

$$M = \frac{P \left( \frac{r}{12} \right) \left( 1 + \frac{r}{12} \right)^n}{\left( 1 + \frac{r}{12} \right)^n - 1}$$

$M$  = monthly payment  
 $P$  = amount borrowed  
 $r$  = annual interest rate  
 $n$  = number of monthly payments

The Banks family would like to borrow \$120,000 to purchase a home. They qualified for an annual interest rate of 4.8%. Algebraically determine the *fewest* number of whole years the Banks family would need to include in the mortgage agreement in order to have a monthly payment of no more than \$720.

- 491 What is the solution, if any, of the equation

$$\frac{2}{x+3} - \frac{3}{4-x} = \frac{2x-2}{x^2-x-12}?$$

- 1) -1  
 2) -5  
 3) all real numbers  
 4) no real solution
- 492 After sitting out of the refrigerator for a while, a turkey at room temperature ( $68^\circ\text{F}$ ) is placed into an oven at 8 a.m., when the oven temperature is  $325^\circ\text{F}$ . Newton's Law of Heating explains that the temperature of the turkey will increase proportionally to the difference between the temperature of the turkey and the temperature of the oven, as given by the formula below:

$$T = T_a + (T_0 - T_a)e^{-kt}$$

$T_a$  = the temperature surrounding the object

$T_0$  = the initial temperature of the object

$t$  = the time in hours

$T$  = the temperature of the object after  $t$  hours

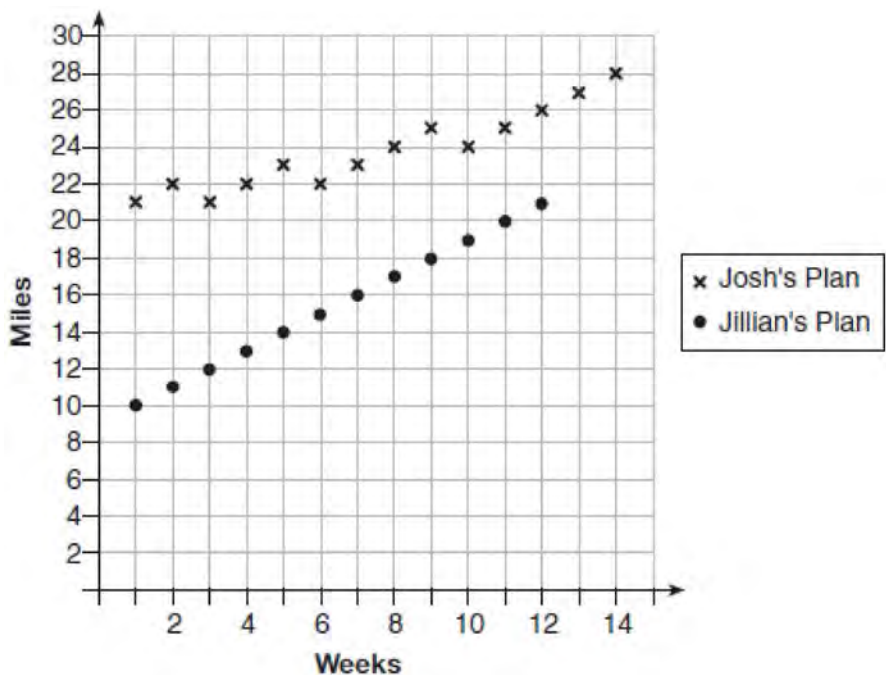
$k$  = decay constant

The turkey reaches the temperature of approximately  $100^\circ\text{F}$  after 2 hours. Find the value of  $k$ , to the *nearest thousandth*, and write an equation to determine the temperature of the turkey after  $t$  hours. Determine the Fahrenheit temperature of the turkey, to the *nearest degree*, at 3 p.m.

- 493 The directrix of the parabola  $12(y+3) = (x-4)^2$  has the equation  $y = -6$ . Find the coordinates of the focus of the parabola.

- 494 A polynomial equation of degree three,  $p(x)$ , is used to model the volume of a rectangular box. The graph of  $p(x)$  has  $x$  intercepts at  $-2$ ,  $10$ , and  $14$ . Which statements regarding  $p(x)$  could be true?
- The equation of  $p(x) = (x - 2)(x + 10)(x + 14)$ .
  - The equation of  $p(x) = -(x + 2)(x - 10)(x - 14)$ .
  - The maximum volume occurs when  $x = 10$ .
  - The maximum volume of the box is approximately 56.
- $A$  and  $C$
  - $A$  and  $D$
  - $B$  and  $C$
  - $B$  and  $D$
- 495 Which statement is *incorrect* for the graph of the function  $y = -3 \cos \left[ \frac{\pi}{3} (x - 4) \right] + 7$ ?
- The period is 6.
  - The amplitude is 3.
  - The range is  $[4, 10]$ .
  - The midline is  $y = -4$ .
- 496 When  $g(x)$  is divided by  $x + 4$ , the remainder is 0. Given  $g(x) = x^4 + 3x^3 - 6x^2 - 6x + 8$ , which conclusion about  $g(x)$  is true?
- $g(4) = 0$
  - $g(-4) = 0$
  - $x - 4$  is a factor of  $g(x)$ .
  - No conclusion can be made regarding  $g(x)$ .
- 497 The zeros for  $f(x) = x^4 - 4x^3 - 9x^2 + 36x$  are
- $\{0, \pm 3, 4\}$
  - $\{0, 3, 4\}$
  - $\{0, \pm 3, -4\}$
  - $\{0, 3, -4\}$
- 498 The function  $p(t) = 110e^{0.03922t}$  models the population of a city, in millions,  $t$  years after 2010. As of today, consider the following two statements:
- The current population is 110 million.
  - The population increases continuously by approximately 3.9% per year.
- This model supports
- I, only
  - II, only
  - both I and II
  - neither I nor II
- 499 Solve the following system of equations algebraically for all values of  $x$ ,  $y$ , and  $z$ :
- $$\begin{aligned} x + y + z &= 1 \\ 2x + 4y + 6z &= 2 \\ -x + 3y - 5z &= 11 \end{aligned}$$
- 500 Julie averaged 85 on the first three tests of the semester in her mathematics class. If she scores 93 on each of the remaining tests, her average will be 90. Which equation could be used to determine how many tests,  $T$ , are left in the semester?
- $\frac{255 + 93T}{3T} = 90$
  - $\frac{255 + 90T}{3T} = 93$
  - $\frac{255 + 93T}{T + 3} = 90$
  - $\frac{255 + 90T}{T + 3} = 93$
- 501 A sine function increasing through the origin can be used to model light waves. Violet light has a wavelength of 400 nanometers. Over which interval is the height of the wave *decreasing*, only?
- $(0, 200)$
  - $(100, 300)$
  - $(200, 400)$
  - $(300, 400)$

502 Elaina has decided to run the Buffalo half-marathon in May. She researched training plans on the Internet and is looking at two possible plans: Jillian's 12-week plan and Josh's 14-week plan. The number of miles run per week for each plan is plotted below.



Which one of the plans follows an arithmetic pattern? Explain how you arrived at your answer. Write a recursive definition to represent the number of miles run each week for the duration of the plan you chose. Jillian's plan has an alternative if Elaina wanted to train instead for a full 26-mile marathon. Week one would start at 13 miles and follow the same pattern for the half-marathon, but it would continue for 14 weeks. Write an explicit formula, in *simplest form*, to represent the number of miles run each week for the full-marathon training plan.

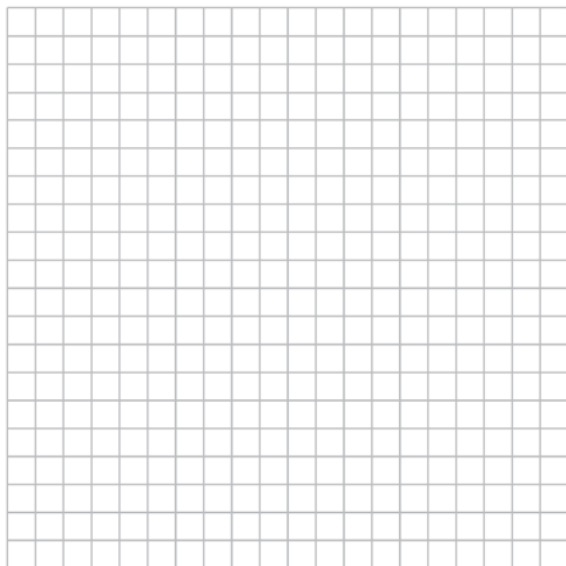
503 Use the properties of rational exponents to determine the value of  $y$  for the equation:

$$\frac{\sqrt[3]{x^8}}{(x^4)^{\frac{1}{3}}} = x^y, \quad x > 1$$

504 Given  $f(9) = -2$ , which function can be used to generate the sequence  $-8, -7.25, -6.5, -5.75, \dots$ ?

- 1)  $f(n) = -8 + 0.75n$
- 2)  $f(n) = -8 - 0.75(n - 1)$
- 3)  $f(n) = -8.75 + 0.75n$
- 4)  $f(n) = -0.75 + 8(n - 1)$

- 505 The ocean tides near Carter Beach follow a repeating pattern over time, with the amount of time between each low and high tide remaining relatively constant. On a certain day, low tide occurred at 8:30 a.m. and high tide occurred at 3:00 p.m. At high tide, the water level was 12 inches above the average local sea level; at low tide it was 12 inches below the average local sea level. Assume that high tide and low tide are the maximum and minimum water levels each day, respectively. Write a cosine function of the form  $f(t) = A \cos(Bt)$ , where  $A$  and  $B$  are real numbers, that models the water level,  $f(t)$ , in inches above or below the average Carter Beach sea level, as a function of the time measured in  $t$  hours since 8:30 a.m. On the grid below, graph one cycle of this function.



People who fish in Carter Beach know that a certain species of fish is most plentiful when the water level is increasing. Explain whether you would recommend fishing for this species at 7:30 p.m. or 10:30 p.m. using evidence from the given context.

- 506 Write  $(5 + 2yi)(4 - 3i) - (5 - 2yi)(4 - 3i)$  in  $a + bi$  form, where  $y$  is a real number.

- 507 Which scenario is best described as an observational study?
- 1) For a class project, students in Health class ask every tenth student entering the school if they eat breakfast in the morning.
  - 2) A social researcher wants to learn whether or not there is a link between attendance and grades. She gathers data from 15 school districts.
  - 3) A researcher wants to learn whether or not there is a link between children's daily amount of physical activity and their overall energy level. During lunch at the local high school, she distributed a short questionnaire to students in the cafeteria.
  - 4) Sixty seniors taking a course in Advanced Algebra Concepts are randomly divided into two classes. One class uses a graphing calculator all the time, and the other class never uses graphing calculators. A guidance counselor wants to determine whether there is a link between graphing calculator use and students' final exam grades.

- 508 Sean's team has a baseball game tomorrow. He pitches 50% of the games. There is a 40% chance of rain during the game tomorrow. If the probability that it rains given that Sean pitches is 40%, it can be concluded that these two events are
- 1) independent
  - 2) dependent
  - 3) mutually exclusive
  - 4) complements

- 509 Verify the following Pythagorean identity for all values of  $x$  and  $y$ :

$$(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$$

- 510 Solve algebraically for all values of  $x$ :

$$\sqrt{x-5} + x = 7$$



511 The population of Jamesburg for the years 2010-2013, respectively, was reported as follows:

250,000 250,937 251,878 252,822

How can this sequence be recursively modeled?

1)  $j_n = 250,000(1.00375)^{n-1}$

2)  $j_n = 250,000 + 937^{(n-1)}$

3)  $j_1 = 250,000$

$j_n = 1.00375j_{n-1}$

4)  $j_1 = 250,000$

$j_n = j_{n-1} + 937$

512 The expression  $\left(\frac{m^2}{m^{\frac{1}{3}}}\right)^{-\frac{1}{2}}$  is equivalent to

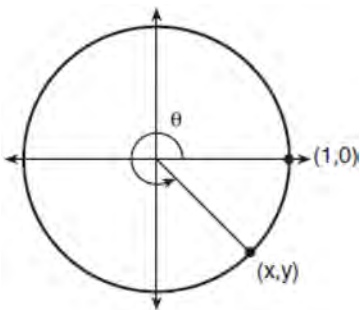
1)  $-\sqrt[6]{m^5}$

2)  $\frac{1}{\sqrt[6]{m^5}}$

3)  $-m^5\sqrt{m}$

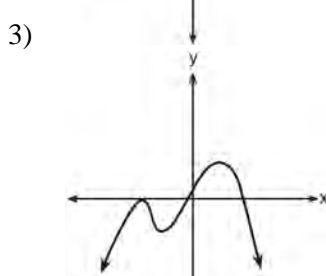
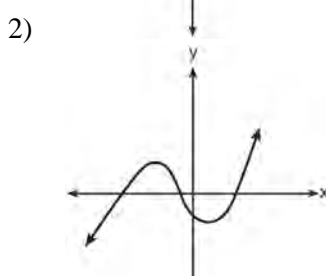
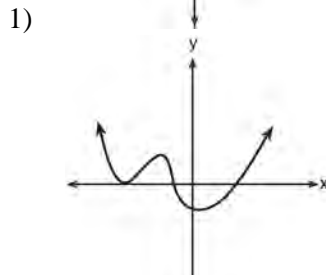
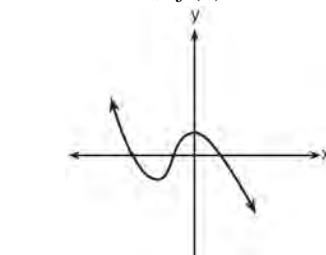
4)  $\frac{1}{m^5\sqrt{m}}$

513 Using the unit circle below, explain why  $\csc \theta = \frac{1}{y}$ .



514 Which graph has the following characteristics?

- three real zeros
- as  $x \rightarrow -\infty, f(x) \rightarrow -\infty$
- as  $x \rightarrow \infty, f(x) \rightarrow \infty$

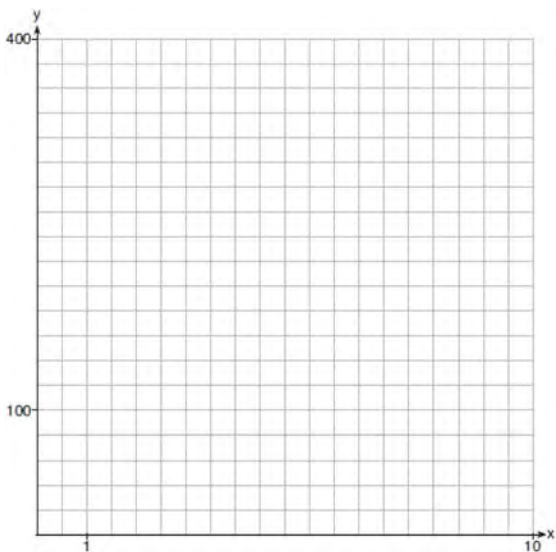


515 Given:  $h(x) = \frac{2}{9}x^3 + \frac{8}{9}x^2 - \frac{16}{13}x + 2$

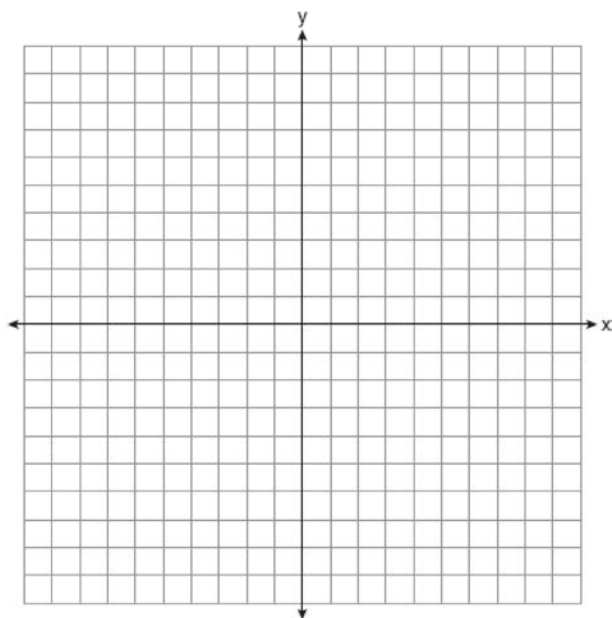
$k(x) = -|0.7x| + 5$

State the solutions to the equation  $h(x) = k(x)$ , rounded to the nearest hundredth.

516 Graph  $y = 400(.85)^{2x} - 6$  on the set of axes below.



517 Graph  $y = \log_2(x + 3) - 5$  on the set of axes below.  
Use an appropriate scale to include *both* intercepts.



Describe the behavior of the given function as  $x$  approaches  $-3$  and as  $x$  approaches positive infinity.

518 Cheap and Fast gas station is conducting a consumer satisfaction survey. Which method of collecting data would most likely lead to a biased sample?

- 1) interviewing every 5th customer to come into the station
- 2) interviewing customers chosen at random by a computer at the checkout
- 3) interviewing customers who call an 800 number posted on the customers' receipts
- 4) interviewing every customer who comes into the station on a day of the week chosen at random out of a hat

519 Which expression is equivalent to  $(3k - 2i)^2$ , where  $i$  is the imaginary unit?

- 1)  $9k^2 - 4$
- 2)  $9k^2 + 4$
- 3)  $9k^2 - 12ki - 4$
- 4)  $9k^2 - 12ki + 4$

520 Solve for all values of  $p$ :  $\frac{3p}{p-5} - \frac{2}{p+3} = \frac{p}{p+3}$

521 Given events  $A$  and  $B$ , such that  $P(A) = 0.6$ ,  $P(B) = 0.5$ , and  $P(A \cup B) = 0.8$ , determine whether  $A$  and  $B$  are independent or dependent.

522 Express  $(2xi^3 - 3y)^2$  in simplest form.

523 The weight of a bag of pears at the local market averages 8 pounds with a standard deviation of 0.5 pound. The weights of all the bags of pears at the market closely follow a normal distribution. Determine what percentage of bags, to the *nearest integer*, weighed *less* than 8.25 pounds.

524 The loudness of sound is measured in units called decibels (dB). These units are measured by first assigning an intensity  $I_0$  to a very soft sound that is called the threshold sound. The sound to be measured is assigned an intensity,  $I$ , and the decibel rating,  $d$ , of this sound is found using  $d = 10 \log \frac{I}{I_0}$ . The threshold sound audible to the average person is  $1.0 \times 10^{-12}$  W/m<sup>2</sup> (watts per square meter). Consider the following sound level classifications:

Moderate	45-69 dB
Loud	70-89 dB
Very loud	90-109 dB
Deafening	>110 dB

How would a sound with intensity  $6.3 \times 10^{-3}$  W/m<sup>2</sup> be classified?

- 1) moderate
- 2) loud
- 3) very loud
- 4) deafening

525 Using the formula below, determine the monthly payment on a 5-year car loan with a monthly percentage rate of 0.625% for a car with an original cost of \$21,000 and a \$1000 down payment, to the nearest cent.

$$P_n = PMT \left( \frac{1 - (1 + i)^{-n}}{i} \right)$$

$P_n$  = present amount borrowed

$n$  = number of monthly pay periods

$PMT$  = monthly payment

$i$  = interest rate per month

The affordable monthly payment is \$300 for the same time period. Determine an appropriate down payment, to the nearest dollar.

526 If  $f(x) = 3|x| - 1$  and  $g(x) = 0.03x^3 - x + 1$ , an approximate solution for the equation  $f(x) = g(x)$  is

- 1) 1.96
- 2) 11.29
- 3) (-0.99, 1.96)
- 4) (11.29, 32.87)

527 A parabola has its focus at (1,2) and its directrix is  $y = -2$ . The equation of this parabola could be

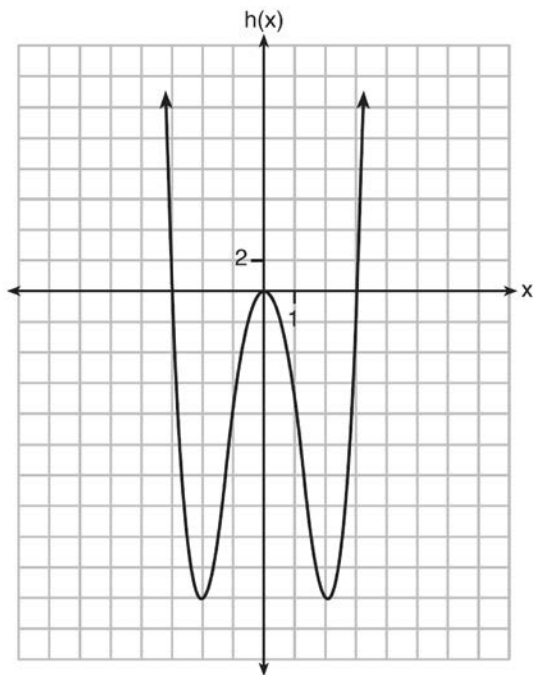
- 1)  $y = 8(x + 1)^2$
- 2)  $y = \frac{1}{8}(x + 1)^2$
- 3)  $y = 8(x - 1)^2$
- 4)  $y = \frac{1}{8}(x - 1)^2$

528 Titanium-44 is a radioactive isotope such that every 63 years, its mass decreases by half. For a sample of titanium-44 with an initial mass of 100 grams, write a function that will give the mass of the sample remaining after any amount of time. Define all variables. Scientists sometimes use the average yearly decrease in mass for estimation purposes. Use the average yearly decrease in mass of the sample between year 0 and year 10 to predict the amount of the sample remaining after 40 years. Round your answer to the nearest tenth. Is the actual mass of the sample or the estimated mass greater after 40 years? Justify your answer.

529 Functions  $f$ ,  $g$ , and  $h$  are given below.

$$f(x) = \sin(2x)$$

$$g(x) = f(x) + 1$$



Which statement is true about functions  $f$ ,  $g$ , and  $h$ ?

- 1)  $f(x)$  and  $g(x)$  are odd,  $h(x)$  is even.
- 2)  $f(x)$  and  $g(x)$  are even,  $h(x)$  is odd.
- 3)  $f(x)$  is odd,  $g(x)$  is neither,  $h(x)$  is even.
- 4)  $f(x)$  is even,  $g(x)$  is neither,  $h(x)$  is odd.

530 The distribution of the diameters of ball bearings made under a given manufacturing process is normally distributed with a mean of 4 cm and a standard deviation of 0.2 cm. What proportion of the ball bearings will have a diameter less than 3.7 cm?

- 1) 0.0668
- 2) 0.4332
- 3) 0.8664
- 4) 0.9500

531 A study of the annual population of the red-winged blackbird in Ft. Mill, South Carolina, shows the population,  $B(t)$ , can be represented by the function  $B(t) = 750(1.16)^t$ , where the  $t$  represents the number of years since the study began. In terms of the monthly rate of growth, the population of red-winged blackbirds can be best approximated by the function

- 1)  $B(t) = 750(1.012)^t$
- 2)  $B(t) = 750(1.012)^{12t}$
- 3)  $B(t) = 750(1.16)^{12t}$
- 4)  $B(t) = 750(1.16)^{\frac{t}{12}}$

532 The function  $f(x) = 2^{-0.25x} \cdot \sin\left(\frac{\pi}{2}x\right)$  represents a damped sound wave function. What is the average rate of change for this function on the interval  $[-7, 7]$ , to the nearest hundredth?

- 1) -3.66
- 2) -0.30
- 3) -0.26
- 4) 3.36

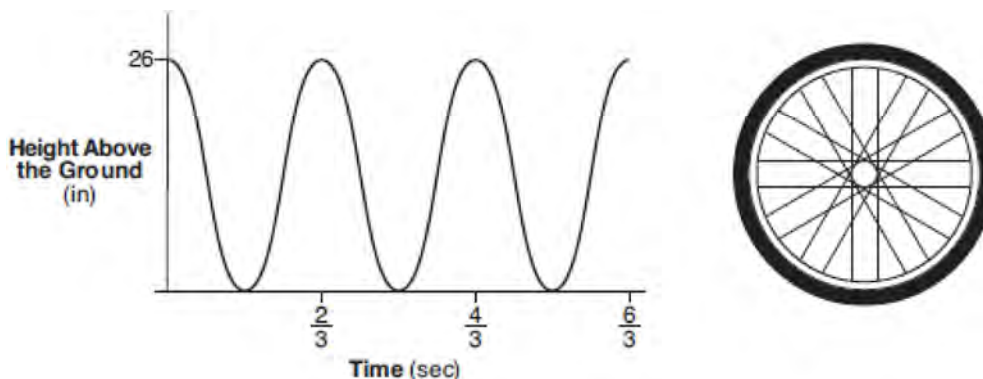
533 Solve algebraically for all values of  $x$ :

$$\sqrt{x-4} + x = 6$$

534 What is the solution to  $8(2^{x+3}) = 48$ ?

- 1)  $x = \frac{\ln 6}{\ln 2} - 3$
- 2)  $x = 0$
- 3)  $x = \frac{\ln 48}{\ln 16} - 3$
- 4)  $x = \ln 4 - 3$

- 535 The graph below represents the height above the ground,  $h$ , in inches, of a point on a triathlete's bike wheel during a training ride in terms of time,  $t$ , in seconds.



Identify the period of the graph and describe what the period represents in this context.

- 536 Which statement regarding the graphs of the functions below is *untrue*?

$$f(x) = 3 \sin 2x, \text{ from } -\pi < x < \pi$$

$$g(x) = (x - 0.5)(x + 4)(x - 2)$$

$$h(x) = \log_2 x$$

$$j(x) = -|4x - 2| + 3$$

- 1)  $f(x)$  and  $j(x)$  have a maximum  $y$ -value of 3.
- 2)  $f(x)$ ,  $h(x)$ , and  $j(x)$  have one  $y$ -intercept.
- 3)  $g(x)$  and  $j(x)$  have the same end behavior as  $x \rightarrow -\infty$ .
- 4)  $g(x)$ ,  $h(x)$ , and  $j(x)$  have rational zeros.

- 537 According to a pricing website, Indroid phones lose 58% of their cash value over 1.5 years. Which expression can be used to estimate the value of a \$300 Indroid phone in 1.5 years?

- 1)  $300e^{-0.87}$
- 2)  $300e^{-0.63}$
- 3)  $300e^{-0.58}$
- 4)  $300e^{-0.42}$

- 538 Jim is looking to buy a vacation home for \$172,600 near his favorite southern beach. The formula to compute a mortgage payment,  $M$ , is

$$M = P \cdot \frac{r(1+r)^N}{(1+r)^N - 1}$$

where  $P$  is the principal

amount of the loan,  $r$  is the monthly interest rate, and  $N$  is the number of monthly payments. Jim's bank offers a monthly interest rate of 0.305% for a 15-year mortgage. With no down payment, determine Jim's mortgage payment, rounded to the *nearest dollar*. Algebraically determine and state the down payment, rounded to the *nearest dollar*, that Jim needs to make in order for his mortgage payment to be \$1100.

- 539 Consider the system shown below.

$$2x - y = 4$$

$$(x + 3)^2 + y^2 = 8$$

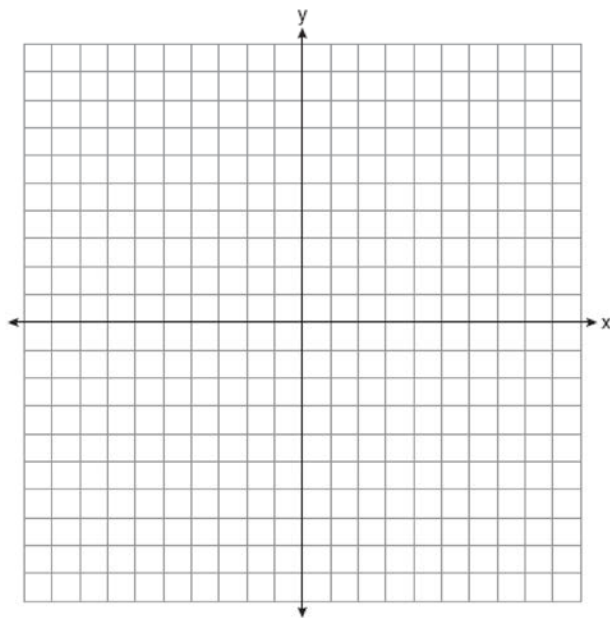
The two solutions of the system can be described as

- 1) both imaginary
- 2) both irrational
- 3) both rational
- 4) one rational and one irrational

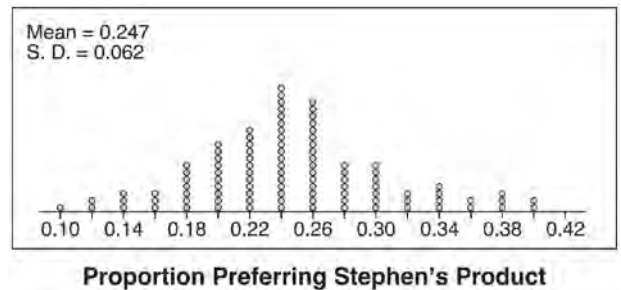
540 Which graph represents a cosine function with no horizontal shift, an amplitude of 2, and a period of  $\frac{2\pi}{3}$ ?

- 1)
- 2)
- 3)
- 4)

541 On the axes below, graph *one* cycle of a cosine function with amplitude 3, period  $\frac{\pi}{2}$ , midline  $y = -1$ , and passing through the point  $(0, 2)$ .



542 Stephen's Beverage Company is considering whether to produce a new brand of cola. The company will launch the product if at least 25% of cola drinkers will buy the product. Fifty cola drinkers are randomly selected to take a blind taste-test of products A, B, and the new product. Nine out of fifty participants preferred Stephen's new cola to products A and B. The company then devised a simulation based on the requirement that 25% of cola drinkers will buy the product. Each dot in the graph shown below represents the proportion of people who preferred Stephen's new product, each of sample size 50, simulated 100 times.



Assume the set of data is approximately normal and the company wants to be 95% confident of its results. Does the sample proportion obtained from the blind taste-test, nine out of fifty, fall within the margin of error developed from the simulation? Justify your answer. The company decides to continue developing the product even though only nine out of fifty participants preferred its brand of cola in the taste-test. Describe how the simulation data could be used to support this decision.

543 Which value is *not* contained in the solution of the system shown below?

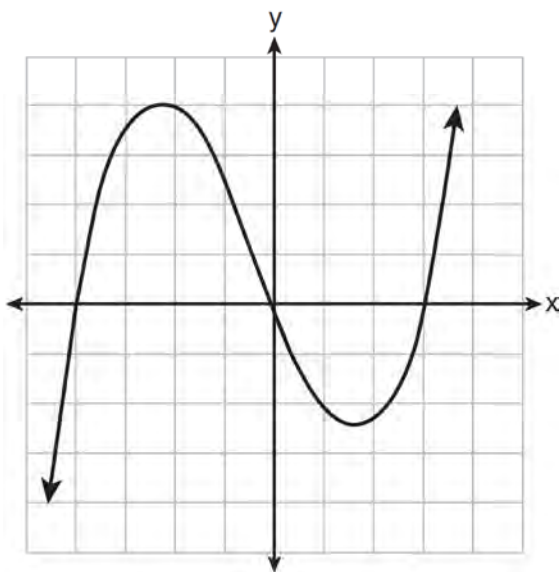
$$\begin{aligned} a + 5b - c &= -20 \\ 4a - 5b + 4c &= 19 \\ -a - 5b - 5c &= 2 \end{aligned}$$

- 1) -2
- 2) 2
- 3) 3
- 4) -3

- 544 To the *nearest tenth*, the value of  $x$  that satisfies  $2^x = -2x + 11$  is
- 1) 2.5
  - 2) 2.6
  - 3) 5.8
  - 4) 5.9

- 545 Express  $(1 - i)^3$  in  $a + bi$  form.

- 546 The graph of  $p(x)$  is shown below.



What is the remainder when  $p(x)$  is divided by  $x + 4$ ?

- 1)  $x - 4$
  - 2)  $-4$
  - 3)  $0$
  - 4)  $4$
- 547 While experimenting with her calculator, Candy creates the sequence 4, 9, 19, 39, 79, .... Write a recursive formula for Candy's sequence. Determine the eighth term in Candy's sequence.

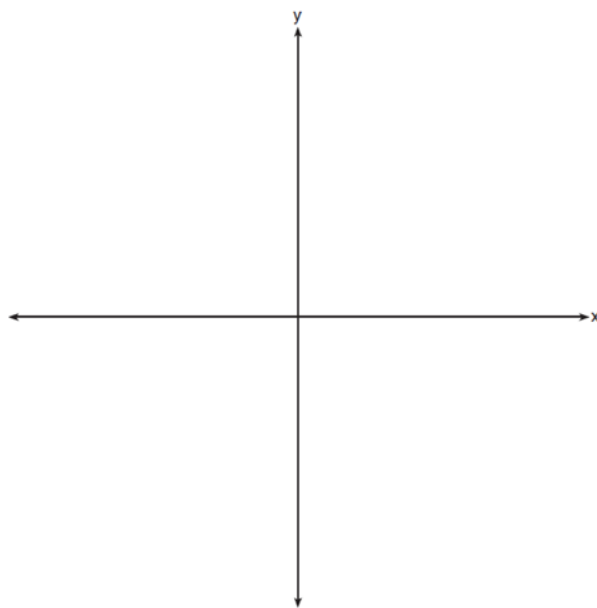
- 548 The focal length,  $F$ , of a camera's lens is related to the distance of the object from the lens,  $J$ , and the distance to the image area in the camera,  $W$ , by the formula below.

$$\frac{1}{J} + \frac{1}{W} = \frac{1}{F}$$

When this equation is solved for  $J$  in terms of  $F$  and  $W$ ,  $J$  equals

- 1)  $F - W$
- 2)  $\frac{FW}{F - W}$
- 3)  $\frac{FW}{W - F}$
- 4)  $\frac{1}{F} - \frac{1}{W}$

- 549 a) On the axes below, sketch *at least one* cycle of a sine curve with an amplitude of 2, a midline at  $y = -\frac{3}{2}$ , and a period of  $2\pi$ .



- b) Explain any differences between a sketch of  $y = 2 \sin\left(x - \frac{\pi}{3}\right) - \frac{3}{2}$  and the sketch from part a.

550 The set of data in the table below shows the results of a survey on the number of messages that people of different ages text on their cell phones each month.

Text Messages per Month			
Age Group	0-10	11-50	Over 50
15-18	4	37	68
19-22	6	25	87
23-60	25	47	157

If a person from this survey is selected at random, what is the probability that the person texts over 50 messages per month given that the person is between the ages of 23 and 60?

- 1)  $\frac{157}{229}$                       3)  $\frac{157}{384}$   
 2)  $\frac{157}{312}$                       4)  $\frac{157}{456}$

551 Based on climate data that have been collected in Bar Harbor, Maine, the average monthly temperature, in degrees F, can be modeled by the equation

$B(x) = 23.914 \sin(0.508x - 2.116) + 55.300$ . The same governmental agency collected average monthly temperature data for Phoenix, Arizona, and found the temperatures could be modeled by the equation

$P(x) = 20.238 \sin(0.525x - 2.148) + 86.729$ . Which statement can *not* be concluded based on the average monthly temperature models  $x$  months after starting data collection?

- The average monthly temperature variation is more in Bar Harbor than in Phoenix.
- The midline average monthly temperature for Bar Harbor is lower than the midline temperature for Phoenix.
- The maximum average monthly temperature for Bar Harbor is  $79^\circ$  F, to the nearest degree.
- The minimum average monthly temperature for Phoenix is  $20^\circ$  F, to the nearest degree.

552 Explain how  $\left(3^{\frac{1}{5}}\right)^2$  can be written as the equivalent radical expression  $\sqrt[5]{9}$ .

553 Iridium-192 is an isotope of iridium and has a half-life of 73.83 days. If a laboratory experiment begins with 100 grams of Iridium-192, the number of grams,  $A$ , of Iridium-192 present after  $t$  days

would be  $A = 100 \left(\frac{1}{2}\right)^{\frac{t}{73.83}}$ . Which equation

approximates the amount of Iridium-192 present after  $t$  days?

- $A = 100 \left(\frac{73.83}{2}\right)^t$
- $A = 100 \left(\frac{1}{147.66}\right)^t$
- $A = 100(0.990656)^t$
- $A = 100(0.116381)^t$



554 The distance needed to stop a car after applying the brakes varies directly with the square of the car's speed. The table below shows stopping distances for various speeds.

<b>Speed (mph)</b>	10	20	30	40	50	60	70
<b>Distance (ft)</b>	6.25	25	56.25	100	156.25	225	306.25

Determine the average rate of change in braking distance, in ft/mph, between one car traveling at 50 mph and one traveling at 70 mph. Explain what this rate of change means as it relates to braking distance.

555 The solution to the equation  $4x^2 + 98 = 0$  is

- 1)  $\pm 7$
- 2)  $\pm 7i$
- 3)  $\pm \frac{7\sqrt{2}}{2}$
- 4)  $\pm \frac{7i\sqrt{2}}{2}$

556 Which expression is equivalent to  $\frac{4x^3 + 9x - 5}{2x - 1}$ ,

where  $x \neq \frac{1}{2}$ ?

- 1)  $2x^2 + x + 5$
- 2)  $2x^2 + \frac{11}{2} + \frac{1}{2(2x - 1)}$
- 3)  $2x^2 - x + 5$
- 4)  $2x^2 - x + 4 + \frac{1}{2x - 1}$

557 If  $g(c) = 1 - c^2$  and  $m(c) = c + 1$ , then which statement is *not* true?

- 1)  $g(c) \cdot m(c) = 1 + c - c^2 - c^3$
- 2)  $g(c) + m(c) = 2 + c - c^2$
- 3)  $m(c) - g(c) = c + c^2$
- 4)  $\frac{m(c)}{g(c)} = \frac{-1}{1 - c}$

558 What does  $\left(\frac{-54x^9}{y^4}\right)^{\frac{2}{3}}$  equal?

- 1)  $\frac{9ix^6\sqrt[3]{4}}{y^3\sqrt[3]{y^2}}$
- 2)  $\frac{9ix^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$
- 3)  $\frac{9x^6\sqrt[3]{4}}{y^3\sqrt[3]{y}}$
- 4)  $\frac{9x^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$

559 The value of a new car depreciates over time. Greg purchased a new car in June 2011. The value,  $V$ , of his car after  $t$  years can be modeled by the equation

$$\log_{0.8}\left(\frac{V}{17000}\right) = t.$$

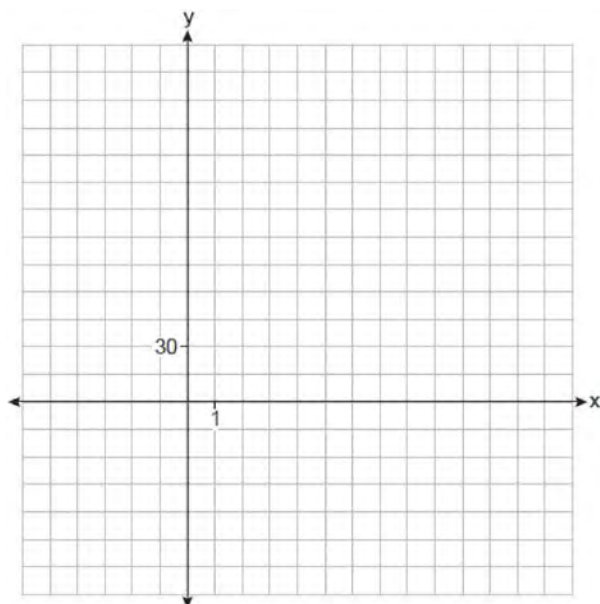
What is the average decreasing rate of change per year of the value of the car from June 2012 to June 2014, to the *nearest ten dollars per year*?

- 1) 1960
- 2) 2180
- 3) 2450
- 4) 2770

560 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit. Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

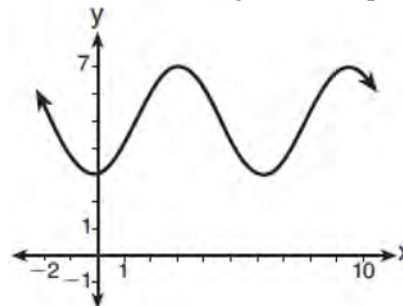
561 The roots of the equation  $x^2 + 2x + 5 = 0$  are

- 1)  $-3$  and  $1$
- 2)  $-1$ , only
- 3)  $-1 + 2i$  and  $-1 - 2i$
- 4)  $-1 + 4i$  and  $-1 - 4i$

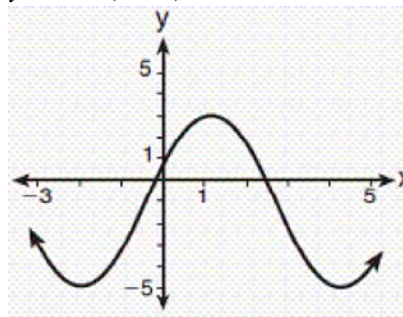
562 The solution to the equation  $18x^2 - 24x + 87 = 0$  is

- 1)  $-\frac{2}{3} \pm 6i\sqrt{158}$
- 2)  $-\frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$
- 3)  $\frac{2}{3} \pm 6i\sqrt{158}$
- 4)  $\frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$

563 Which sinusoid has the greatest amplitude?



- 1)
- 2)  $y = 3 \sin(\theta - 3) + 5$



- 3)
- 4)  $y = -5 \sin(\theta - 1) - 3$

564 When factored completely,  $m^5 + m^3 - 6m$  is equivalent to

- 1)  $(m+3)(m-2)$
- 2)  $(m^2 + 3m)(m^2 - 2)$
- 3)  $m(m^4 + m^2 - 6)$
- 4)  $m(m^2 + 3)(m^2 - 2)$

565 Given that  $\sin^2 \theta + \cos^2 \theta = 1$  and  $\sin \theta = -\frac{\sqrt{2}}{5}$ ,

what is a possible value of  $\cos \theta$ ?

- 1)  $\frac{5 + \sqrt{2}}{5}$
- 2)  $\frac{\sqrt{23}}{5}$
- 3)  $\frac{3\sqrt{3}}{5}$
- 4)  $\frac{\sqrt{35}}{5}$

566 A rabbit population doubles every 4 weeks. There are currently five rabbits in a restricted area. If  $t$  represents the time, in weeks, and  $P(t)$  is the population of rabbits with respect to time, about how many rabbits will there be in 98 days?

- 1) 56
- 2) 152
- 3) 3688
- 4) 81,920

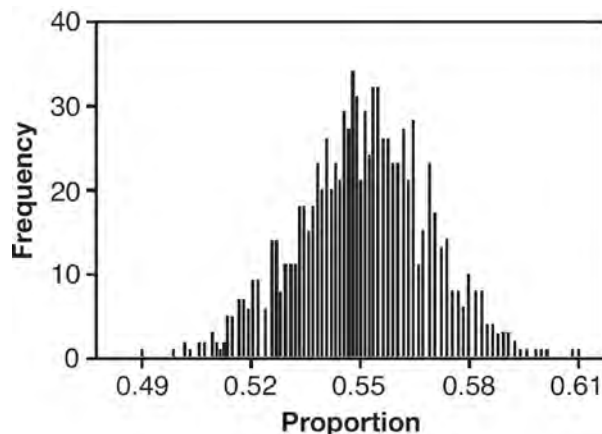
567 The lifespan of a 60-watt lightbulb produced by a company is normally distributed with a mean of 1450 hours and a standard deviation of 8.5 hours. If a 60-watt lightbulb produced by this company is selected at random, what is the probability that its lifespan will be between 1440 and 1465 hours?

- 1) 0.3803
- 2) 0.4612
- 3) 0.8415
- 4) 0.9612

568 Last year, the total revenue for Home Style, a national restaurant chain, increased 5.25% over the previous year. If this trend were to continue, which expression could the company's chief financial officer use to approximate their monthly percent increase in revenue? [Let  $m$  represent months.]

- 1)  $(1.0525)^m$
- 2)  $(1.0525)^{\frac{12}{m}}$
- 3)  $(1.00427)^m$
- 4)  $(1.00427)^{\frac{m}{12}}$

569 A candidate for political office commissioned a poll. His staff received responses from 900 likely voters and 55% of them said they would vote for the candidate. The staff then conducted a simulation of 1000 more polls of 900 voters, assuming that 55% of voters would vote for their candidate. The output of the simulation is shown in the diagram below.



Given this output, and assuming a 95% confidence level, the margin of error for the poll is closest to

- 1) 0.01
- 2) 0.03
- 3) 0.06
- 4) 0.12

570 Data collected about jogging from students with two older siblings are shown in the table below.

	Neither Sibling Jogs	One Sibling Jogs	Both Siblings Jog
Student Does Not Jog	1168	1823	1380
Student Jogs	188	416	400

Using these data, determine whether a student with two older siblings is more likely to jog if one sibling jogs or if both siblings jog. Justify your answer.

571 Which equation represents a parabola with the focus at  $(0, -1)$  and the directrix of  $y = 1$ ?

- 1)  $x^2 = -8y$
- 2)  $x^2 = -4y$
- 3)  $x^2 = 8y$
- 4)  $x^2 = 4y$

572 Over the set of integers, factor the expression  $4x^3 - x^2 + 16x - 4$  completely.

573 The volume of air in a person's lungs, as the person breathes in and out, can be modeled by a sine graph. A scientist is studying the differences in this volume for people at rest compared to people told to take a deep breath. When examining the graphs, should the scientist focus on the amplitude, period, or midline? Explain your choice.

574 Alexa earns \$33,000 in her first year of teaching and earns a 4% increase in each successive year. Write a geometric series formula,  $S_n$ , for Alexa's total earnings over  $n$  years. Use this formula to find Alexa's total earnings for her first 15 years of teaching, to the *nearest cent*.

575 In 2010, the population of New York State was approximately 19,378,000 with an annual growth rate of 1.5%. Assuming the growth rate is maintained for a large number of years, which equation can be used to predict the population of New York State  $t$  years after 2010?

- 1)  $P_t = 19,378,000(1.5)^t$
- 2)  $P_0 = 19,378,000$   
 $P_t = 19,378,000 + 1.015P_{t-1}$
- 3)  $P_t = 19,378,000(1.015)^{t-1}$
- 4)  $P_0 = 19,378,000$   
 $P_t = 1.015P_{t-1}$

576 A payday loan company makes loans between \$100 and \$1000 available to customers. Every 14 days, customers are charged 30% interest with compounding. In 2013, Remi took out a \$300 payday loan. Which expression can be used to calculate the amount she would owe, in dollars, after one year if she did not make payments?

- 1)  $300(.30)^{\frac{14}{365}}$
- 2)  $300(1.30)^{\frac{14}{365}}$
- 3)  $300(.30)^{\frac{365}{14}}$
- 4)  $300(1.30)^{\frac{365}{14}}$

- 577 Joelle has a credit card that has a 19.2% annual interest rate compounded monthly. She owes a total balance of  $B$  dollars after  $m$  months. Assuming she makes no payments on her account, the table below illustrates the balance she owes after  $m$  months.

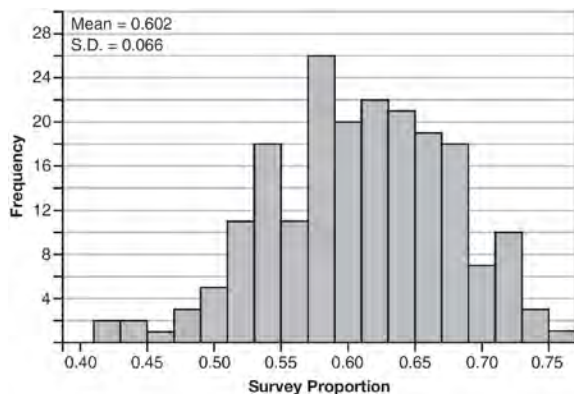
<b>m</b>	<b>B</b>
0	100.00
10	1172.00
19	1352.00
36	1770.80
60	2591.90
69	2990.00
72	3135.80
73	3186.00

Over which interval of time is her average rate of change for the balance on her credit card account the greatest?

- 1) month 10 to month 60                      3) month 36 to month 72  
 2) month 19 to month 69                      4) month 60 to month 73
- 578 An equation to represent the value of a car after  $t$  months of ownership is  $v = 32,000(0.81)^{\frac{t}{12}}$ . Which statement is *not* correct?
- 1) The car lost approximately 19% of its value each month.  
 2) The car maintained approximately 98% of its value each month.  
 3) The value of the car when it was purchased was \$32,000.  
 4) The value of the car 1 year after it was purchased was \$25,920.
- 579 Given the equal terms  $\sqrt[3]{x^5}$  and  $y^{\frac{5}{6}}$ , determine and state  $y$ , in terms of  $x$ .
- 580 Given  $z(x) = 6x^3 + bx^2 - 52x + 15$ ,  $z(2) = 35$ , and  $z(-5) = 0$ , algebraically determine all the zeros of  $z(x)$ .
- 581 An orange-juice processing plant receives a truckload of oranges. The quality control team randomly chooses three pails of oranges, each containing 50 oranges, from the truckload. Identify the sample and the population in the given scenario. State *one* conclusion that the quality control team could make about the population if 5% of the sample was found to be unsatisfactory.
- 582 Algebraically determine the values of  $h$  and  $k$  to correctly complete the identity stated below.  

$$2x^3 - 10x^2 + 11x - 7 = (x - 4)(2x^2 + hx + 3) + k$$
- 583 A ball is dropped from a height of 32 feet. It bounces and rebounds 80% of the height from which it was falling. What is the total downward distance, in feet, the ball traveled up to the 12th bounce?
- 1) 29  
 2) 58  
 3) 120  
 4) 149

584 Fifty-five students attending the prom were randomly selected to participate in a survey about the music choice at the prom. Sixty percent responded that a DJ would be preferred over a band. Members of the prom committee thought that the vote would have 50% for the DJ and 50% for the band. A simulation was run 200 times, each of sample size 55, based on the premise that 60% of the students would prefer a DJ. The approximate normal simulation results are shown below.



Using the results of the simulation, determine a plausible interval containing the middle 95% of the data. Round all values to the *nearest hundredth*. Members of the prom committee are concerned that a vote of all students attending the prom may produce a 50% – 50% split. Explain what statistical evidence supports this concern.

585 The speed of a tidal wave,  $s$ , in hundreds of miles per hour, can be modeled by the equation  $s = \sqrt{t} - 2t + 6$ , where  $t$  represents the time from its origin in hours. Algebraically determine the time when  $s = 0$ . How much faster was the tidal wave traveling after 1 hour than 3 hours, to the *nearest mile per hour*? Justify your answer.

586 Algebraically prove that the difference of the squares of any two consecutive integers is an odd integer.

587 The expression  $\frac{x^3 + 2x^2 + x + 6}{x + 2}$  is equivalent to

- 1)  $x^2 + 3$
- 2)  $x^2 + 1 + \frac{4}{x + 2}$
- 3)  $2x^2 + x + 6$
- 4)  $2x^2 + 1 + \frac{4}{x + 2}$

588 If  $p(x) = ab^x$  and  $r(x) = cd^x$ , then  $p(x) \cdot r(x)$  equals

- 1)  $ac(b + d)^x$
- 2)  $ac(b + d)^{2x}$
- 3)  $ac(bd)^x$
- 4)  $ac(bd)^{x^2}$

589 Using the identity  $\sin^2 \theta + \cos^2 \theta = 1$ , find the value of  $\tan \theta$ , to the *nearest hundredth*, if  $\cos \theta$  is  $-0.7$  and  $\theta$  is in Quadrant II.

590 A house purchased 5 years ago for \$100,000 was just sold for \$135,000. Assuming exponential growth, approximate the annual growth rate, to the *nearest percent*.

591 One of the medical uses of Iodine-131 (I-131), a radioactive isotope of iodine, is to enhance x-ray images. The half-life of I-131 is approximately 8.02 days. A patient is injected with 20 milligrams of I-131. Determine, to the *nearest day*, the amount of time needed before the amount of I-131 in the patient's body is approximately 7 milligrams.

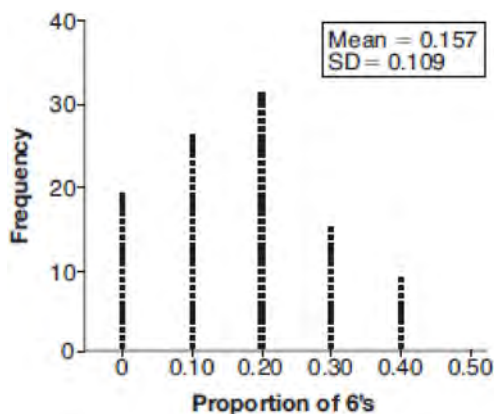
592 Write  $\sqrt[3]{x} \cdot \sqrt{x}$  as a single term with a rational exponent.

- 593 A game spinner is divided into 6 equally sized regions, as shown in the diagram below.



For Miles to win, the spinner must land on the number 6. After spinning the spinner 10 times, and losing all 10 times, Miles complained that the spinner is unfair. At home, his dad ran 100 simulations of spinning the spinner 10 times, assuming the probability of winning each spin is  $\frac{1}{6}$ .

The output of the simulation is shown in the diagram below.



Which explanation is appropriate for Miles and his dad to make?

- 1) The spinner was likely unfair, since the number 6 failed to occur in about 20% of the simulations.
- 2) The spinner was likely unfair, since the spinner should have landed on the number 6 by the sixth spin.
- 3) The spinner was likely not unfair, since the number 6 failed to occur in about 20% of the simulations.
- 4) The spinner was likely not unfair, since in the output the player wins once or twice in the majority of the simulations.

- 594 The solutions to the equation  $-\frac{1}{2}x^2 = -6x + 20$  are

- 1)  $-6 \pm 2i$
- 2)  $-6 \pm 2\sqrt{19}$
- 3)  $6 \pm 2i$
- 4)  $6 \pm 2\sqrt{19}$

- 595 Which factorization is *incorrect*?

- 1)  $4k^2 - 49 = (2k + 7)(2k - 7)$
- 2)  $a^3 - 8b^3 = (a - 2b)(a^2 + 2ab + 4b^2)$
- 3)  $m^3 + 3m^2 - 4m + 12 = (m - 2)^2(m + 3)$
- 4)  $t^3 + 5t^2 + 6t + t^2 + 5t + 6 = (t + 1)(t + 2)(t + 3)$

- 596 Two versions of a standardized test are given, an April version and a May version. The statistics for the April version show a mean score of 480 and a standard deviation of 24. The statistics for the May version show a mean score of 510 and a standard deviation of 20. Assume the scores are normally distributed. Joanne took the April version and scored in the interval 510-540. What is the probability, to the *nearest ten thousandth*, that a test paper selected at random from the April version scored in the same interval? Maria took the May version. In what interval must Maria score to claim she scored as well as Joanne?

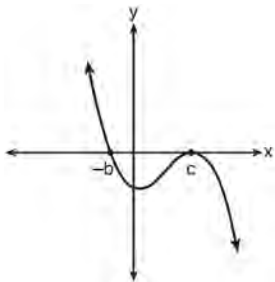
- 597 The probability that Gary and Jane have a child with blue eyes is 0.25, and the probability that they have a child with blond hair is 0.5. The probability that they have a child with both blue eyes and blond hair is 0.125. Given this information, the events blue eyes and blond hair are

- I: dependent  
 II: independent  
 III: mutually exclusive

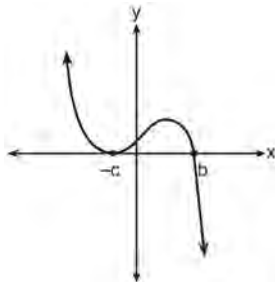
- 1) I, only
- 2) II, only
- 3) I and III
- 4) II and III

598 If  $a$ ,  $b$ , and  $c$  are all positive real numbers, which graph could represent the sketch of the graph of

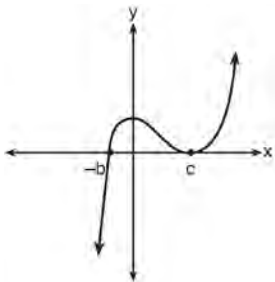
$$p(x) = -a(x+b)(x^2 - 2cx + c^2)?$$



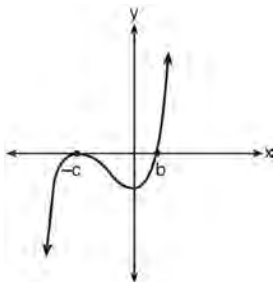
1)



2)



3)



4)

599 The sequence  $a_1 = 6$ ,  $a_n = 3a_{n-1}$  can also be written as

- 1)  $a_n = 6 \cdot 3^n$
- 2)  $a_n = 6 \cdot 3^{n+1}$
- 3)  $a_n = 2 \cdot 3^n$
- 4)  $a_n = 2 \cdot 3^{n+1}$

600 During the summer, Adam saved \$4000 and Betty saved \$3500. Adam deposited his money in Bank A at an annual rate of 2.4% compounded monthly. Betty deposited her money in Bank B at an annual rate of 4% compounded quarterly. Write two functions that represent the value of each account after  $t$  years if no other deposits or withdrawals are made, where Adam's account value is represented by  $A(t)$ , and Betty's by  $B(t)$ . Using technology, determine, to the *nearest tenth of a year*, how long it will take for the two accounts to have the same amount of money in them. Justify your answer.

601 The function  $M(t)$  represents the mass of radium over time,  $t$ , in years.

$$M(t) = 100e^{\frac{\left(\ln \frac{1}{2}\right)t}{1590}}$$

Determine if the function  $M(t)$  represents growth or decay. Explain your reasoning.

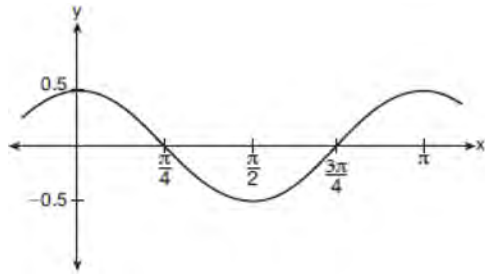
602 An initial investment of \$1000 reaches a value,  $V(t)$ , according to the model  $V(t) = 1000(1.01)^{4t}$ , where  $t$  is the time in years. Determine the average rate of change, to the *nearest dollar per year*, of this investment from year 2 to year 7.

603 Which expression has been rewritten correctly to form a true statement?

- 1)  $(x+2)^2 + 2(x+2) - 8 = (x+6)x$
- 2)  $x^4 + 4x^2 + 9x^2y^2 - 36y^2 = (x+3y)^2(x-2)^2$
- 3)  $x^3 + 3x^2 - 4xy^2 - 12y^2 = (x-2y)(x+3)^2$
- 4)  $(x^2-4)^2 - 5(x^2-4) - 6 = (x^2-7)(x^2-6)$



604 Which equation is represented by the graph shown below?



- 1)  $y = \frac{1}{2} \cos 2x$
- 2)  $y = \cos x$
- 3)  $y = \frac{1}{2} \cos x$
- 4)  $y = 2 \cos \frac{1}{2}x$

605 Pedro and Bobby each own an ant farm. Pedro starts with 100 ants and says his farm is growing exponentially at a rate of 15% per month. Bobby starts with 350 ants and says his farm is steadily decreasing by 5 ants per month. Assuming both boys are accurate in describing the population of their ant farms, after how many months will they both have approximately the same number of ants?

- 1) 7
- 2) 8
- 3) 13
- 4) 36

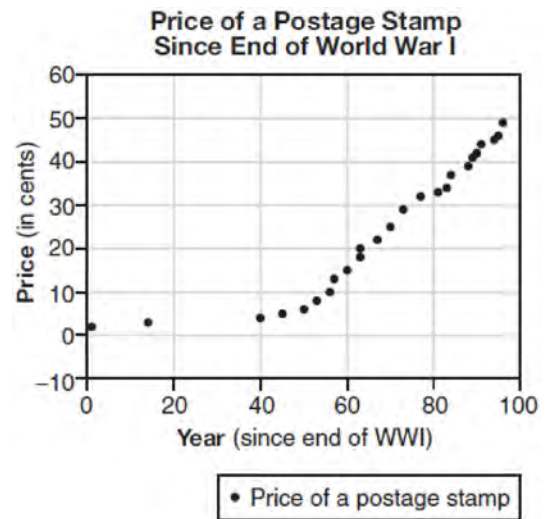
606 Describe how a controlled experiment can be created to examine the effect of ingredient X in a toothpaste.

607 Use an appropriate procedure to show that  $x - 4$  is a factor of the function  $f(x) = 2x^3 - 5x^2 - 11x - 4$ . Explain your answer.

608 The solution set for the equation  $\sqrt{56-x} = x$  is

- 1)  $\{-8, 7\}$
- 2)  $\{-7, 8\}$
- 3)  $\{7\}$
- 4)  $\{\}$

609 The price of a postage stamp in the years since the end of World War I is shown in the scatterplot below.



The equation that best models the price, in cents, of a postage stamp based on these data is

- 1)  $y = 0.59x - 14.82$
- 2)  $y = 1.04(1.43)^x$
- 3)  $y = 1.43(1.04)^x$
- 4)  $y = 24 \sin(14x) + 25$

610 When  $g(x) = \frac{2}{x+2}$  and  $h(x) = \log(x+1) + 3$  are graphed on the same set of axes, which coordinates best approximate their point of intersection?

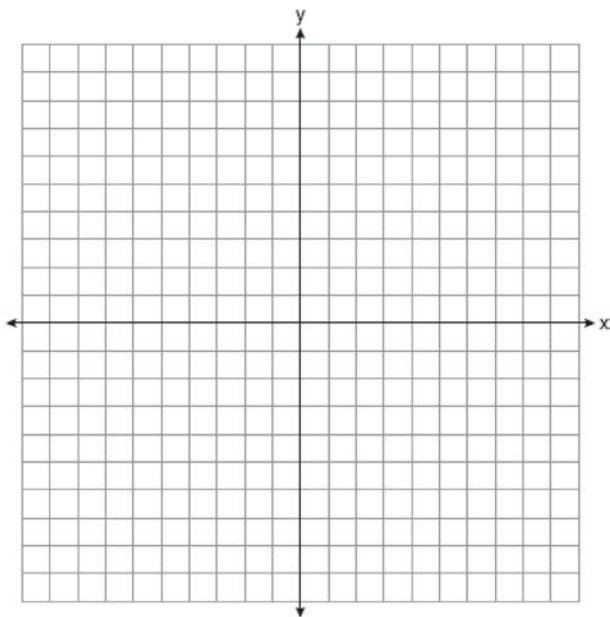
- 1)  $(-0.9, 1.8)$
- 2)  $(-0.9, 1.9)$
- 3)  $(1.4, 3.3)$
- 4)  $(1.4, 3.4)$

- 611 Using a microscope, a researcher observed and recorded the number of bacteria spores on a large sample of uniformly sized pieces of meat kept at room temperature. A summary of the data she recorded is shown in the table below.

Hours (x)	Average Number of Spores (y)
0	4
0.5	10
1	15
2	60
3	260
4	1130
6	16,380

Using these data, write an exponential regression equation, rounding all values to the *nearest thousandth*. The researcher knows that people are likely to suffer from food-borne illness if the number of spores exceeds 100. Using the exponential regression equation, determine the maximum amount of time, to the *nearest quarter hour*, that the meat can be kept at room temperature safely.

- 612 Find algebraically the zeros for  $p(x) = x^3 + x^2 - 4x - 4$ . On the set of axes below, graph  $y = p(x)$ .



- 613 A student studying public policy created a model for the population of Detroit, where the population decreased 25% over a decade. He used the model  $P = 714(0.75)^d$ , where  $P$  is the population, in thousands,  $d$  decades after 2010. Another student, Suzanne, wants to use a model that would predict the population after  $y$  years. Suzanne's model is best represented by

- 1)  $P = 714(0.6500)^y$
- 2)  $P = 714(0.8500)^y$
- 3)  $P = 714(0.9716)^y$
- 4)  $P = 714(0.9750)^y$

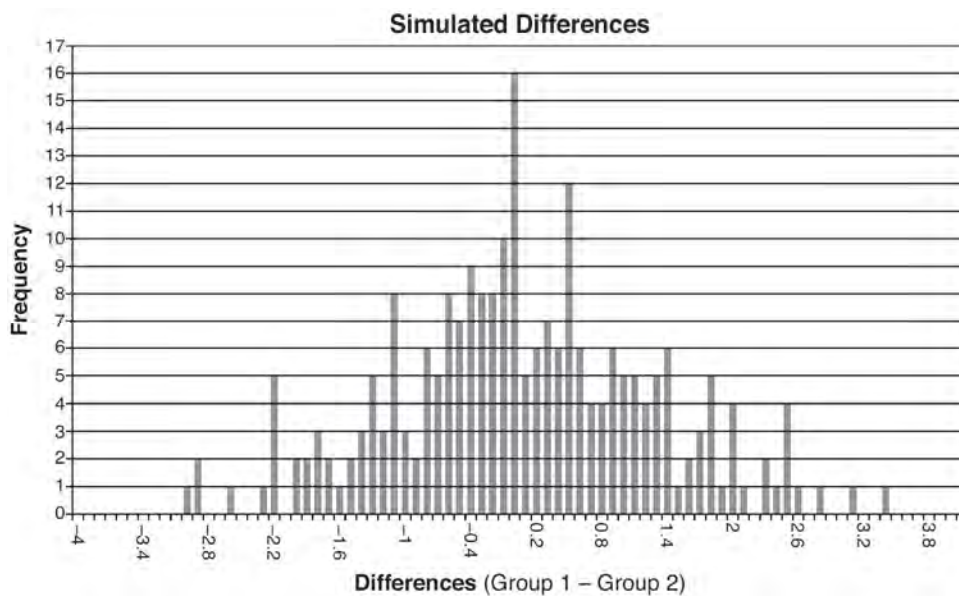
- 614 Solve the equation  $\sqrt{2x - 7} + x = 5$  algebraically, and justify the solution set.

- 615 Explain how  $(-8)^{\frac{4}{3}}$  can be evaluated using properties of rational exponents to result in an integer answer.

616 Ayva designed an experiment to determine the effect of a new energy drink on a group of 20 volunteer students. Ten students were randomly selected to form group 1 while the remaining 10 made up group 2. Each student in group 1 drank one energy drink, and each student in group 2 drank one cola drink. Ten minutes later, their times were recorded for reading the same paragraph of a novel. The results of the experiment are shown below.

Group 1 (seconds)	Group 2 (seconds)
17.4	23.3
18.1	18.8
18.2	22.1
19.6	12.7
18.6	16.9
16.2	24.4
16.1	21.2
15.3	21.2
17.8	16.3
19.7	14.5
Mean = 17.7	Mean = 19.1

Ayva thinks drinking energy drinks makes students read faster. Using information from the experimental design or the results, explain why Ayva's hypothesis may be *incorrect*. Using the given results, Ayva randomly mixes the 20 reading times, splits them into two groups of 10, and simulates the difference of the means 232 times.



Ayva has decided that the difference in mean reading times is not an unusual occurrence. Support her decision using the results of the simulation. Explain your reasoning.

- 617 A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts
Allergic to Milk	3	42
Not Allergic to Milk	12	1443

Determine the probability that a randomly selected survey respondent is allergic to milk. Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts. Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

- 618 The results of a poll of 200 students are shown in the table below:

	Preferred Music Style		
	Techno	Rap	Country
Female	54	25	27
Male	36	40	18

For this group of students, do these data suggest that gender and preferred music styles are independent of each other? Justify your answer.

- 619 The heights of the members of a ski club are normally distributed. The average height is 64.7 inches with a standard deviation of 4.3 inches. Determine the percentage of club members, to the *nearest percent*, who are between 67 inches and 72 inches tall.
- 620 To solve  $\frac{2x}{x-2} - \frac{11}{x} = \frac{8}{x^2-2x}$ , Ren multiplied both sides by the least common denominator. Which statement is true?
- 1) 2 is an extraneous solution.
  - 2)  $\frac{7}{2}$  is an extraneous solution.
  - 3) 0 and 2 are extraneous solutions.
  - 4) This equation does not contain any extraneous solutions.
- 621 Elizabeth waited for 6 minutes at the drive thru at her favorite fast-food restaurant the last time she visited. She was upset about having to wait that long and notified the manager. The manager assured her that her experience was very unusual and that it would not happen again. A study of customers commissioned by this restaurant found an approximately normal distribution of results. The mean wait time was 226 seconds and the standard deviation was 38 seconds. Given these data, and using a 95% level of confidence, was Elizabeth's wait time unusual? Justify your answer.

622 Simon lost his library card and has an overdue library book. When the book was 5 days late, he owed \$2.25 to replace his library card and pay the fine for the overdue book. When the book was 21 days late, he owed \$6.25 to replace his library card and pay the fine for the overdue book. Suppose the total amount Simon owes when the book is  $n$  days late can be determined by an arithmetic sequence. Determine a formula for  $a_n$ , the  $n$ th term of this sequence. Use the formula to determine the amount of money, in dollars, Simon needs to pay when the book is 60 days late.

623 Which statement(s) about statistical studies is true?

- I. A survey of all English classes in a high school would be a good sample to determine the number of hours students throughout the school spend studying.
  - II. A survey of all ninth graders in a high school would be a good sample to determine the number of student parking spaces needed at that high school.
  - III. A survey of all students in one lunch period in a high school would be a good sample to determine the number of hours adults spend on social media websites.
  - IV. A survey of all Calculus students in a high school would be a good sample to determine the number of students throughout the school who don't like math.
- 1) I, only
  - 2) II, only
  - 3) I and III
  - 4) III and IV

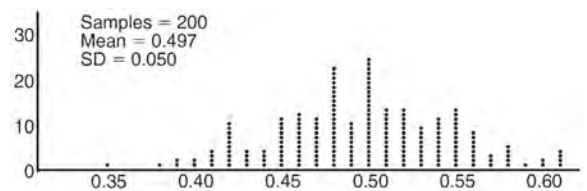
624 Given the parent function  $p(x) = \cos x$ , which phrase best describes the transformation used to obtain the graph of  $g(x) = \cos(x + a) - b$ , if  $a$  and  $b$  are positive constants?

- 1) right  $a$  units, up  $b$  units
- 2) right  $a$  units, down  $b$  units
- 3) left  $a$  units, up  $b$  units
- 4) left  $a$  units, down  $b$  units

625 When  $b > 0$  and  $d$  is a positive integer, the expression  $(3b)^{\frac{2}{d}}$  is equivalent to

- 1)  $\frac{1}{\left(\sqrt[d]{3b}\right)^2}$
- 2)  $\left(\sqrt{3b}\right)^d$
- 3)  $\frac{1}{\sqrt{3b^d}}$
- 4)  $\left(\sqrt[d]{3b}\right)^2$

626 Anne has a coin. She does not know if it is a fair coin. She flipped the coin 100 times and obtained 73 heads and 27 tails. She ran a computer simulation of 200 samples of 100 fair coin flips. The output of the proportion of heads is shown below.

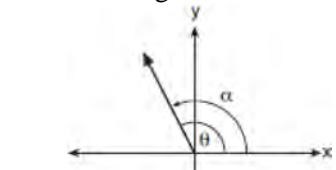


Given the results of her coin flips and of her computer simulation, which statement is most accurate?

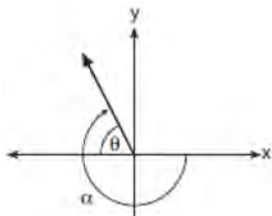
- 1) 73 of the computer's next 100 coin flips will be heads.
- 2) 50 of her next 100 coin flips will be heads.
- 3) Her coin is not fair.
- 4) Her coin is fair.

627 A study was designed to test the effectiveness of a new drug. Half of the volunteers received the drug. The other half received a sugar pill. The probability of a volunteer receiving the drug and getting well was 40%. What is the probability of a volunteer getting well, given that the volunteer received the drug?

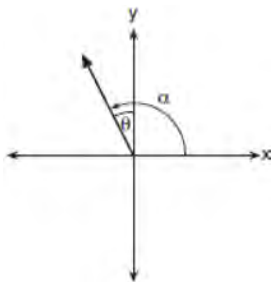
628 Which diagram represents an angle,  $\alpha$ , measuring  $\frac{13\pi}{20}$  radians drawn in standard position, and its reference angle,  $\theta$ ?



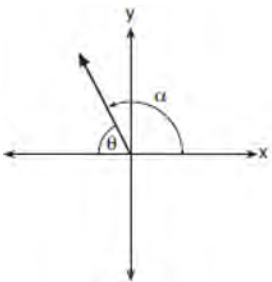
1)



2)



3)

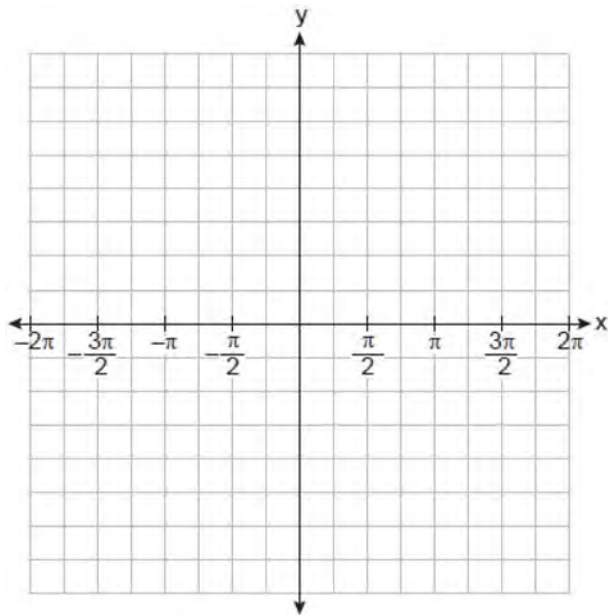


4)

629 The equation  $4x^2 - 24x + 4y^2 + 72y = 76$  is equivalent to

- 1)  $4(x - 3)^2 + 4(y + 9)^2 = 76$
- 2)  $4(x - 3)^2 + 4(y + 9)^2 = 121$
- 3)  $4(x - 3)^2 + 4(y + 9)^2 = 166$
- 4)  $4(x - 3)^2 + 4(y + 9)^2 = 436$

630 On the graph below, draw at least one complete cycle of a sine graph passing through point  $(0, 2)$  that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .



Based on your graph, state an interval in which the graph is increasing.

631 The inverse of the function  $f(x) = \frac{x+1}{x-2}$  is

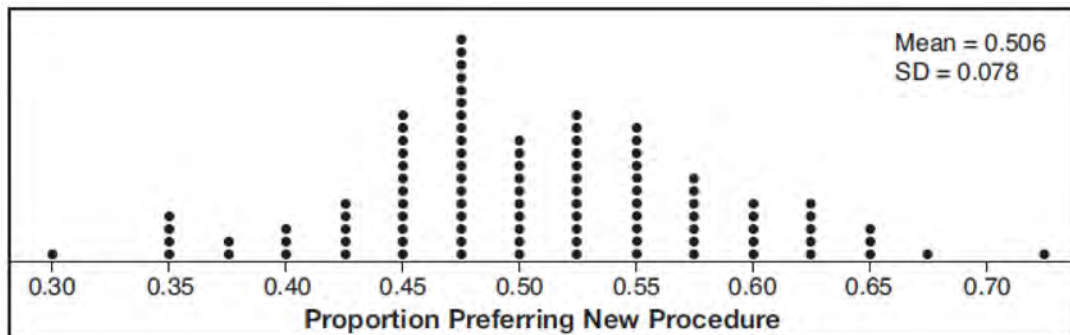
- 1)  $f^{-1}(x) = \frac{x+1}{x+2}$
- 2)  $f^{-1}(x) = \frac{2x+1}{x-1}$
- 3)  $f^{-1}(x) = \frac{x+1}{x-2}$
- 4)  $f^{-1}(x) = \frac{x-1}{x+1}$

632 Algebraically determine the values of  $x$  that satisfy the system of equations below.

$$y = -2x + 1$$

$$y = -2x^2 + 3x + 1$$

- 633 Charlie's Automotive Dealership is considering implementing a new check-in procedure for customers who are bringing their vehicles for routine maintenance. The dealership will launch the procedure if 50% or more of the customers give the new procedure a favorable rating when compared to the current procedure. The dealership devises a simulation based on the minimal requirement that 50% of the customers prefer the new procedure. Each dot on the graph below represents the proportion of the customers who preferred the new check-in procedure, each of sample size 40, simulated 100 times.



Assume the set of data is approximately normal and the dealership wants to be 95% confident of its results. Determine an interval containing the plausible sample values for which the dealership will launch the new procedure. Round your answer to the *nearest hundredth*. Forty customers are selected randomly to undergo the new check-in procedure and the proportion of customers who prefer the new procedure is 32.5%. The dealership decides *not* to implement the new check-in procedure based on the results of the study. Use statistical evidence to explain this decision.

- 634 The  $x$ -value of which function's  $x$ -intercept is larger,  $f$  or  $h$ ? Justify your answer.

$$f(x) = \log(x - 4)$$

$x$	$h(x)$
-1	6
0	4
1	2
2	0
3	-2

- 635 Simplify  $xi(i - 7i)^2$ , where  $i$  is the imaginary unit.

- 637 Write an explicit formula for  $a_n$ , the  $n$ th term of the recursively defined sequence below.

$$a_1 = x + 1$$

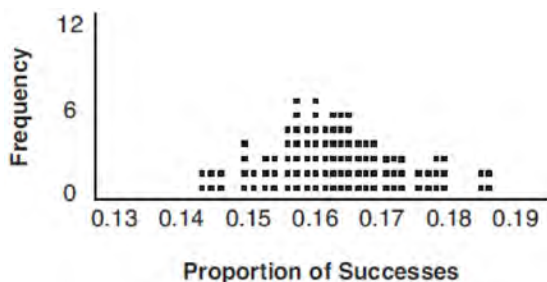
$$a_n = x(a_{n-1})$$

- 636 For the function  $f(x) = (x - 3)^3 + 1$ , find  $f^{-1}(x)$ .

For what values of  $x$  would  $a_n = 0$  when  $n > 1$ ?

638 In contract negotiations between a local government agency and its workers, it is estimated that there is a 50% chance that an agreement will be reached on the salaries of the workers. It is estimated that there is a 70% chance that there will be an agreement on the insurance benefits. There is a 20% chance that no agreement will be reached on either issue. Find the probability that an agreement will be reached on *both* issues. Based on this answer, determine whether the agreement on salaries and the agreement on insurance are independent events. Justify your answer.

639 A study conducted in 2004 in New York City found that 212 out of 1334 participants had hypertension. Kim ran a simulation of 100 studies based on these data. The output of the simulation is shown in the diagram below.



At a 95% confidence level, the proportion of New York City residents with hypertension and the margin of error are closest to

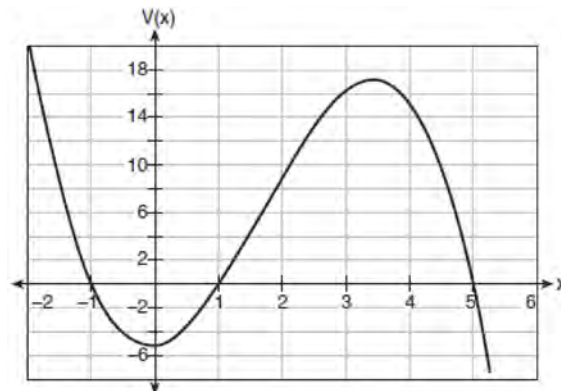
- 1) proportion  $\approx .16$ ; margin of error  $\approx .01$
- 2) proportion  $\approx .16$ ; margin of error  $\approx .02$
- 3) proportion  $\approx .01$ ; margin of error  $\approx .16$
- 4) proportion  $\approx .02$ ; margin of error  $\approx .16$

640 The solution set for the equation

$$\sqrt{x+14} - \sqrt{2x+5} = 1$$

- 1)  $\{-6\}$
- 2)  $\{2\}$
- 3)  $\{18\}$
- 4)  $\{2, 22\}$

641 A cardboard box manufacturing company is building boxes with length represented by  $x + 1$ , width by  $5 - x$ , and height by  $x - 1$ . The volume of the box is modeled by the function below.



Over which interval is the volume of the box changing at the fastest average rate?

- 1)  $[1, 2]$
- 2)  $[1, 3.5]$
- 3)  $[1, 5]$
- 4)  $[0, 3.5]$

642 The expression  $\frac{6x^3 + 17x^2 + 10x + 2}{2x + 3}$  equals

- 1)  $3x^2 + 4x - 1 + \frac{5}{2x + 3}$
- 2)  $6x^2 + 8x - 2 + \frac{5}{2x + 3}$
- 3)  $6x^2 - x + 13 - \frac{37}{2x + 3}$
- 4)  $3x^2 + 13x + \frac{49}{2} + \frac{151}{2x + 3}$

643 The function  $f(x) = \frac{x-3}{x^2 + 2x - 8}$  is undefined when

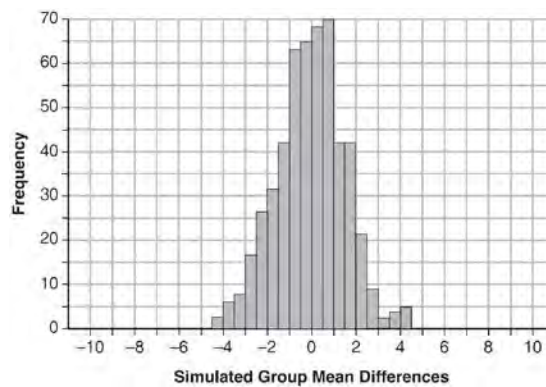
- $x$  equals
- 1) 2 or  $-4$
  - 2) 4 or  $-2$
  - 3) 3, only
  - 4) 2, only



644 Seventy-two students are randomly divided into two equally-sized study groups. Each member of the first group (group 1) is to meet with a tutor after school twice each week for one hour. The second group (group 2), is given an online subscription to a tutorial account that they can access for a maximum of two hours each week. Students in both groups are given the same tests during the year. A summary of the two groups' final grades is shown below:

	Group 1	Group 2
$\bar{x}$	80.16	83.8
$S_x$	6.9	5.2

Calculate the mean difference in the final grades (group 1 – group 2) and explain its meaning in the context of the problem. A simulation was conducted in which the students' final grades were rerandomized 500 times. The results are shown below.



Use the simulation to determine if there is a significant difference in the final grades. Explain your answer.

645 Solve the following system of equations algebraically for all values of  $x$ ,  $y$ , and  $z$ :

$$x + 3y + 5z = 45$$

$$6x - 3y + 2z = -10$$

$$-2x + 3y + 8z = 72$$

646 If  $\sin^2(32^\circ) + \cos^2(M) = 1$ , then  $M$  equals

- 1)  $32^\circ$
- 2)  $58^\circ$
- 3)  $68^\circ$
- 4)  $72^\circ$

647 The voltage used by most households can be modeled by a sine function. The maximum voltage is 120 volts, and there are 60 cycles *every second*. Which equation best represents the value of the voltage as it flows through the electric wires, where  $t$  is time in seconds?

- 1)  $V = 120 \sin(t)$
- 2)  $V = 120 \sin(60t)$
- 3)  $V = 120 \sin(60\pi t)$
- 4)  $V = 120 \sin(120\pi t)$

648 The Rickerts decided to set up an account for their daughter to pay for her college education. The day their daughter was born, they deposited \$1000 in an account that pays 1.8% compounded annually. Beginning with her first birthday, they deposit an additional \$750 into the account on each of her birthdays. Which expression correctly represents the amount of money in the account  $n$  years after their daughter was born?

1)  $a_n = 1000(1.018)^n + 750$

2)  $a_n = 1000(1.018)^n + 750n$

3)  $a_0 = 1000$

$$a_n = a_{n-1}(1.018) + 750$$

4)  $a_0 = 1000$

$$a_n = a_{n-1}(1.018) + 750n$$

649 Given  $i$  is the imaginary unit,  $(2 - yi)^2$  in simplest form is

1)  $y^2 - 4yi + 4$

2)  $-y^2 - 4yi + 4$

3)  $-y^2 + 4$

4)  $y^2 + 4$

650 Seth's parents gave him \$5000 to invest for his 16th birthday. He is considering two investment options. Option A will pay him 4.5% interest compounded annually. Option B will pay him 4.6% compounded quarterly. Write a function of option A and option B that calculates the value of each account after  $n$  years. Seth plans to use the money after he graduates from college in 6 years. Determine how much more money option B will earn than option A to the nearest cent. Algebraically determine, to the nearest tenth of a year, how long it would take for option B to double Seth's initial investment.

651 Given  $f(x) = 3x^2 + 7x - 20$  and  $g(x) = x - 2$ , state the quotient and remainder of  $\frac{f(x)}{g(x)}$ , in the form

$$q(x) + \frac{r(x)}{g(x)}.$$

652 Which function represents exponential decay?

1)  $y = 2^{0.3t}$

2)  $y = 1.2^{3t}$

3)  $y = \left(\frac{1}{2}\right)^{-t}$

4)  $y = 5^{-t}$

653 A recursive formula for the sequence 18, 9, 4.5, ... is

1)  $g_1 = 18$

$$g_n = \frac{1}{2}g_{n-1}$$

2)  $g_n = 18\left(\frac{1}{2}\right)^{n-1}$

3)  $g_1 = 18$

$$g_n = 2g_{n-1}$$

4)  $g_n = 18(2)^{n-1}$

654 The expression  $\frac{4x^3 + 5x + 10}{2x + 3}$  is equivalent to

1)  $2x^2 + 3x - 7 + \frac{31}{2x + 3}$

2)  $2x^2 - 3x + 7 - \frac{11}{2x + 3}$

3)  $2x^2 + 2.5x + 5 + \frac{15}{2x + 3}$

4)  $2x^2 - 2.5x - 5 - \frac{20}{2x + 3}$

655 Which function shown below has a greater average rate of change on the interval  $[-2,4]$ ? Justify your answer.

$x$	$f(x)$
-4	0.3125
-3	0.625
-2	1.25
-1	2.5
0	5
1	10
2	20
3	40
4	80
5	160
6	320

$$g(x) = 4x^3 - 5x^2 + 3$$

656 Mallory wants to buy a new window air conditioning unit. The cost for the unit is \$329.99. If she plans to run the unit three months out of the year for an annual operating cost of \$108.78, which function models the cost per year over the lifetime of the unit,  $C(n)$ , in terms of the number of years,  $n$ , that she owns the air conditioner.

- 1)  $C(n) = 329.99 + 108.78n$
- 2)  $C(n) = 329.99 + 326.34n$
- 3)  $C(n) = \frac{329.99 + 108.78n}{n}$
- 4)  $C(n) = \frac{329.99 + 326.34n}{n}$

657 Which equation represents a parabola with a focus of  $(0,4)$  and a directrix of  $y = 2$ ?

- 1)  $y = x^2 + 3$
- 2)  $y = -x^2 + 1$
- 3)  $y = \frac{x^2}{2} + 3$
- 4)  $y = \frac{x^2}{4} + 3$

658 A manufacturing company has developed a cost model,  $C(x) = 0.15x^3 + 0.01x^2 + 2x + 120$ , where  $x$  is the number of items sold, in thousands. The sales price can be modeled by  $S(x) = 30 - 0.01x$ . Therefore, revenue is modeled by  $R(x) = x \cdot S(x)$ . The company's profit,  $P(x) = R(x) - C(x)$ , could be modeled by

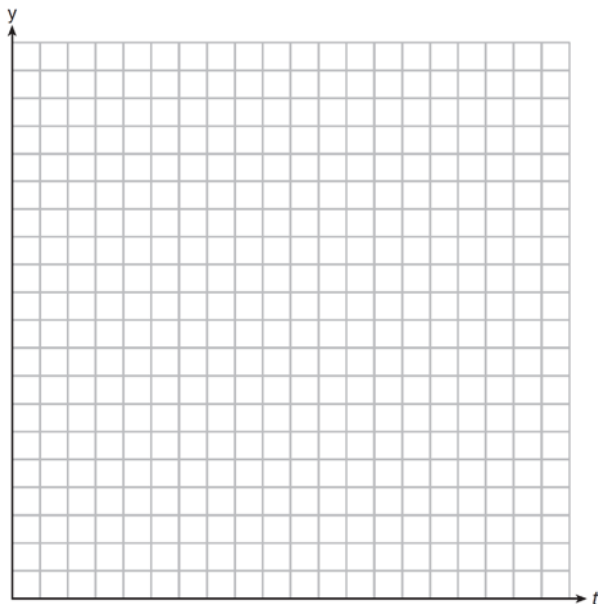
- 1)  $0.15x^3 + 0.02x^2 - 28x + 120$
- 2)  $-0.15x^3 - 0.02x^2 + 28x - 120$
- 3)  $-0.15x^3 + 0.01x^2 - 2.01x - 120$
- 4)  $-0.15x^3 + 32x + 120$

659 When  $\left(\frac{1}{\sqrt[3]{y^2}}\right)y^4$  is written in the form  $y^n$ , what is the value of  $n$ ? Justify your answer.

660 Determine if  $x - 5$  is a factor of  $2x^3 - 4x^2 - 7x - 10$ . Explain your answer.

- 661 As  $x$  increases from 0 to  $\frac{\pi}{2}$ , the graph of the equation  $y = 2 \tan x$  will
- 1) increase from 0 to 2
  - 2) decrease from 0 to  $-2$
  - 3) increase without limit
  - 4) decrease without limit
- 662 The heights of women in the United States are normally distributed with a mean of 64 inches and a standard deviation of 2.75 inches. The percent of women whose heights are between 64 and 69.5 inches, to the *nearest whole percent*, is
- 1) 6
  - 2) 48
  - 3) 68
  - 4) 95
- 663 Algebraically prove that  $\frac{x^3 + 9}{x^3 + 8} = 1 + \frac{1}{x^3 + 8}$ , where  $x \neq -2$ .
- 664 Algebraically determine whether the function  $j(x) = x^4 - 3x^2 - 4$  is odd, even, or neither.
- 665 Which value, to the *nearest tenth*, is *not* a solution of  $p(x) = q(x)$  if  $p(x) = x^3 + 3x^2 - 3x - 1$  and  $q(x) = 3x + 8$ ?
- 1)  $-3.9$
  - 2)  $-1.1$
  - 3)  $2.1$
  - 4)  $4.7$
- 666 Rewrite the expression  $(4x^2 + 5x)^2 - 5(4x^2 + 5x) - 6$  as a product of four linear factors.
- 667 What is the completely factored form of  $k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$ ?
- 1)  $(k - 2)(k - 2)(k + 3)(k + 4)$
  - 2)  $(k - 2)(k - 2)(k + 6)(k + 2)$
  - 3)  $(k + 2)(k - 2)(k + 3)(k + 4)$
  - 4)  $(k + 2)(k - 2)(k + 6)(k + 2)$
- 668 The expression  $6xi^3(-4xi + 5)$  is equivalent to
- 1)  $2x - 5i$
  - 2)  $-24x^2 - 30xi$
  - 3)  $-24x^2 + 30x - i$
  - 4)  $26x - 24x^2i - 5i$
- 669 A radioactive substance has a mass of 140 g at 3 p.m. and 100 g at 8 p.m. Write an equation in the form  $A = A_0 \left(\frac{1}{2}\right)^{\frac{t}{h}}$  that models this situation, where  $h$  is the constant representing the number of hours in the half-life,  $A_0$  is the initial mass, and  $A$  is the mass  $t$  hours after 3 p.m. Using this equation, solve for  $h$ , to the *nearest ten thousandth*. Determine when the mass of the radioactive substance will be 40 g. Round your answer to the *nearest tenth of an hour*.
- 670 Which statement about the graph of  $c(x) = \log_6 x$  is *false*?
- 1) The asymptote has equation  $y = 0$ .
  - 2) The graph has no  $y$ -intercept.
  - 3) The domain is the set of positive reals.
  - 4) The range is the set of all real numbers.
- 671 Given  $r(x) = x^3 - 4x^2 + 4x - 6$ , find the value of  $r(2)$ . What does your answer tell you about  $x - 2$  as a factor of  $r(x)$ ? Explain.

672 Drugs break down in the human body at different rates and therefore must be prescribed by doctors carefully to prevent complications, such as overdosing. The breakdown of a drug is represented by the function  $N(t) = N_0(e)^{-rt}$ , where  $N(t)$  is the amount left in the body,  $N_0$  is the initial dosage,  $r$  is the decay rate, and  $t$  is time in hours. Patient A,  $A(t)$ , is given 800 milligrams of a drug with a decay rate of 0.347. Patient B,  $B(t)$ , is given 400 milligrams of another drug with a decay rate of 0.231. Write two functions,  $A(t)$  and  $B(t)$ , to represent the breakdown of the respective drug given to each patient. Graph each function on the set of axes below.



To the *nearest hour*,  $t$ , when does the amount of the given drug remaining in patient B begin to exceed the amount of the given drug remaining in patient A? The doctor will allow patient A to take another 800 milligram dose of the drug once only 15% of the original dose is left in the body. Determine, to the *nearest tenth of an hour*, how long patient A will have to wait to take another 800 milligram dose of the drug.

673 Given  $f^{-1}(x) = -\frac{3}{4}x + 2$ , which equation represents  $f(x)$ ?

- 1)  $f(x) = \frac{4}{3}x - \frac{8}{3}$
- 2)  $f(x) = -\frac{4}{3}x + \frac{8}{3}$
- 3)  $f(x) = \frac{3}{4}x - 2$
- 4)  $f(x) = -\frac{3}{4}x + 2$

674 Which equation represents an odd function?

- 1)  $y = \sin x$
- 2)  $y = \cos x$
- 3)  $y = (x + 1)^3$
- 4)  $y = e^{5x}$

675 What is the solution set of the equation

$$\frac{3x + 25}{x + 7} - 5 = \frac{3}{x}?$$

- 1)  $\left\{\frac{3}{2}, 7\right\}$
- 2)  $\left\{\frac{7}{2}, -3\right\}$
- 3)  $\left\{-\frac{3}{2}, 7\right\}$
- 4)  $\left\{-\frac{7}{2}, -3\right\}$

676 Which binomial is *not* a factor of the expression

$$x^3 - 11x^2 + 16x + 84?$$

- 1)  $x + 2$
- 2)  $x + 4$
- 3)  $x - 6$
- 4)  $x - 7$

677 Jasmine decides to put \$100 in a savings account each month. The account pays 3% annual interest, compounded monthly. How much money,  $S$ , will Jasmine have after one year?

- 1)  $S = 100(1.03)^{12}$
- 2)  $S = \frac{100 - 100(1.0025)^{12}}{1 - 1.0025}$
- 3)  $S = 100(1.0025)^{12}$
- 4)  $S = \frac{100 - 100(1.03)^{12}}{1 - 1.03}$

678 Kristin wants to increase her running endurance. According to experts, a gradual mileage increase of 10% per week can reduce the risk of injury. If Kristin runs 8 miles in week one, which expression can help her find the total number of miles she will have run over the course of her 6-week training program?

- 1)  $\sum_{n=1}^6 8(1.10)^{n-1}$
- 2)  $\sum_{n=1}^6 8(1.10)^n$
- 3)  $\frac{8 - 8(1.10)^6}{0.90}$
- 4)  $\frac{8 - 8(0.10)^n}{1.10}$

679 The explicit formula  $a_n = 6 + 6n$  represents the number of seats in each row in a movie theater, where  $n$  represents the row number. Rewrite this formula in recursive form.

680 What are the zeros of  $P(m) = (m^2 - 4)(m^2 + 1)$ ?

- 1) 2 and -2, only
- 2) 2, -2, and -4
- 3) -4,  $i$ , and  $-i$
- 4) 2, -2,  $i$ , and  $-i$

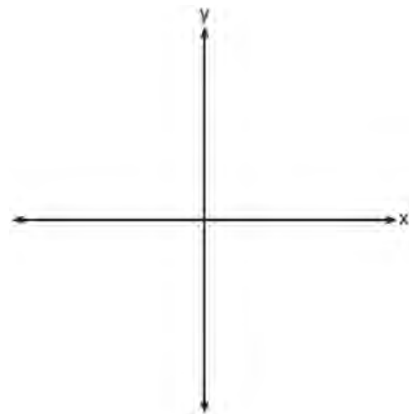
681 The expression  $\frac{-3x^2 - 5x + 2}{x^3 + 2x^2}$  can be rewritten as

- 1)  $\frac{-3x - 3}{x^2 + 2x}$
- 2)  $\frac{-3x - 1}{x^2}$
- 3)  $-3x^{-1} + 1$
- 4)  $-3x^{-1} + x^{-2}$

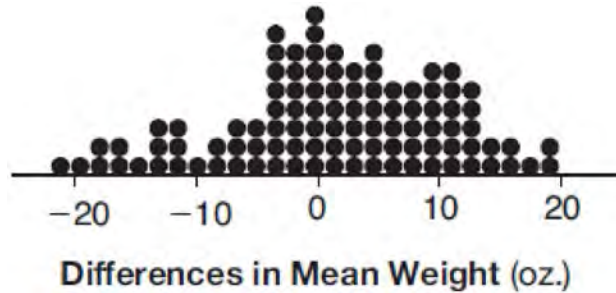
682 Sally's high school is planning their spring musical. The revenue,  $R$ , generated can be determined by the function  $R(t) = -33t^2 + 360t$ , where  $t$  represents the price of a ticket. The production cost,  $C$ , of the musical is represented by the function  $C(t) = 700 + 5t$ . What is the highest ticket price, to the nearest dollar, they can charge in order to not lose money on the event?

- 1)  $t = 3$
- 2)  $t = 5$
- 3)  $t = 8$
- 4)  $t = 11$

683 On the axes below, sketch a possible function  $p(x) = (x - a)(x - b)(x + c)$ , where  $a$ ,  $b$ , and  $c$  are positive,  $a > b$ , and  $p(x)$  has a positive  $y$ -intercept of  $d$ . Label all intercepts.



684 Gabriel performed an experiment to see if planting 13 tomato plants in black plastic mulch leads to larger tomatoes than if 13 plants are planted without mulch. He observed that the average weight of the tomatoes from tomato plants grown in black plastic mulch was 5 ounces greater than those from the plants planted without mulch. To determine if the observed difference is statistically significant, he rerandomized the tomato groups 100 times to study these random differences in the mean weights. The output of his simulation is summarized in the dotplot below.



Given these results, what is an appropriate inference that can be drawn?

- |   |   |
|---|---|
| 1) There was no effect observed between the two groups.   | 3) There is strong evidence to support the hypothesis that tomatoes from plants planted in black plastic mulch are larger than those planted without mulch. |
| 2) There was an effect observed that could be due to the random assignment of plants to the groups. | 4) There is strong evidence to support the hypothesis that tomatoes from plants planted without mulch are larger than those planted in black plastic mulch. |

685 Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x-1}$

686 Solve for  $x$ :  $\frac{1}{x} - \frac{1}{3} = -\frac{1}{3x}$

687 In 2013, approximately 1.6 million students took the Critical Reading portion of the SAT exam. The mean score, the modal score, and the standard deviation were calculated to be 496, 430, and 115, respectively. Which interval reflects 95% of the Critical Reading scores?

- 1)  $430 \pm 115$
- 2)  $430 \pm 230$
- 3)  $496 \pm 115$
- 4)  $496 \pm 230$

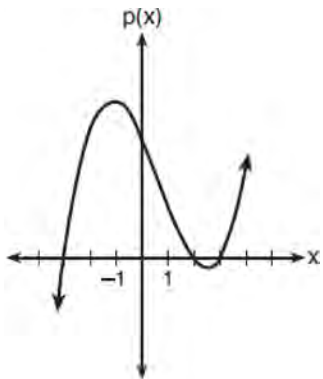
688 The guidance department has reported that of the senior class, 2.3% are members of key club,  $K$ , 8.6% are enrolled in AP Physics,  $P$ , and 1.9% are in both. Determine the probability of  $P$  given  $K$ , to the *nearest tenth of a percent*. The principal would like a basic interpretation of these results. Write a statement relating your calculated probabilities to student enrollment in the given situation.

689 Solve the system of equations shown below algebraically.

$$(x - 3)^2 + (y + 2)^2 = 16$$

$$2x + 2y = 10$$

690 The graph of the function  $p(x)$  is sketched below.



Which equation could represent  $p(x)$ ?

- 1)  $p(x) = (x^2 - 9)(x - 2)$
- 2)  $p(x) = x^3 - 2x^2 + 9x + 18$
- 3)  $p(x) = (x^2 + 9)(x - 2)$
- 4)  $p(x) = x^3 + 2x^2 - 9x - 18$

691 The formula below can be used to model which scenario?

$$a_1 = 3000$$

$$a_n = 0.80a_{n-1}$$

- 1) The first row of a stadium has 3000 seats, and each row thereafter has 80 more seats than the row in front of it.
- 2) The last row of a stadium has 3000 seats, and each row before it has 80 fewer seats than the row behind it.
- 3) A bank account starts with a deposit of \$3000, and each year it grows by 80%.
- 4) The initial value of a specialty toy is \$3000, and its value each of the following years is 20% less.

692 Which equation has  $1 - i$  as a solution?

- 1)  $x^2 + 2x - 2 = 0$
- 2)  $x^2 + 2x + 2 = 0$
- 3)  $x^2 - 2x - 2 = 0$
- 4)  $x^2 - 2x + 2 = 0$

693 Which diagram shows an angle rotation of 1 radian on the unit circle?

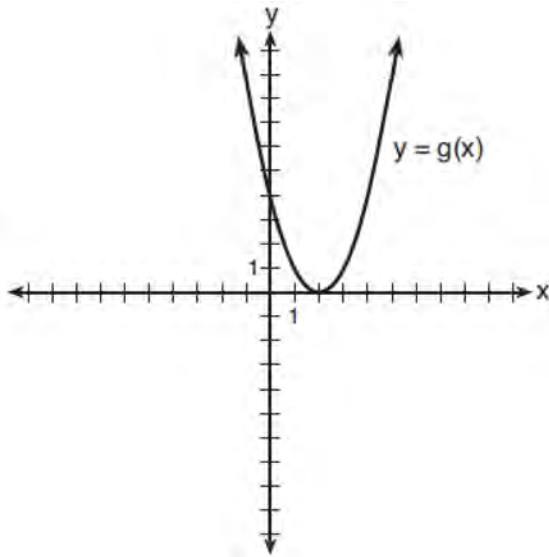
- 1)
- 2)
- 3)
- 4)

694 Which statement about statistical analysis is *false*?

- 1) Experiments can suggest patterns and relationships in data.
- 2) Experiments can determine cause and effect relationships.
- 3) Observational studies can determine cause and effect relationships.
- 4) Observational studies can suggest patterns and relationships in data.



- 695 What is the solution to the system of equations  $y = 3x - 2$  and  $y = g(x)$  where  $g(x)$  is defined by the function below?

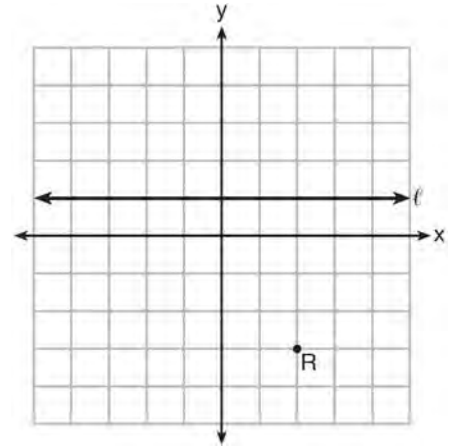


- 1)  $\{(0, -2)\}$
- 2)  $\{(0, -2), (1, 6)\}$
- 3)  $\{(1, 6)\}$
- 4)  $\{(1, 1), (6, 16)\}$

- 696 A solution of the equation  $2x^2 + 3x + 2 = 0$  is

- 1)  $-\frac{3}{4} + \frac{1}{4}i\sqrt{7}$
- 2)  $-\frac{3}{4} + \frac{1}{4}i$
- 3)  $-\frac{3}{4} + \frac{1}{4}\sqrt{7}$
- 4)  $\frac{1}{2}$

- 697 Which equation represents the set of points equidistant from line  $\ell$  and point  $R$  shown on the graph below?



- 1)  $y = -\frac{1}{8}(x+2)^2 + 1$
- 2)  $y = -\frac{1}{8}(x+2)^2 - 1$
- 3)  $y = -\frac{1}{8}(x-2)^2 + 1$
- 4)  $y = -\frac{1}{8}(x-2)^2 - 1$

## Algebra II Regents at Random Worksheets Answer Section

1 ANS: 1

$$2000 \left( 1 + \frac{.032}{12} \right)^{12t} \approx 2000(1.003)^{12t}$$

PTS: 2 REF: 012004aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

2 ANS: 1

$$7 - 3i + x^2 - 4xi + 4i^2 - 4i - 2x^2 = 7 - 7i - x^2 - 4xi - 4 = 3 - x^2 - 4xi - 7i = (3 - x^2) - (4x + 7)i$$

PTS: 2 REF: 012022aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

3 ANS: 2

$$-23(1) + 56 = 33; \quad -23(-1) + 56 = 79$$

PTS: 2 REF: 062305aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

4 ANS:

$$r = \frac{360}{300} = 1.2 \quad S_n = \frac{300 - 300(1.2)^n}{1 - 1.2} \quad S_{10} = \frac{300 - 300(1.2)^{10}}{1 - 1.2} \approx 7787.6$$

PTS: 2 REF: 012029aai NAT: A.SSE.B.4 TOP: Series

KEY: geometric

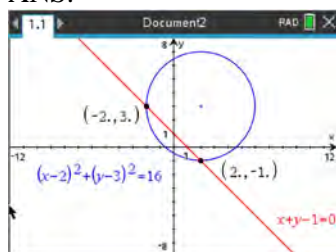
5 ANS:

$$x = \frac{-5 \pm \sqrt{5^2 - 4(3)(8)}}{2(3)} = -\frac{5}{6} \pm \frac{i\sqrt{71}}{6}$$

PTS: 2 REF: 082327aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

6 ANS:



$$y = -x + 1 \quad y = -2 + 1 = -1 \quad (2, -1)$$

$$(x-2)^2 + (-x+1-3)^2 = 16 \quad y = 2+1 = 3 \quad (-2, 3)$$

$$x^2 - 4x + 4 + x^2 + 4x + 4 = 16$$

$$2x^2 = 8$$

$$x = -2, 2$$

PTS: 4 REF: 012035aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems



16 ANS: 3

$$x = -\frac{2y}{5} + 4 \quad y = -\frac{5}{2}(6) + 10 = -5$$

$$5x = -2y + 20$$

$$2y = -5x + 20$$

$$y = -\frac{5}{2}x + 10$$

PTS: 2 REF: 082223aii NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: linear

17 ANS: 1 PTS: 2 REF: 062214aii NAT: S.ID.A.4

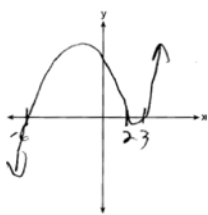
TOP: Normal Distributions KEY: predict

18 ANS:

.651  $\pm$  2  $\cdot$  .034 = .58  $-$  .72. No, since .61 (122/200) falls within the 95% interval.

PTS: 4 REF: 062235aii NAT: S.IC.A.2 TOP: Analysis of Data

19 ANS:



$$p(x) = (x - 2)(x - 3)(x + 6)$$

PTS: 4 REF: 062333aii NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

20 ANS:

$m(3) = 3^3 - 3^2 - 5(3) - 3 = 27 - 9 - 15 - 3 = 0$  Since  $m(3) = 0$ , there is no remainder when  $m(x)$  is divided by  $x - 3$ , and so  $x - 3$  is a factor.

PTS: 2 REF: 012026aii NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

21 ANS: 3

$$y = -6x + \frac{1}{2}$$

$$x = -6y + \frac{1}{2}$$

$$x - \frac{1}{2} = -6y$$

$$-\frac{1}{6} \left( x - \frac{1}{2} \right) = y$$

PTS: 2 REF: 062217aii NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: linear

22 ANS: 1

$$\begin{array}{r|rrrrrr}
 -2 & 1 & -1 & -11 & 5 & 30 \\
 & & -2 & 6 & 10 & -30 \\
 \hline
 & 1 & -3 & -5 & 15 & 0
 \end{array}$$

Since there is no remainder when the quartic is divided by  $x + 2$ , this binomial is a factor.

PTS: 2 REF: 082320aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

23 ANS: 2 PTS: 2 REF: 062222aai NAT: F.IF.C.9

TOP: Comparing Functions

24 ANS: 2

$$\begin{array}{r}
 \phantom{x-2} \overline{) x^3 - 0x^2 + 0x - 2} \\
 \underline{x^3 - 2x^2} \phantom{+ 0x - 2} \\
 2x^2 + 0x \phantom{- 2} \\
 \underline{2x^2 - 4x} \phantom{- 2} \\
 4x - 2 \\
 \underline{4x - 8} \\
 6
 \end{array}$$

PTS: 2 REF: 082217aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

25 ANS: 4

(1) and (3) are not recursive

PTS: 2 REF: 012013aai NAT: F.BF.A.2 TOP: Sequences

26 ANS: 2

$$4300e^{0.07x} = 5123$$

$$\ln e^{0.07x} = \ln \frac{5123}{4300}$$

$$0.07x = \ln \frac{5123}{4300}$$

$$x = \frac{\ln \frac{5123}{4300}}{0.07}$$

$$x \approx 2.5$$

PTS: 2 REF: 012302aai NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

27 ANS: 1 PTS: 2 REF: 062308aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

28 ANS: 2

$$1 = \frac{2\pi}{k}$$

$$k = 2\pi$$

PTS: 2

REF: 012313aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

29 ANS:

$$\left(p^2 n^{\frac{1}{2}}\right)^8 \sqrt{p^5 n^4} = (p^{16} n^4) p^2 n^2 \sqrt{p} = p^{18} n^6 \sqrt{p}$$

PTS: 2

REF: 012025aai

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

30 ANS:

$$(x^3 + 2x - 1)(x^2 + 7) - 3(x^4 - 5x)$$

$$x^5 + 7x^3 + 2x^3 + 14x - x^2 - 7 - 3x^4 + 15x$$

$$x^5 - 3x^4 + 9x^3 - x^2 + 29x - 7$$

PTS: 2

REF: 012330aai

NAT: F.BF.A.1

TOP: Operations with Functions

31 ANS:

$$3(x^3 + 4x^2 - x - 4) = 0$$

$$(x^2(x+4) - (x+4)) = 0$$

$$(x^2 - 1)(x+4) = 0$$

$$x = \pm 1, -4$$

PTS: 2

REF: 012325aai

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

32 ANS: 1

$$\ln e^{x+2} = \ln \frac{7}{5}$$

$$(x+2)\ln e = \ln \frac{7}{5}$$

$$x = -2 + \ln \frac{7}{5}$$

PTS: 2

REF: 062207aai

NAT: F.LE.A.4

TOP: Exponential Equations

KEY: without common base

33 ANS: 4

$$\log 2^t = \log \sqrt{10} \quad 2) \frac{\log \sqrt{10}}{\log 2} = \log_2 \sqrt{10}, \quad 1) \log_2 \sqrt{10} = \log_2 10^{\frac{1}{2}} = \frac{1}{2} \log_2 10, \quad 3) \log_4 10 = \frac{\log_2 10}{\log_2 4} = \frac{1}{2} \log_2 10$$

$$t \log 2 = \log \sqrt{10}$$

$$t = \frac{\log \sqrt{10}}{\log 2}$$

PTS: 2 REF: 012009aai NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

34 ANS: 2

$$f(x) = f(-x)$$

$$x^2 + 1 = (-x)^2 + 1$$

$$x^2 + 1 = x^2 + 1$$

PTS: 2 REF: 082323aai NAT: F.BF.B.3 TOP: Even and Odd Functions

35 ANS: 2

$$a^{\sqrt[5]{4}} = a^{\frac{5}{5}} \cdot a^{\frac{4}{5}} = a^{\frac{9}{5}}$$

PTS: 2 REF: 062306aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

36 ANS: 4

PTS: 2

REF: 012014aai

NAT: S.IC.B.5

TOP: Analysis of Data

37 ANS: 2

$$a_2 = 8 + \log_{2+1} 1 = 8 + 0 = 8$$

$$a_3 = 8 + \log_{3+1} 2 = 8 + \frac{1}{2} = 8.5$$

PTS: 2 REF: 062221aai NAT: F.IF.A.3 TOP: Sequences

KEY: recursive

38 ANS: 3

$$\text{between } 000 \text{ and } 449, \text{ inclusive} \rightarrow \frac{450}{1000} = 45\%$$

PTS: 2 REF: 012024aai NAT: S.IC.B.3 TOP: Analysis of Data

KEY: type

39 ANS:

.819  $\pm$  2  $\cdot$  .053 = .713 – .925. Since .70 does not fall within the 95% interval.

PTS: 4 REF: 082236aai NAT: S.IC.A.2 TOP: Analysis of Data

40 ANS: 3

$$y = 1.77(1.18)^x \quad y(41) \approx 1,850,950$$

PTS: 2 REF: 062314aai NAT: S.ID.B.6 TOP: Regression

KEY: exponential

41 ANS: 4

$$2 \times 0.035 = 0.07 \text{ or } ME = \left( z \sqrt{\frac{p(1-p)}{n}} \right) = \left( 1.96 \sqrt{\frac{(0.65)(0.35)}{200}} \right) \approx 0.07$$

PTS: 2 REF: 012319aai NAT: S.IC.B.4 TOP: Analysis of Data

42 ANS: 3

$$(6 - ki)^2 = 27 - 36i$$

$$36 - 12ki + k^2 i^2 = 27 - 36i$$

$$9 - k^2 - 12ki = -36i$$

Set real part equal to real part:  $9 - k^2 = 0$  Set imaginary part equal to imaginary part:  $-12ki = -36i$ 

$$k = \pm 3$$

$$\frac{-12ki}{-12i} = \frac{-36i}{-12i}$$

$$k = 3$$

PTS: 2 REF: 012308aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

43 ANS: 4 PTS: 2 REF: 062215aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

44 ANS: 4

$$45\% + 31\% - 58\% = 18\%$$

PTS: 2 REF: 082307aai NAT: S.CP.B.7 TOP: Theoretical Probability

45 ANS:

$$\frac{63}{189} = \frac{1}{3} a_1 = 189$$

$$a_n = \frac{1}{3} a_{n-1}$$

PTS: 2 REF: 062329aai NAT: F.BF.A.1 TOP: Sequences

KEY: recursive



46 ANS:

$$\begin{array}{r}
 3x^2 + 8x + 34 \\
 x-4 \overline{) 3x^3 - 4x^2 + 2x - 1} \\
 \underline{3x^3 - 12x^2} \phantom{+ 2x - 1} \\
 8x^2 + 2x \phantom{- 1} \\
 \underline{8x^2 - 32x} \phantom{- 1} \\
 34x - 1 \\
 \underline{34x - 136} \\
 135
 \end{array}$$

$x = 4$  is not a root of  $f(x)$  because  $\frac{f(x)}{g(x)}$  has a remainder.

PTS: 4 REF: 082235aia NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

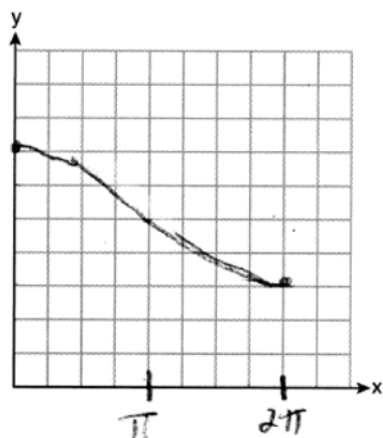
47 ANS: 1 PTS: 2 REF: 082309aia NAT: F.BF.A.1

TOP: Modeling Exponential Functions

48 ANS: 4 PTS: 2 REF: 082318aia NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

49 ANS:



PTS: 2 REF: 062231aia NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

50 ANS: 2  
.962<sup>10</sup> ≈ .679

PTS: 2 REF: 082311aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

51 ANS:

$$2x^2 - 7x + 4 = 11 - 2x \quad y = 11 - 2\left(\frac{7}{2}\right) = 4 \quad \left\{ \left(\frac{7}{2}, 4\right), (-1, 13) \right\}$$

$$2x^2 - 5x - 7 = 0 \quad y = 11 - 2(-1) = 13$$

$$(2x - 7)(x + 1) = 0$$

$$x = \frac{7}{2}, -1$$

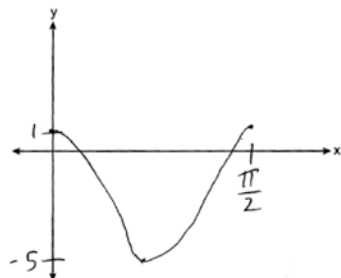
PTS: 2

REF: 082232aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

52 ANS:



PTS: 2

REF: 082328aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

53 ANS:

$$\sqrt[3]{81} = \sqrt[3]{3^4} = 3^{\frac{4}{3}} \quad a = \frac{4}{3}$$

PTS: 2

REF: 062230aai

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: variables

54 ANS: 3

$$(x + a)^2 + 5(x + a) + 4 \quad \text{let } u = x + a$$

$$u^2 + 5u + 4$$

$$(u + 4)(u + 1)$$

$$(x + a + 4)(x + a + 1)$$

PTS: 2

REF: 012006aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

KEY: multivariable

55 ANS: 4

PTS: 2

REF: 062309aai

NAT: F.IF.C.9

TOP: Comparing Functions

56 ANS:

$$a_n = 100(.8)^{n-1} \quad S_{20} = \frac{100 - 100(.8)^{20}}{1 - .8} \approx 494 \quad \text{No, because } 494 > 40 \times 12.$$

PTS: 4

REF: 012033aai

NAT: A.SSE.B.4

TOP: Series

KEY: geometric

57 ANS:

$$\text{antibiotic } n(0) = \frac{0+1}{0+5} + \frac{18}{0^2 + 8(0) + 15} = \frac{3}{15} + \frac{18}{15} = \frac{21}{15}$$

$$a(0) = \frac{9}{0+3} = 3$$

$$\frac{t+1}{t+5} + \frac{18}{t^2 + 8t + 15} = \frac{9}{t+3}$$

$$\frac{(t+1)(t+3)}{(t+5)(t+3)} + \frac{18}{(t+3)(t+5)} = \frac{9(t+5)}{(t+3)(t+5)}$$

$$t^2 + 4t + 3 + 18 = 9t + 45$$

$$t^2 - 5t - 24 = 0$$

$$(t-8)(t+3) = 0$$

$$t = 8$$

PTS: 6 REF: 012037aai NAT: A.REI.A.2 TOP: Solving Rationals  
KEY: rational solutions

58 ANS: 2 PTS: 2 REF: 082308aai NAT: A.REI.B.4  
TOP: Using the Discriminant KEY: determine nature of roots given equation, graph, table

59 ANS: 4  
1)  $d(2) = 2$ ; 2)  $d(1) = 12$ ; 3)  $d(9) \approx 11$ ; 4)  $d(-1) = 2$

PTS: 2 REF: 062220aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

60 ANS:  
 $p$  is the distance from the focus to the vertex:  $8 - 7 = 1$ .  $p$  is the distance from the directrix to the vertex:  
 $1 = 7 - d$ .  $y = 6$

$$d = 6$$

PTS: 2 REF: 082330aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

61 ANS: 2 PTS: 2 REF: 082324aai NAT: A.APR.B.3  
TOP: Graphing Polynomial Functions

62 ANS: 1 PTS: 2 REF: 082221aai NAT: F.BF.B.6  
TOP: Sigma Notation KEY: represent

63 ANS: 2 PTS: 2 REF: 012311aai NAT: A.APR.C.4  
TOP: Polynomial Identities

64 ANS: 4 PTS: 2 REF: 012008aai NAT: S.CP.A.3  
TOP: Conditional Probability

65 ANS: 3 PTS: 2 REF: 082214aai NAT: F.IF.C.7  
TOP: Graphing Exponential Functions

66 ANS: 3 PTS: 2 REF: 012015aai NAT: S.IC.B.3  
TOP: Analysis of Data KEY: type

67 ANS: 1

The product of the roots equals  $(3+i)(3-i) = 9 - i^2 = 10 = \frac{c}{a}$ . OR

$$(x - (3+i))(x - (3-i)) = 0$$

$$(x - 3 - i)(x - 3 + i) = 0$$

$$((x - 3) - i)((x - 3) + i) = 0$$

$$(x - 3)^2 - i^2 = 0$$

$$x^2 - 6x + 9 + 1 = 0$$

$$x^2 - 6x + 10 = 0$$

PTS: 2 REF: 082208aai NAT: A.REI.B.4 TOP: Complex Conjugate Root Theorem

68 ANS: 2

$x^2 = 3x + 40$ .  $x = -5$  is an extraneous solution.

$$x^2 - 3x - 40 = 0$$

$$(x - 8)(x + 5) = 0$$

$$x = 8, -5$$

PTS: 2 REF: 012010aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

69 ANS: 4 PTS: 2 REF: 082205aai NAT: F.TF.A.2

TOP: Unit Circle

70 ANS:

$\frac{B(10) - B(6)}{10 - 6} \approx -3.88$ . The average monthly high temperature decreases about  $4^\circ$  each month from June and October.

PTS: 4 REF: 012336aai NAT: F.IF.B.6 TOP: Rate of Change

71 ANS: 2 PTS: 2 REF: 012402aai NAT: A.REI.B.4  
TOP: Using the Discriminant KEY: determine nature of roots given equation

72 ANS:

$e^{0.0532} > 1$ , so  $P(t)$  is increasing.

PTS: 2 REF: 062327aai NAT: F.IF.C.7 TOP: Graphing Exponential Functions

73 ANS:

$$\frac{1}{3} \times \frac{5}{12} = \frac{5}{36}$$

PTS: 2 REF: 012327aai NAT: S.CP.A.2 TOP: Probability of Compound Events  
KEY: probability

74 ANS: 1

$$2) (x^4 - x^2y^2 + y^4) \neq (x^2 - y^2)(x^2 - y^2); 3) x^6 + y^6 \neq (x^3 + y^3)^2; 4) \frac{x^6 + y^6}{x^2 + y^2} \neq x^6 + y^6 - (x^2 + y^2)$$

PTS: 2 REF: 082219aai NAT: A.APR.C.4 TOP: Polynomial Identities

75 ANS: 3

$$P = 210x^{\frac{4}{3}}y^{\frac{7}{3}} = 210x^{\frac{3}{3}}x^{\frac{1}{3}}y^{\frac{6}{3}}y^{\frac{1}{3}} = 210x \cdot x^{\frac{1}{3}}y^2y^{\frac{1}{3}} = 210xy^2\sqrt[3]{xy}$$

PTS: 2 REF: 012413aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

76 ANS:

$$\frac{x^2(2x+1) - 9(2x+1)}{x(3-x)} = \frac{(x^2-9)(2x+1)}{x(3-x)} = \frac{(x+3)(x-3)(2x+1)}{x(3-x)} = \frac{(x+3)(2x+1)}{-x}$$

PTS: 2 REF: 062331ai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

77 ANS: 4

$$(x^2 - y^2) + (2xy)^2 = x^2 + 4x^2y^2 - y^2$$

$$(x - y) + (x^2 - xy + y^2) = x^2 + x - y - xy + y^2$$

$$(x - y)(x - y)(x^2 + y^2) = (x^2 - 2xy + y^2)(x^2 + y^2) = x^4 - 2x^3y + x^2y^2 + x^2y^2 - 2xy^3 + y^4$$

PTS: 2 REF: 062322aai NAT: A.APR.C.4 TOP: Polynomial Identities

78 ANS:

$$\cos A = \frac{\cos A}{\sin A}$$

$$-3 = \frac{3}{\frac{\sqrt{10}}{\sin A}}$$

$$\sin A = \frac{3}{-3\sqrt{10}} = -\frac{1}{\sqrt{10}}$$

PTS: 2 REF: 082229aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

79 ANS:

$$\left( \frac{y^{\frac{17}{8}}}{y^{\frac{10}{8}}} \right)^{-4} = y^n \quad n = -\frac{7}{2}$$

$$\left( y^{\frac{7}{8}} \right)^{-4} = y^n$$

$$y^{-\frac{7}{2}} = y^n$$

PTS: 2 REF: 082228aai NAT: A.APR.D.6 TOP: Expressions with Negative Exponents  
KEY: variables

80 ANS:

$$t = 2\pi\sqrt{\frac{67}{9.81}} \approx 16.4 \quad 9.6 = 2\pi\sqrt{\frac{L}{9.81}}$$

$$L \approx 22.9$$

PTS: 4 REF: 062234aai NAT: A.REI.A.2 TOP: Solving Radicals  
KEY: context

81 ANS: 3

$$\frac{4}{k^2 - 8k + 12} = \frac{k(k-6) + (k-2)}{k^2 - 8k + 12} \quad k = 6 \text{ is extraneous}$$

$$4 = k^2 - 6k + k - 2$$

$$0 = k^2 - 5k - 6$$

$$0 = (k-6)(k+1)$$

$$k = 6, -1$$

PTS: 2 REF: 082218aai NAT: A.REI.A.2 TOP: Solving Rationals

82 ANS: 3

$$x = \frac{2}{3}y + \frac{1}{6}$$

$$6x = 4y + 1$$

$$4y = 6x - 1$$

$$y = \frac{6}{4}x - \frac{1}{4}$$

PTS: 2 REF: 062321aai NAT: F.BF.B.4 TOP: Inverse of Functions  
KEY: linear

83 ANS: 3

To determine student opinion, survey the widest range of students.

PTS: 2

REF: 062202aai

NAT: S.IC.B.3

TOP: Analysis of Data

KEY: bias

84 ANS:

$$1.5\%; P(t) = 92.2(1.015)^t; \quad \frac{300}{92.2} = (1.015)^t$$

$$\log \frac{300}{92.2} = t \log(1.015)$$

$$\frac{\log \frac{300}{92.2}}{\log(1.015)} = t$$

$$t \approx 79$$

PTS: 6

REF: 062237aai

NAT: F.BF.A.2

TOP: Sequences

85 ANS: 3

$$\frac{x^{\frac{1}{5}}}{x^{\frac{1}{2}}} = x^{\frac{1}{5} - \frac{1}{2}} = x^{-\frac{3}{10}} = \frac{1}{x^{\frac{3}{10}}} = \frac{1}{\sqrt[10]{x^3}}$$

PTS: 2

REF: 012312aai

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

86 ANS: 2

$$\frac{x^2 + 3x}{x^2 + 5x + 6} = \frac{x(x+3)}{(x+2)(x+3)}$$

PTS: 2

REF: 082215aai

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: factoring

87 ANS: 3

$$r = \frac{-2\sqrt{3}}{\sqrt{6}} = \frac{-2}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{-2\sqrt{2}}{2} = -\sqrt{2} \quad a_7 = \sqrt{6}(-\sqrt{2})^{7-1} = \sqrt{6}(-\sqrt{2})^6 = \sqrt{6} \cdot 2^3 = 8\sqrt{6}$$

PTS: 2

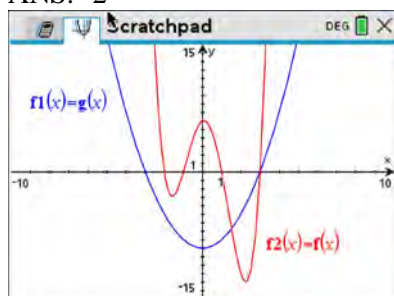
REF: 012410aai

NAT: F.BF.A.1

TOP: Sequences

KEY: explicit

88 ANS: 2



PTS: 2 REF: 082319aai NAT: A.REI.D.11 TOP: Other Systems

89 ANS: 1 PTS: 2 REF: 012405aai NAT: A.APR.B.3

TOP: Graphing Polynomial Functions

90 ANS:

Pick random names from a list of all students and ask each one his method.

PTS: 2 REF: 062325aai NAT: S.IC.B.3 TOP: Analysis of Data

91 ANS: 2

$$\frac{x^2 + 12}{x^2 + 3} = \frac{x^2 + 3}{x^2 + 3} + \frac{9}{x^2 + 3} = 1 + \frac{9}{x^2 + 3}$$

PTS: 2 REF: 062218aai NAT: A.APR.D.7 TOP: Addition and Subtraction of Rationals

92 ANS: 4

$$x^3 - x^2yi - xy^2 + x^2yi - xy^2i^2 - y^3i = x^3 - xy^2 - xy^2(-1) - y^3i = x^3 - y^3i$$

PTS: 2 REF: 062223aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

93 ANS: 3 PTS: 2 REF: 012005aai NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

94 ANS: 2

$$1) \frac{29860 - 629}{1910 - 1850} \approx 487; 2) \frac{790390 - 494290}{2010 - 1990} \approx 14805; 3) \frac{251808 - 132459}{1970 - 1950} \approx 5967; 4) \frac{251808 - 14575}{1970 - 1890} \approx 2965$$

PTS: 2 REF: 062301aai NAT: F.IF.B.6 TOP: Rate of Change



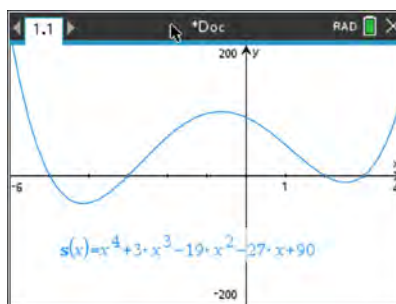
95 ANS: 2

$$\begin{array}{r}
 2x^2 - 3x + 5 \\
 x + 3 \overline{) 2x^3 + 3x^2 - 4x + 5} \\
 \underline{2x^3 + 6x^2} \phantom{- 4x + 5} \\
 -3x^2 - 4x \phantom{+ 5} \\
 \underline{-3x^2 - 9x} \phantom{+ 5} \\
 5x + 5 \\
 \underline{5x + 15} \\
 -10
 \end{array}$$

PTS: 2 REF: 082302aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

96 ANS: 4



$$\begin{aligned}
 s(x) &= x^4 - 9x^2 + 3x^3 - 27x - 10x^2 + 90 \\
 &= x^2(x^2 - 9) + 3x(x^2 - 9) - 10(x^2 - 9) \\
 &= (x^2 + 3x - 10)(x^2 - 9) \\
 &= (x + 5)(x - 2)(x + 3)(x - 3)
 \end{aligned}$$

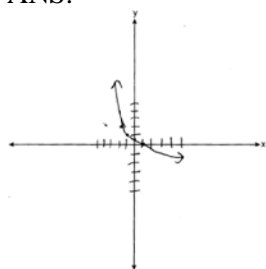
PTS: 2 REF: 062303aai NAT: A.APR.B.3 TOP: Solving Polynomial Equations

97 ANS: 4 PTS: 2 REF: 012314aai NAT: S.IC.B.3

TOP: Analysis of Data

KEY: type

98 ANS:

As  $x \rightarrow -3$ ,  $y \rightarrow \infty$ . As  $x \rightarrow \infty$ ,  $y \rightarrow -\infty$ .

PTS: 4 REF: 082333aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

99 ANS: 3

$$\sqrt{3x+18} = x \quad -3 \text{ is extraneous.}$$

$$3x+18 = x^2$$

$$x^2 - 3x - 18 = 0$$

$$(x-6)(x+3) = 0$$

$$x = 6, -3$$

PTS: 2

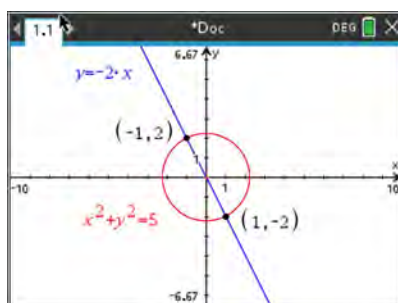
REF: 082315aai

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

100 ANS: 4



$$x^2 + (-2x)^2 = 5 \quad y = -2(-1) = 2$$

$$5x^2 = 5$$

$$x^2 = 1$$

$$x = \pm 1$$

PTS: 2

REF: 012407aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

101 ANS: 3

$$x = \frac{1}{2}y + 2$$

$$2x = y + 4$$

$$y = 2x - 4$$

PTS: 2

REF: 012315aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

102 ANS: 3

$$3i(ai - 6i^2) = 3ai^2 - 18i^3 = -3a + 18i$$

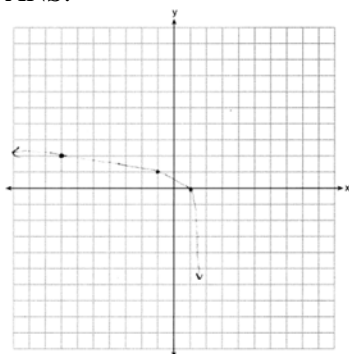
PTS: 2

REF: 062307aai

NAT: N.CN.A.2

TOP: Operations with Complex Numbers

103 ANS:



Domain:  $x < 2$ , Asymptote  $x = 2$

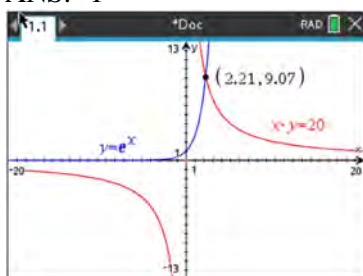
PTS: 4

REF: 012034aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

104 ANS: 1



PTS: 2

REF: 082210aai

NAT: A.REI.D.11

TOP: Other Systems

105 ANS:

$\frac{1}{10}, \frac{1}{5}$ , and no, since 0.10 clearly falls within 95% of 0.20.

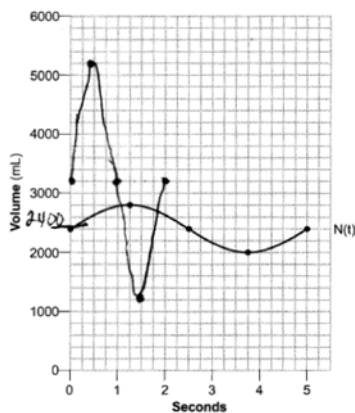
PTS: 4

REF: 012334aai

NAT: S.IC.A.2

TOP: Analysis of Data

106 ANS:



$$N(t) = 400 \sin\left(\frac{2\pi}{5} t\right) + 2400.$$

4 times.

PTS: 6

REF: 062337aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

- 107 ANS: 2  
1)  $x \rightarrow \infty, f(x) \rightarrow \infty$ ; 3) quartic polynomial; 4) three real roots

PTS: 2 REF: 012318aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

- 108 ANS:

$$a^{x+1} = a^{\frac{2}{3}}$$

$$x+1 = \frac{2}{3}$$

$$x = -\frac{1}{3}$$

PTS: 2 REF: 012326aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

- 109 ANS: 1

$$\frac{f(x)}{g(x)} = \frac{2x^2 + 7x - 15}{3 - 2x} = \frac{(2x-3)(x+5)}{-(2x-3)} = \frac{x+5}{-1} = -x-5$$

PTS: 2 REF: 012412aai NAT: F.BF.A.1 TOP: Operations with Functions

- 110 ANS: 2

$$2x + 4y - 2z = 2 \quad -x - 3y + 2z = 0 \quad x + y = 2 \quad 3 + 2y - z = 1 \quad 2y - z = -2$$

$$-x - 3y + 2z = 0 \quad 4x - 8y + 2z = 20 \quad x - y = 4 \quad 6 - 4y + z = 10 \quad 2(-1) - z = -2$$

$$x + y = 2 \quad 5x - 5y = 20 \quad 2x = 6 \quad 2y - z = -2 \quad z = 0$$

$$x - y = 4 \quad x = 3 \quad -4y + z = 4$$

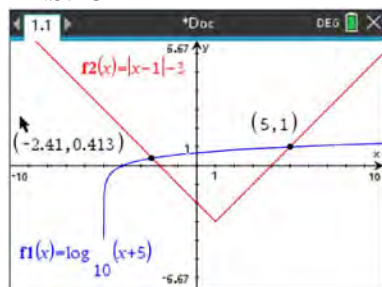
$$-2y = 2$$

$$y = -1$$

PTS: 2 REF: 062208aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

- 111 ANS: 3



PTS: 2 REF: 012317aai NAT: A.REI.D.11 TOP: Other Systems

112 ANS:

$$S_5 = \frac{6 - 6(.8)^5}{1 - .8} \approx 20.17$$

PTS: 2 REF: 062226aai NAT: A.SSE.B.4 TOP: Series  
KEY: geometric

113 ANS: 2 PTS: 2 REF: 082203aai NAT: F.IF.C.7  
TOP: Graphing Trigonometric Functions KEY: amplitude

114 ANS: 2

$$(x^2 + 3)^2 - 2(x^2 + 3) - 24 \text{ let } u = x^2 + 3$$

$$u^2 - 2u - 24$$

$$(u - 6)(u + 4)$$

$$(x^2 + 3 - 6)(x^2 + 3 + 4)$$

PTS: 2 REF: 062310aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

115 ANS:

$$\frac{P(10.5) - P(0)}{10.5 - 0} \approx 10.76 \text{ fruit flies per day}$$

PTS: 2 REF: 082332aai NAT: F.IF.B.6 TOP: Rate of Change

116 ANS: 2

$$x - 3 \overline{) \begin{array}{r} 2x^3 + 6x^2 + 13x + 42 \\ 2x^4 + 0x^3 - 5x^2 + 3x - 2 \end{array}}$$

$$\underline{2x^4 - 6x^3}$$

$$6x^3 - 5x^2$$

$$\underline{6x^3 - 18x^2}$$

$$13x^2 + 3x$$

$$\underline{13x^2 - 39x}$$

$$42x - 2$$

$$\underline{42x - 126}$$

$$124$$

PTS: 2 REF: 012408aai NAT: A.APR.D.6 TOP: Rational Expressions  
KEY: division

117 ANS:

$$\text{a) } p(t) = 11000(2)^{\frac{t}{20}}; \text{ b) } \frac{1000000}{11000} = \frac{11000(2)^{\frac{t}{20}}}{11000}$$

$$\log \frac{1000}{11} = \log 2^{\frac{t}{20}}$$

$$\log \frac{1000}{11} = \frac{t \cdot \log 2}{20}$$

$$\frac{20 \log \frac{1000}{11}}{\log 2} = t$$

$$t \approx 130.13$$

PTS: 4      REF: 082233aia      NAT: F.LE.A.4      TOP: Exponential Growth

118 ANS:

$$3x + 7 = x^2 - 2x + 1 \quad -1 \text{ is extraneous.}$$

$$0 = x^2 - 5x - 6$$

$$0 = (x - 6)(x + 1)$$

$$x = 6, -1$$

PTS: 2      REF: 062326aia      NAT: A.REI.A.2      TOP: Solving Radicals

KEY: extraneous solutions

119 ANS: 3

$$x = 12y - 4$$

$$x + 4 = 12y$$

$$\frac{x + 4}{12} = y$$

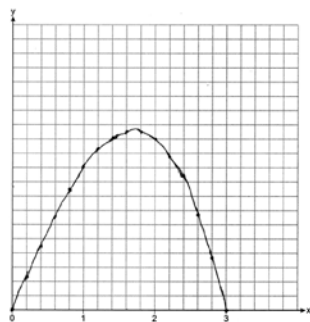
PTS: 2      REF: 082304aia      NAT: F.BF.B.4      TOP: Inverse of Functions

KEY: linear

120 ANS: 4      PTS: 2      REF: 082301aia      NAT: S.IC.B.3

TOP: Analysis of Data

121 ANS:



12.6

PTS: 4

REF: 082234aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

122 ANS:

$$\frac{3}{n} = \frac{2}{n^2} \quad 0 \text{ is an extraneous solution.}$$

$$3n^2 = 2n$$

$$3n^2 - 2n = 0$$

$$n(3n - 2) = 0$$

$$n = 0, \frac{2}{3}$$

PTS: 2

REF: 062227aai

NAT: A.REI.A.2

TOP: Solving Rationals

123 ANS: 4

1)  $-1$  is also a zero. 2)  $x^2(x - a) + 16(x - a) = (x^2 + 16)(x - a)$   $a$  is the only zero. 3)  $-a$  is the only zero. 4)  $x^2(x - a) - 9(x - a) = (x^2 - 9)(x - a)$ .

PTS: 2

REF: 012019aai

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

124 ANS:



43

PTS: 2

REF: 012328aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: percent

125 ANS: 2

$$\begin{array}{cccccc} 3 & 1 & -1 & -21 & 45 & 0 \\ & & 3 & 6 & -45 & 0 \\ & & 1 & 2 & -15 & 0 & 0 \end{array}$$

$$x^3 + 2x^2 - 15x = 0$$

$$x(x^2 + 2x - 15) = 0$$

$$x(x + 5)(x - 3) = 0$$

$$x = 0, -5, 3$$

PTS: 2 REF: 012403aai NAT: A.APR.B.3 TOP: Solving Polynomial Equations

126 ANS: 3

$$M = \frac{240000 \left( \frac{4.5\%}{12} \right) \left( 1 + \frac{4.5\%}{12} \right)^{15 \times 12}}{\left( 1 + \frac{4.5\%}{12} \right)^{15 \times 12} - 1} \approx 1835.98$$

PTS: 2 REF: 062209aai NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

127 ANS: 4 PTS: 2 REF: 062216aai NAT: S.IC.B.3

TOP: Analysis of Data KEY: type

128 ANS: 3 PTS: 2 REF: 082201aai NAT: S.IC.B.3

TOP: Analysis of Data KEY: type

129 ANS: 4

The distance between the focus and directrix is  $1 - (-3) = 4$ .  $p$  is half this distance, or 2. The vertex of the parabola is  $(4, -1)$ . Since the directrix is above the focus, the parabola faces downward.  $y = -\frac{1}{4p}(x - h)^2 + k$

$$y = -\frac{1}{4(2)}(x - 4)^2 - 1$$

$$y + 1 = -\frac{1}{8}(x - 4)^2$$

PTS: 2 REF: 012322aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

130 ANS: 3

$$95.4x - 6x^2 - (0.18x^3 + 0.02x^2 + 4x + 180)$$

PTS: 2 REF: 082322aai NAT: F.BF.A.1 TOP: Operations with Functions



131 ANS:

$$\sqrt{4x+1} = 11-x \quad 20 \text{ is extraneous.}$$

$$4x+1 = 121 - 22x + x^2$$

$$0 = x^2 - 26x + 120$$

$$0 = (x-6)(x-20)$$

$$x = 6, 20$$

PTS: 2 REF: 082227aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

132 ANS: 4 PTS: 2 REF: 012016aii NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

133 ANS: 2

$$p(x) = 4^x, q(x) = \left(\frac{5}{9}\right)^x, r(x) = 5.29^x, s(x) = 2^x$$

PTS: 2 REF: 012304aii NAT: F.IF.C.7 TOP: Graphing Exponential Functions

134 ANS: 3 PTS: 2 REF: 012404aii NAT: A.APR.B.3

TOP: Express Exponentials as Logarithms

135 ANS: 1

$$\begin{array}{r} x^2 - 2x + 5 \\ 2x + 4 \overline{) 2x^3 + 0x^2 + 2x - 7} \end{array}$$

$$\underline{2x^3 + 4x^2}$$

$$-4x^2 + 2x$$

$$\underline{-4x^2 - 8x}$$

$$10x - 7$$

$$\underline{10x + 20}$$

$$-27$$

PTS: 2 REF: 062313aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

136 ANS:

$$F(t) = 169.136(.971)^t$$

PTS: 2 REF: 062232aii NAT: S.ID.B.6 TOP: Regression

KEY: exponential

137 ANS: 4

$$g(x): \frac{10-6}{4-2} = 2 \quad t(x): \frac{3-5}{4-2} = 4$$

PTS: 2 REF: 062212ai NAT: F.IF.B.6 TOP: Rate of Change

138 ANS:

$$x^2 + 8x - 5 = 8x - 4$$

$$x^2 - 1 = 0$$

$$x = \pm 1$$

PTS: 2 REF: 082326aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

139 ANS:

$$(5xi^3 - 4i)^2 = (-5xi - 4i)^2 = 25x^2i^2 + 40xi^2 + 16i^2 = -25x^2 - 40x - 16$$

PTS: 2 REF: 082329aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

140 ANS:

$\pi < \theta < 2\pi \rightarrow$  Quadrant III or IV  $\theta$  must be in Quadrant IV, where  $\tan \theta$  is negative.

$$\cos \theta = \frac{\sqrt{3}}{4} \rightarrow \text{Quadrant I or IV}$$

PTS: 2 REF: 012332aai NAT: F.TF.A.2 TOP: Finding the Terminal Side of an Angle

141 ANS: 4

Translate the parent log function 2 to the right and reflect over the  $x$ -axis.

PTS: 2 REF: 082207aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

142 ANS:

$$g(3) = 0; \quad 0 = 3^3 + a(3)^2 - 5(3) + 6$$

$$0 = 27 + 9a - 15 + 6$$

$$-18 = 9a$$

$$a = -2$$

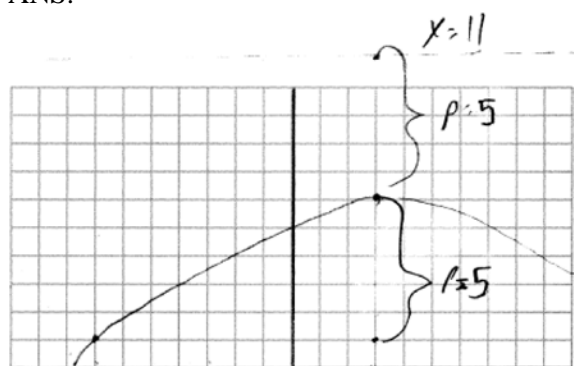
PTS: 2 REF: 062328aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

143 ANS: 3

$$a = 105, 0 < b < 1$$

PTS: 2 REF: 082314aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

144 ANS:

vertex (3, 6), focus (3, 1),  $p = 5$ , directrix  $y = 6 + 5 = 11$ 

PTS: 2 REF: 012028aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

145 ANS:

$$y = 101.523(.883)^x \quad 29 = 101.523(.883)^x$$

$$\frac{29}{101.523} = (.883)^x$$

$$\log \frac{29}{101.523} = x \log(.883)$$

$$\frac{\log \frac{29}{101.523}}{\log(.883)} = x$$

$$x \approx 10.07$$

PTS: 4 REF: 012036aai NAT: S.ID.B.6 TOP: Regression

KEY: exponential

146 ANS:

$0.01 \pm 2 \cdot 0.38 = -0.75 - 0.77$ . No, since 0.6 falls within the 95% interval.

PTS: 4 REF: 082336aai NAT: S.IC.B.5 TOP: Analysis of Data

147 ANS:

$$b^2 - 4ac = (-4)^2 - 4(1)(13) = 16 - 52 = -36 \text{ imaginary}$$

PTS: 2 REF: 062225aai NAT: A.REI.B.4 TOP: Using the Discriminant

KEY: determine nature of roots given equation, graph, table

148 ANS:

$$\sqrt{49 - 10x} = 2x - 5 \quad -\frac{3}{2} \text{ is extraneous.}$$

$$49 - 10x = 4x^2 - 20x + 25$$

$$0 = 4x^2 - 10x - 24$$

$$0 = 2x^2 - 5x - 12$$

$$0 = (2x + 3)(x - 4)$$

$$x = -\frac{3}{2}, 4$$

PTS: 4 REF: 012333aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

149 ANS: 2

$$\sqrt{(-2)^2 + (-3)^2} = \sqrt{13}; \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\frac{-3}{\sqrt{13}}}{\frac{-2}{\sqrt{13}}} = \frac{3}{2}$$

PTS: 2 REF: 062304aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions

KEY: extension to reals

150 ANS: 1

$$\frac{x(x^2 - 9)}{-(x^2 - 9)} = -x$$

PTS: 2 REF: 012023aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

151 ANS:

$$2x^3 - 3x^2 - 18x + 27$$

$$x^2(2x - 3) - 9(2x - 3)$$

$$(x^2 - 9)(2x - 3)$$

$$(x + 3)(x - 3)(2x - 3)$$

PTS: 2 REF: 082325aii NAT: A.SSE.A.2 TOP: Factoring Polynomials

152 ANS: 1

$$x + y + z = 9 \quad 4 - y - z = -1 \quad 4 - 6 + z = 9$$

$$\underline{x - y - z = -1} \quad 4 - y + z = 21 \quad z = 11$$

$$2x = 8 \quad -y - z = -5$$

$$x = 4 \quad \underline{-y + z = 17}$$

$$-2y = 12$$

$$y = -6$$

PTS: 2 REF: 012018aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

153 ANS: 4

1) is a correct formula, but not recursive

PTS: 2 REF: 082216aai NAT: F.BF.A.2 TOP: Sequences

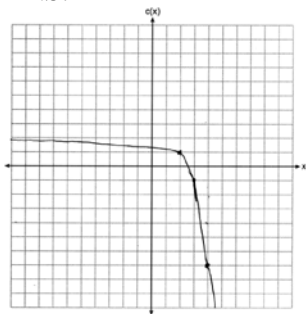
154 ANS: 2 PTS: 2 REF: 062324aai NAT: A.SSE.B.4

TOP: Series KEY: geometric

155 ANS: 3 PTS: 2 REF: 012002aai NAT: F.BF.A.1

TOP: Operations with Functions

156 ANS:

As  $x \rightarrow \infty, c(x) \rightarrow -\infty$ . As  $x \rightarrow -\infty, c(x) \rightarrow 2$ .

PTS: 4 REF: 012335aai NAT: F.IF.C.7 TOP: Graphing Exponential Functions

157 ANS: 3

$$S_{20} = \frac{-2 - (-2)(-3)^{20}}{1 - (-3)} = 1,743,392,200$$

PTS: 2 REF: 012306aai NAT: A.SSE.B.4 TOP: Series

KEY: geometric

158 ANS: 3 PTS: 2 REF: 062205aai NAT: F.BF.B.3

TOP: Transformations with Functions

159 ANS: 1

$$u = x + 2 \quad u^2 - 5u + 6$$

$$(u - 3)(u - 2)$$

$$(x + 2 - 3)(x + 2 - 2)$$

$$(x - 1)x$$

PTS: 2 REF: 012301aai NAT: A.SSE.A.2 TOP: Factoring Polynomials  
KEY: higher power

160 ANS: 1

$$\left(1.03^{\frac{1}{12}}\right)^{12t} \approx 1.00247^{12t}$$

PTS: 2 REF: 062224aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

161 ANS: 2

$$9.82 \pm 2(1.4)$$

PTS: 2 REF: 012411aai NAT: S.IC.B.4 TOP: Analysis of Data

162 ANS: 2

TOP: Sequences

PTS: 2

REF: 012321aai

NAT: F.BF.A.2

163 ANS: 3

$$x^2 - 6x + 9 - (x^2 + 6x + 9) = -12x$$

PTS: 2 REF: 062210aai NAT: F.BF.A.1 TOP: Operations with Functions

164 ANS: 1

$$\frac{(x+3)(x+2)}{(x-5)(x+2)} + \frac{6(x-5)}{(x+2)(x-5)} = \frac{6+10x}{(x-5)(x+2)} \quad 5 \text{ is extraneous.}$$

$$x^2 + 5x + 6 + 6x - 30 = 10x + 6$$

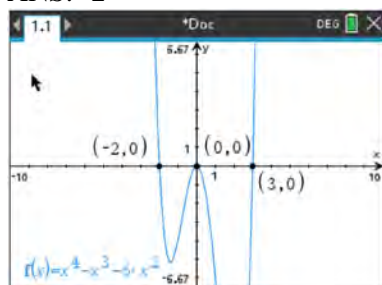
$$x^2 + x - 30 = 0$$

$$(x+6)(x-5) = 0$$

$$x = -6, 5$$

PTS: 2 REF: 062319aai NAT: A.REI.A.2 TOP: Solving Rationals

165 ANS: 2



PTS: 2

REF: 012316aai

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

166 ANS: 4

$$\frac{15000}{12000} = \frac{12000e^{.025t}}{12000}$$

$$1.25 = e^{.025t}$$

$$\ln 1.25 = \ln e^{.025t}$$

$$\ln 1.25 = .025t$$

$$\frac{\ln 1.25}{.025} = t$$

PTS: 2

REF: 082209aai

NAT: F.LE.A.4

TOP: Exponential Growth

167 ANS: 1

$$x^2 - 4x + 4 = -13 + 4$$

$$(x - 2)^2 = -9$$

$$x - 2 = \pm 3i$$

$$x = 2 \pm 3i$$

PTS: 2

REF: 062312aai

NAT: A.REI.B.4

TOP: Solving Quadratics

KEY: complex solutions | completing the square

168 ANS: 2

1) 1 real, mult. 2; 3) not a quadratic; 4) not a function.

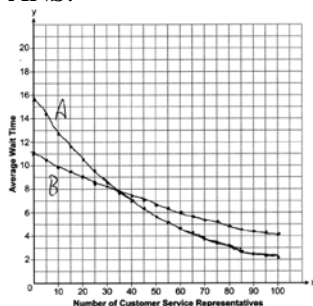
PTS: 2

REF: 012324aai

NAT: A.REI.B.4

TOP: Using the Discriminant

169 ANS:



35;  $B(100) - A(100) \approx 2$ , which represents the difference of the average wait time when there are 100 CSRs between the plans.

PTS: 6 REF: 082237aai NAT: A.REI.D.11 TOP: Other Systems

170 ANS: 2 PTS: 2 REF: 082313aai NAT: S.ID.A.4

TOP: Normal Distributions KEY: percent

171 ANS:

$$\begin{aligned} 2x + 4y - 3z &= 12 & 2x + 4y - 3z &= 12 & 8x + z &= -6 & 32x + 4z &= -24 & 8(-1) + z &= -6 & -(-1) + y - 3(2) &= 0 \\ 2(3x - 2y + 2z &= -9) & 6x - 4y + 4z &= -18 & 2x - 8z &= -18 & \underline{x - 4z} &= \underline{-9} & z &= 2 & y &= 5 \\ 4(-x + y - 3z &= 0) & -4x + 4y - 12z &= 0 & & & 33x &= -33 & & & & & \\ & & & & & & x &= -1 & & & & \end{aligned}$$

PTS: 4 REF: 082335aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

172 ANS: 1

$$\frac{20}{14 + 20 + 6} = \frac{1}{2}$$

PTS: 2 REF: 082303aai NAT: S.CP.A.4 TOP: Conditional Probability

173 ANS:

$$T = (400 - 75)e^{-0.0735t} + 75, \quad 325e^{-0.0735(5)} + 75 \approx 300, \quad 270 = (450 - 75)e^{-8r} + 75, \quad 325e^{-0.0735t} + 75 = 375e^{-0.0817t} + 75$$

$$r \approx 0.0817 \qquad t \approx 17$$

PTS: 6 REF: 012337aai NAT: A.CED.A.1 TOP: Exponential Decay

174 ANS: 4

$$\frac{x^2 + 6}{x^2 + 4} = \frac{x^2 + 4}{x^2 + 4} + \frac{2}{x^2 + 4} = 1 + \frac{2}{x^2 + 4}$$

PTS: 2 REF: 082321aai NAT: A.APR.D.7 TOP: Addition and Subtraction of Rationals

175 ANS: 1

$$\frac{-12}{16} = \frac{9}{-12} = \frac{-6.75}{9}$$

PTS: 2 REF: 012017aai NAT: F.IF.A.3 TOP: Sequences

KEY: difference or ratio



176 ANS:

$$\ln e^{0.49x} = \ln 7.5$$

$$0.49x = \ln 7.5$$

$$x = \frac{\ln 7.5}{0.49} \approx 4.112$$

PTS: 2 REF: 062330aai NAT: F.LE.A.4 TOP: Exponential Equations  
KEY: without common base

177 ANS:

$$y = 2.459(1.616)^x$$

PTS: 2 REF: 012329aai NAT: S.ID.B.6 TOP: Regression  
KEY: exponential

178 ANS: 4

PTS: 2 REF: 062316aai NAT: S.ID.A.4 TOP: Normal Distributions  
KEY: percent

179 ANS: 4

$$M = \frac{45000 \left( \frac{6.75\%}{12} \right) \left( 1 + \frac{6.75\%}{12} \right)^{5 \times 12}}{\left( 1 + \frac{6.75\%}{12} \right)^{5 \times 12} - 1} \approx 885.76$$

PTS: 2 REF: 082316aai NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

180 ANS:

$$A(t) = 8000 \left( 1 + \frac{.042}{4} \right)^{4t} \quad A(18) = 16970.900 \quad 24000 = 8000e^{.039t}$$

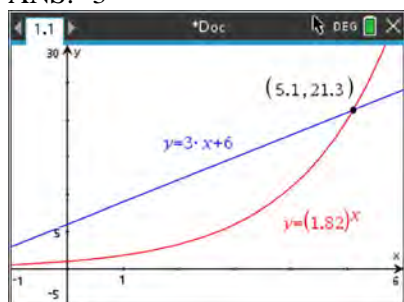
$$B(t) = 8000e^{.039t} \quad B(18) = \underline{16142.274} \quad \ln 3 = \ln e^{.039t}$$

$$828.63 \quad \ln 3 = .039t$$

$$t \approx 28.2$$

PTS: 6 REF: 082337aai NAT: A.CED.A.1 TOP: Exponential Growth

181 ANS: 3



PTS: 2 REF: 012406aia NAT: A.REI.D.11 TOP: Other Systems

182 ANS: 1

The vertical distance from the directrix to the vertex,  $p$ , is 2. The vertical distance from the vertex to the focus must also be 2.

PTS: 2 REF: 062213aia NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

183 ANS:

No.  $0.852 \pm 2(0.029) \rightarrow 0.794 - 0.91$ . 0.88 falls within this interval.

PTS: 2 REF: 062332aia NAT: S.IC.A.2 TOP: Analysis of Data

184 ANS: 3

PTS: 2

REF: 012401aia

NAT: S.IC.B.3

TOP: Analysis of Data

185 ANS:

$$\frac{x \cdot x^{\frac{3}{2}}}{x^{\frac{5}{3}}} = \frac{x^{\frac{6}{6}} \cdot x^{\frac{9}{6}}}{x^{\frac{10}{6}}} = x^{\frac{5}{6}}$$

PTS: 2 REF: 082331aia NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

186 ANS: 1

Distance from the focus to the directrix is 2, so  $p = 1$ . Vertex is  $(-3, 1)$ .  $y = \frac{1}{4(1)}(x + 3)^2 + 1$

PTS: 2 REF: 012409aia NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

187 ANS:

$$x^3 - 2x^2 - 9x + 18 = x^2(x - 2) - 9(x - 2) = (x^2 - 9)(x - 2) = (x + 3)(x - 3)(x - 2)$$

PTS: 2 REF: 082226aia NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

188 ANS: 4

$$\frac{13}{13 + 11} = \frac{13}{24}$$

PTS: 2 REF: 012011aia NAT: S.CP.A.4 TOP: Conditional Probability

189 ANS: 4

$$y = -(x-1)^2 + 5 \quad 3+y = 4$$

$$4-x = -x^2 + 2x - 1 + 5 \quad y = 1$$

$$x^2 - 3x = 0$$

$$x(x-3) = 0$$

$$x = 0, 3$$

PTS: 2

REF: 082305aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

190 ANS:

$$x^4 - 5x^2 + 4$$

$$(x^2 - 4)(x^2 - 1)$$

$$(x+2)(x-2)(x+1)(x-1)$$

PTS: 2

REF: 012331aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

191 ANS: 2

Since the distance from the focus to the directrix is 2,  $p = 1$  and the vertex of the parabola is (0,5).

$$y = \frac{1}{4p}(x-h)^2 + k$$

$$y = \frac{1}{4(1)}(x-0)^2 + 5$$

$$y = \frac{1}{4}x^2 + 5$$

$$y - 5 = \frac{1}{4}x^2$$

$$4(y-5) = x^2$$

PTS: 2

REF: 062323aai

NAT: G.GPE.A.2

TOP: Graphing Quadratic Functions

192 ANS:

$$-x(2x^3 - x^2 - 18x + 9)$$

$$-x(x^2(2x-1) - 9(2x-1))$$

$$-x(x^2 - 9)(2x - 1)$$

$$-x(x+3)(x-3)(2x-1)$$

PTS: 2

REF: 062228aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

KEY: factoring by grouping

193 ANS: 1

$$\begin{array}{r}
 \phantom{x+3} \overline{2x^2 + x - 6} \\
 x+3 \overline{) 2x^3 + 7x^2 - 3x - 25} \\
 \underline{2x^3 + 6x^2} \phantom{- 3x - 25} \\
 \phantom{2x^3 +} x^2 - 3x \phantom{- 25} \\
 \underline{\phantom{2x^3 +} x^2 + 3x} \phantom{- 25} \\
 \phantom{2x^3 +} \phantom{x^2 -} -6x - 25 \\
 \underline{\phantom{2x^3 +} \phantom{x^2 -} -6x - 18} \\
 \phantom{2x^3 +} \phantom{x^2 -} \phantom{-6x -} -7
 \end{array}$$

PTS: 2 REF: 062203aai NAT: A.APR.D.6 TOP: Rational Expressions  
 KEY: division

194 ANS:

Yes.  $P(B|I) = P(B|G)$ 

$$0.14 + 0.26 = \frac{.14}{.35}$$

$$.4 = .4$$

PTS: 2 REF: 062229aai NAT: S.CP.A.4 TOP: Conditional Probability

195 ANS: 1

$$\begin{array}{r}
 \phantom{x+2} \overline{x^3 - 2x^2 - x + 6} \\
 x+2 \overline{) x^4 + 0x^3 - 5x^2 + 4x + 14} \\
 \underline{x^4 + 2x^3} \phantom{+ 4x + 14} \\
 \phantom{x^4 +} -2x^3 - 5x^2 \phantom{+ 4x + 14} \\
 \underline{\phantom{x^4 +} -2x^3 - 4x^2} \phantom{+ 4x + 14} \\
 \phantom{x^4 +} \phantom{-2x^3 -} -x^2 + 4x \phantom{+ 14} \\
 \underline{\phantom{x^4 +} \phantom{-2x^3 -} -x^2 - 2x} \phantom{+ 14} \\
 \phantom{x^4 +} \phantom{-2x^3 -} \phantom{-x^2 +} 6x + 14 \\
 \underline{\phantom{x^4 +} \phantom{-2x^3 -} \phantom{-x^2 +} 6x + 12} \\
 \phantom{x^4 +} \phantom{-2x^3 -} \phantom{-x^2 +} \phantom{6x +} 2
 \end{array}$$

PTS: 2 REF: 012305aai NAT: A.APR.D.6 TOP: Rational Expressions  
 KEY: division

196 ANS: 4

$$\text{I. } \left(\frac{y}{x^3}\right)^{-1} = \frac{x^3}{y}; \quad \text{II. } \sqrt[3]{x^9}(y^{-1}) = \frac{x^{\frac{9}{3}}}{y} = \frac{x^3}{y}; \quad \text{III. } \frac{x^{\frac{64}{4}}\sqrt{y^8}}{x^3y^3} = \frac{x^3y^{\frac{8}{4}}}{y^3} = \frac{x^3}{y}$$

PTS: 2 REF: 062320aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

197 ANS: 3

$$\begin{array}{r} x+y+z=2 \quad x-2y-z=-4 \quad 2x-y=-2 \quad x+2+z=2 \quad x+z=0 \quad 0+2+z=2 \\ \hline x-2y-z=-4 \quad x-9y+z=-18 \quad 2x-11y=-22 \quad x-2(2)-z=-4 \quad x-z=0 \quad z=0 \\ \hline 2x-y=-2 \quad 2x-11y=-22 \quad 10y=20 \quad 2x=0 \\ \hline y=2 \quad x=0 \end{array}$$

PTS: 2 REF: 062311aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

198 ANS: 2

The mass of the carbon-14 is decreasing by half every 5715 years.

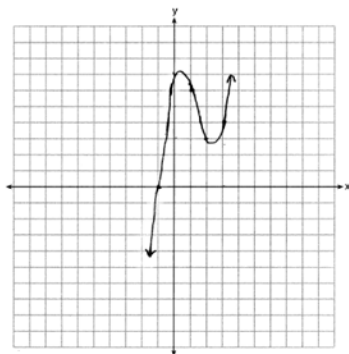
PTS: 2 REF: 062211aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions

199 ANS: 3

$$e^{\left(\frac{-3}{0.6}\right)} \approx 0.006738$$

PTS: 2 REF: 062315aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

200 ANS:



PTS: 2 REF: 012032aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

201 ANS: 1

$$1.0325^{\frac{1}{12}} \approx 1.0027$$

PTS: 2 REF: 012323aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

202 ANS: 3

$$\frac{-2}{\sqrt{5^2 - 2^2}} = \frac{-2}{\sqrt{21}}$$

PTS: 2 REF: 082312aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

203 ANS: 4

$$\frac{1}{2}x^2 + 2x = \frac{1}{4}x - 8 \quad b^2 - 4ac$$

$$2x^2 + 8x = x - 32 \quad 7^2 - 4(2)(32) < 0$$

$$2x^2 + 7x + 32 = 0$$

PTS: 2 REF: 012310aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

204 ANS:

Light wave C. The periods for A, B, and C are 280, 220 and 320.

PTS: 2 REF: 012030aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: period

205 ANS: 1

$$\sqrt[4]{81x^8y^6} = 81^{\frac{1}{4}}x^{\frac{8}{4}}y^{\frac{6}{4}} = 3x^2y^{\frac{3}{2}}$$

PTS: 2 REF: 012001aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

206 ANS: 1

$$\left(a^3\sqrt{2b^2}\right)\left(\sqrt[3]{4a^2b}\right) = a^3\sqrt{8a^2b^3} = 2ab^3\sqrt{a^2}$$

PTS: 2 REF: 082213aai NAT: N.RN.A.2 TOP: Operations with Radicals

KEY: with variables, index &gt; 2

207 ANS:

$$\frac{x-2}{(x-6)(x-2)} + \frac{x(x-6)}{(x-6)(x-2)} = \frac{4}{(x-6)(x-2)}. \quad 6 \text{ is extraneous.}$$

$$x - 2 + x^2 - 6x = 4$$

$$x^2 - 5x - 6 = 0$$

$$(x-6)(x+1) = 0$$

$$x = 6, -1$$

PTS: 4 REF: 082334aai NAT: A.REI.A.2 TOP: Solving Rationals

208 ANS: 1

PTS: 2

REF: 062318aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

209 ANS: 1

$$\log 3^{x+4} = \log 28$$

$$\frac{(x+4)\log 3}{\log 3} = \frac{\log 28}{\log 3}$$

$$x+4 = \frac{\log 28}{\log 3}$$

$$x = \log_3 28 - 4$$

PTS: 2 REF: 082306aai NAT: A.CED.A.1 TOP: Exponential Equations

KEY: without common base

210 ANS:

$$(x-2)^2 + (-2x+7-3)^2 = 20 \quad y = -2(0)+7 = 7 \quad (0,7), (4,-1)$$

$$(x-2)^2 + (-2x+4)^2 = 20 \quad y = -2(4)+7 = -1$$

$$x^2 - 4x + 4 + 4x^2 - 16x + 16 = 20$$

$$5x^2 - 20x = 0$$

$$5x(x-4) = 0$$

$$x = 0, 4$$

PTS: 4 REF: 062335aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

211 ANS: 2

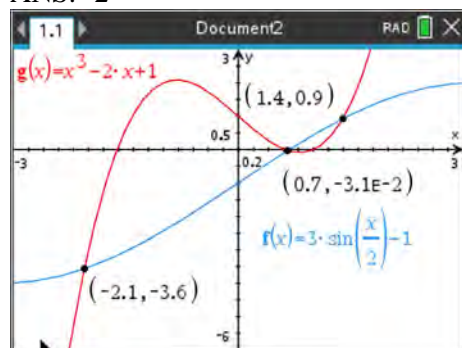
PTS: 2

REF: 062219aai

NAT: F.TF.A.1

TOP: Unit Circle

212 ANS: 2



PTS: 2 REF: 012021aai NAT: A.REI.D.11 TOP: Other Systems

213 ANS: 1

1)  $A(20) > 0$ ; 2)  $.5 \times .5 = .25$ ; 3) true; 4)  $A(7) \approx 9.9$ 

PTS: 2 REF: 082211aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions

214 ANS: 2

$$2x^3 + x^2 - 18x - 9$$

$$x^2(2x + 1) - 9(2x + 1)$$

$$(x^2 - 9)(2x + 1)$$

$$(x + 3)(x - 3)(2x + 1)$$

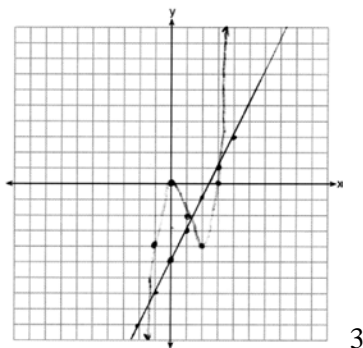
PTS: 2

REF: 082206aaii

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

215 ANS:



3

PTS: 4

REF: 062233aaii

NAT: A.REI.D.11

TOP: Other Systems

216 ANS:

$$x^2 + (2x - 5)^2 = 25 \quad y + 5 = 2(0) \quad y + 5 = 2(4) \quad (0, -5), (4, 3)$$

$$x^2 + 4x^2 - 20x + 25 = 25 \quad y = -5 \quad y = 3$$

$$5x^2 - 20x = 0$$

$$5x(x - 4) = 0$$

$$x = 0, 4$$

PTS: 4

REF: 062236aaii

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

217 ANS: 2

.43  $\pm$  2(0.05) contains about 95% of the data.

PTS: 2

REF: 062317aaii

NAT: S.IC.B.4

TOP: Analysis of Data

218 ANS:

 $P(x) = 500(0.97)^x$ ; 18; The number of palm trees and flamingos will be equal in 18 years.

$$F(x) = 200e^{0.02x}$$

PTS: 4

REF: 062336aaii

NAT: A.REI.D.11

TOP: Other Systems

219 ANS: 4

PTS: 2

REF: 012303aaii

NAT: F.LE.B.5

TOP: Modeling Exponential Functions

220 ANS: 3

PTS: 2

REF: 062302aaii

NAT: A.SSE.A.2

TOP: Factoring Polynomials



221 ANS: 1

$$50(.9)^t = 25$$

$$t \approx 6.57$$

PTS: 2

REF: 082317aai

NAT: A.CED.A.1

TOP: Exponential Decay

222 ANS: 3

$$\frac{x+2}{x} + \frac{x}{3} = \frac{2x^2+6}{3x} \quad 0 \text{ is extraneous.}$$

$$\frac{x^2+3x+6}{3x} = \frac{2x^2+6}{3x}$$

$$x^2+3x+6 = 2x^2+6$$

$$x^2-3x = 0$$

$$x(x-3) = 0$$

$$x = 0, 3$$

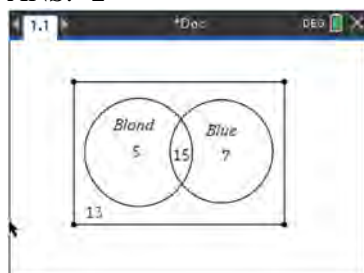
PTS: 2

REF: 012309aai

NAT: A.REI.A.2

TOP: Solving Rationals

223 ANS: 2



$$40 - (20 + 22 - 15) = 13$$

PTS: 2

REF: 062204aai

NAT: S.CP.A.1

TOP: Venn Diagrams

224 ANS:

No, because  $P(F / CR) \neq P(F)$ 

$$\frac{36}{42+36} \neq \frac{17+37+36+15}{39+17+42+12+17+37+36+15}$$

$$\frac{36}{78} \neq \frac{105}{215}$$

$$\frac{6}{13} \neq \frac{21}{43}$$

PTS: 2

REF: 082231aai

NAT: S.CP.A.4

TOP: Conditional Probability

225 ANS: 3

$$\sin^2 A + \left(\frac{\sqrt{5}}{3}\right)^2 = 1 \quad \text{Since } \tan A < 0, \sin A = -\frac{2}{3}$$

$$\sin^2 A + \frac{5}{9} = \frac{9}{9}$$

$$\sin^2 A = \frac{4}{9}$$

$$\sin A = \pm \frac{2}{3}$$

PTS: 2 REF: 012320aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

226 ANS: 2 PTS: 2 REF: 082204aai NAT: S.IC.B.3

TOP: Analysis of Data KEY: type

227 ANS: 4

$$f(0) = 4 \sin(2(0)) = 0; \quad g(0) = 3(0)^4 + 2(0)^3 + 7 = 7; \quad h(0) = 5e^{2(0)} + 3 = 8; \quad j(0) = 6 \log_2(3(0) + 4) = 12$$

PTS: 2 REF: 082310aai NAT: F.IF.C.9 TOP: Comparing Functions

228 ANS: 1

$$0.5^{\frac{1}{0.0803}} \approx 0.000178$$

PTS: 2 REF: 082224aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

229 ANS: 3

The distance from the vertex to the focus,  $p$ , is 4. Since the focus is below the vertex,  $p$  is negative.

$$y = -\frac{1}{4(4)}(x-2)^2 + 1$$

PTS: 2 REF: 082212aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

230 ANS: 2

$$2x^4 - x^3 - 16x + 8 = 0$$

$$x^3(2x-1) - 8(2x-1) = 0$$

$$(x^3 - 8)(2x-1) = 0$$

$$x = 2, \frac{1}{2}$$

PTS: 2 REF: 012307aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

231 ANS: 3 PTS: 2 REF: 012003aai NAT: A.APR.C.4

TOP: Polynomial Identities

232 ANS:

$$\frac{1200}{1200+2016} \approx .373. \quad \text{Yes, because } \frac{1600}{4288} \approx .373 \text{ also.}$$

PTS: 4 REF: 062334aai NAT: S.CP.A.4 TOP: Conditional Probability

233 ANS: 2                      PTS: 2                      REF: 062206aai                      NAT: A.APR.B.2  
TOP: Remainder and Factor Theorems

234 ANS: 2

$$5x^2 - 4x + 2 = 0 \quad \frac{4 \pm \sqrt{(-4)^2 - 4(5)(2)}}{2(5)} = \frac{4 \pm \sqrt{-24}}{10} = \frac{4 \pm 2i\sqrt{6}}{10} = \frac{2 \pm i\sqrt{6}}{5}$$

PTS: 2                      REF: 012020aai                      NAT: A.REI.B.4                      TOP: Solving Quadratics  
KEY: complex solutions | quadratic formula

235 ANS:

$$\frac{60 - 20}{4 - 2} = \frac{40}{2} = 20$$

PTS: 2                      REF: 082225aai                      NAT: F.IF.B.6                      TOP: Rate of Change

236 ANS: 2

$$S_{20} = \frac{.01 - .01(3)^{20}}{1 - 3} = 17,433,922$$

PTS: 2                      REF: 011822aai                      NAT: A.SSE.B.4                      TOP: Series  
KEY: geometric

## Algebra II Regents at Random Worksheets

## Answer Section

237 ANS:

$138.905 \pm 2 \cdot 7.95 = 123 - 155$ . No, since 125 (50% of 250) falls within the 95% interval.

PTS: 4 REF: 011835aii NAT: S.IC.A.2 TOP: Analysis of Data

238 ANS: 2 PTS: 2 REF: 011804aii NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

239 ANS:

$$-\frac{1}{2}i^3(3i-4) - 3i^2 = -\frac{3}{2}i^4 + 2i^3 - 3i^2 = -\frac{3}{2} - 2i + 3 = \frac{3}{2} - 2i$$

PTS: 2 REF: 081927aii NAT: N.CN.A.2 TOP: Operations with Complex Numbers

240 ANS: 4

$$S_7 = \frac{85000 - 85000(1.06)^7}{1 - 1.06} \approx 713476.20$$

PTS: 2 REF: 061905aii NAT: A.SSE.B.4 TOP: Series

KEY: geometric

241 ANS:

$$20e^{.05t} = 30e^{.03t}$$

$$\frac{\frac{2}{3}e^{.05t}}{e^{.05t}} = \frac{e^{.03t}}{e^{.05t}}$$

$$\ln \frac{2}{3} = \ln e^{-.02t}$$

$$\ln \frac{2}{3} = -.02t \ln e$$

$$\frac{\ln \frac{2}{3}}{-.02} = t$$

$$20.3 \approx t$$

PTS: 2 REF: 011829aii NAT: A.REI.D.11 TOP: Other Systems

242 ANS: 1

$$-4(-1) - 3 = 1 \quad 8 = \frac{2\pi}{b}$$

$$b = \frac{\pi}{4}$$

PTS: 2 REF: 081820aii NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

KEY: maximum/minimum

243 ANS: 2                    PTS: 2                    REF: 081802aai           NAT: S.IC.B.3  
TOP: Analysis of Data                    KEY: type

244 ANS: 1  
 $1240(1.06)^x = 890(1.11)^x$   
 $x \approx 7$

PTS: 2                    REF: 061814aai           NAT: A.REI.D.11           TOP: Other Systems  
245 ANS: 4                    PTS: 2                    REF: 081817aai           NAT: F.BF.B.3  
TOP: Transformations with Functions

246 ANS: 3  
 $440 \times 2.3\% \approx 10$

PTS: 2                    REF: 011807aai           NAT: S.ID.A.4           TOP: Normal Distributions  
KEY: predict

247 ANS: 1  
 $x - \frac{4}{x-1} = 2$                      $x = \frac{3 \pm \sqrt{(-3)^2 - 4(1)(-2)}}{2(1)} = \frac{3 \pm \sqrt{17}}{2}$

$$x(x-1) - 4 = 2(x-1)$$

$$x^2 - x - 4 = 2x - 2$$

$$x^2 - 3x - 2 = 0$$

PTS: 2                    REF: 011812aai           NAT: A.REI.A.2           TOP: Solving Rationals  
KEY: rational solutions

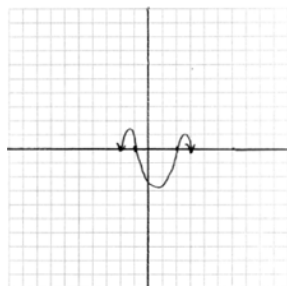
248 ANS: 2  
 $P = \frac{2\pi}{\frac{\pi}{45}} = 90$

PTS: 2                    REF: 081822aai           NAT: F.IF.C.7           TOP: Graphing Trigonometric Functions  
KEY: period

249 ANS: 2  
 $x^2 + 4x - 1 = x - 3$             $y + 3 = -1$   
 $x^2 + 3x + 2 = 0$                      $y = -4$   
 $(x+2)(x+1) = 0$   
 $x = -2, -1$

PTS: 2                    REF: 061801aai           NAT: A.REI.C.7           TOP: Quadratic-Linear Systems

250 ANS:



PTS: 2 REF: 011831aii NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

251 ANS: 4

The vertex is (2,2) and  $p = 3$ .  $3 + 2 = 5$ 

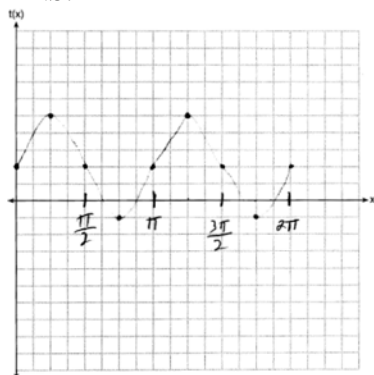
PTS: 2 REF: 081823aii NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

252 ANS:

$$16x^4 - 81 = (4x^2 + 9)(4x^2 - 9) = (4x^2 + 9)(2x + 3)(2x - 3)$$
 No, because  $\pm \frac{3i}{2}$  are roots.

PTS: 4 REF: 061933aii NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

253 ANS:



PTS: 2 REF: 081830aii NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

254 ANS:

$$D = 1.223(2.652)^A$$

PTS: 2 REF: 011826aii NAT: S.ID.B.6 TOP: Regression

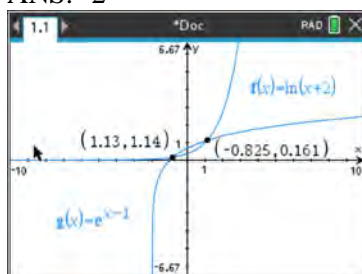
KEY: exponential

255 ANS: 2



PTS: 2 REF: 061817aai NAT: S.ID.A.4 TOP: Normal Distributions  
 KEY: probability

256 ANS: 2



PTS: 2 REF: 081920aai NAT: A.REI.D.11 TOP: Other Systems

257 ANS:

$$C(t) = 63000 \left(1 + \frac{0.0255}{12}\right)^{12t} = 100000$$

$$12t \log(1.002125) = \log \frac{100}{63}$$

$$t \approx 18.14$$

PTS: 4 REF: 061835aai NAT: A.CED.A.1 TOP: Exponential Growth

258 ANS: 3

$$e^{bt} = \frac{c}{a}$$

$$\ln e^{bt} = \ln \frac{c}{a}$$

$$bt \ln e = \ln \frac{c}{a}$$

$$t = \frac{\ln \frac{c}{a}}{b}$$

PTS: 2 REF: 011813aai NAT: F.LE.A.4 TOP: Exponential Equations  
 KEY: without common base

259 ANS: 2  
 $1.00643^{12} \approx 1.08$

PTS: 2 REF: 081808aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

260 ANS:

$$\frac{1}{8} + \frac{1}{6} = \frac{1}{t_b}; \quad \frac{24t_b}{8} + \frac{24t_b}{6} = \frac{24t_b}{t_b}$$

$$3t_b + 4t_b = 24$$

$$t_b = \frac{24}{7} \approx 3.4$$

PTS: 2 REF: 011827aai NAT: A.REI.A.2 TOP: Solving Rationals

261 ANS: 4

$$(a + b + c)^2 = a^2 + ab + ac + ab + b^2 + bc + ac + ab + c^2$$

$$x = a^2 + b^2 + c^2 + 2(ab + bc + ac)$$

$$x = y + 2z$$

PTS: 2 REF: 061822aai NAT: A.APR.C.4 TOP: Polynomial Identities

262 ANS: 1 PTS: 2 REF: 011902aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

263 ANS: 1

$$(x^{\frac{3}{2}})^2 = x^3$$

PTS: 2 REF: 061908aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

264 ANS:

$$i^2 = -1, \text{ and not } 1; 10 + 10i$$

PTS: 2 REF: 011825aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

265 ANS:

$$\frac{\sqrt[3]{x^2y^5}}{\sqrt[4]{x^3y^4}} = \frac{x^{\frac{2}{3}}y^{\frac{5}{3}}}{x^{\frac{3}{4}}y} = \frac{x^{\frac{8}{12}}y^{\frac{20}{12}}}{x^{\frac{9}{12}}y^{\frac{12}{12}}} = x^{-\frac{1}{12}}y^{\frac{2}{3}}$$

PTS: 2 REF: 011925aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

266 ANS: 1

$$\frac{N(10) - N(1)}{10 - 1} \approx -2.03, \quad \frac{N(20) - N(10)}{20 - 10} \approx -1.63, \quad \frac{N(25) - N(15)}{25 - 15} \approx -1.46, \quad \frac{N(30) - N(1)}{30 - 1} \approx -1.64$$

PTS: 2 REF: 061807aai NAT: F.IF.B.6 TOP: Rate of Change



267 ANS:

$\frac{B(11) - B(8)}{11 - 8} \approx -10.1$  The average monthly high temperature decreases  $10.1^\circ$  each month from August to November.

PTS: 2 REF: 011930aai NAT: F.IF.B.6 TOP: Rate of Change

268 ANS: 1

The cosine function has been translated +3. Since the maximum is 5 and the minimum is 1, the amplitude is 2.

$$\frac{\pi}{3} = \frac{2\pi}{b}$$

$$b = 6$$

PTS: 2 REF: 011913aai NAT: F.TF.B.5 TOP: Modeling Trigonometric Functions

269 ANS: 4

$$\begin{array}{r} 5x^2 + x - 3 \\ 2x - 1 \overline{) 10x^3 - 3x^2 - 7x + 3} \\ \underline{10x^3 - 5x^2} \phantom{+ 3} \\ 2x^2 - 7x \phantom{+ 3} \\ \underline{2x^2 - x} \phantom{+ 3} \\ -6x + 3 \\ \underline{-6x + 3} \\ 0 \end{array}$$

PTS: 2 REF: 011809aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

270 ANS: 2

$$x = \frac{y}{y+2}$$

$$xy + 2x = y$$

$$xy - y = -2x$$

$$y(x - 1) = -2x$$

$$y = \frac{-2x}{x - 1}$$

PTS: 2 REF: 081924aai NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: rational

271 ANS: 3 PTS: 2 REF: 061906aai NAT: F.LE.A.2

TOP: Families of Functions

272 ANS: 1 PTS: 2 REF: 011814aai NAT: A.REI.D.11

TOP: Other Systems

273 ANS:

John found the means of the scores of the two rooms and subtracted the means. The mean score for the classical room was 7 higher than the rap room (82-75). Yes, there is less than a 5% chance this difference occurring due to random chance. It is likely the difference was due to the music.

PTS: 4 REF: 081836aai NAT: S.IC.B.5 TOP: Analysis of Data

274 ANS: 4

$$\frac{5+9}{2} = 7, \text{ vertex: } (-2, 7); p = 7 - 9 = -2, y = \frac{1}{4(-2)}(x+2)^2 + 7$$

$$y - 7 = \frac{1}{-8}(x+2)^2$$

$$-8(y - 7) = (x + 2)^2$$

PTS: 2 REF: 061821aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

275 ANS: 3 PTS: 2 REF: 011824aai NAT: F.BF.A.2

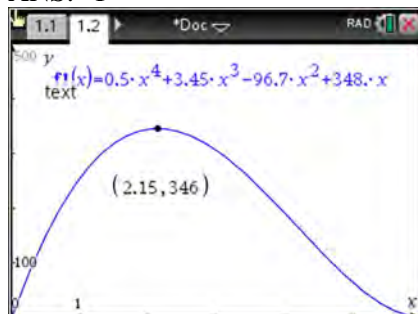
TOP: Sequences

276 ANS: 1

$$x^2 + 2x + 1 = (x + 1)^2$$

PTS: 2 REF: 011919aai NAT: A.APR.B.3 TOP: Graphing Polynomial Functions

277 ANS: 1



PTS: 2 REF: 011908aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

278 ANS: 2

$$2 - \frac{x-1}{x+2}$$

$$1 + \frac{x+2}{x+2} - \frac{x-1}{x+2}$$

$$1 + \frac{x+2-(x-1)}{x+2}$$

$$1 + \frac{3}{x+2}$$

PTS: 2 REF: 081907aai NAT: A.APR.D.7 TOP: Addition and Subtraction of Rationals

279 ANS:

$$\text{No. } \left(\sqrt[7]{x^2}\right)\left(\sqrt[5]{x^3}\right) = x^{\frac{2}{7}} \cdot x^{\frac{3}{5}} = x^{\frac{31}{35}} = \sqrt[35]{x^{31}}$$

PTS: 2 REF: 061929aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents  
KEY: variables

280 ANS:

$$2 = e^{0.0375t}$$

$$t \approx 18.5$$

PTS: 4 REF: 081835aai NAT: F.LE.A.4 TOP: Exponential Growth  
281 ANS: 3 PTS: 2 REF: 081909aai NAT: F.BF.A.2  
TOP: Sequences

282 ANS: 3

$$y = x^3 - 2$$

$$x = y^3 - 2$$

$$x + 2 = y^3$$

$$\sqrt[3]{x + 2} = y$$

PTS: 2 REF: 061815aai NAT: F.BF.B.4 TOP: Inverse of Functions  
KEY: polynomial

283 ANS: 4

$$120 = 68 + (195 - 68)e^{-0.05t}$$

$$52 = 127e^{-0.05t}$$

$$\ln \frac{52}{127} = \ln e^{-0.05t}$$

$$\ln \frac{52}{127} = -0.05t$$

$$\frac{\ln \frac{52}{127}}{-0.05} = t$$

$$18 \approx t$$

PTS: 2 REF: 081918aai NAT: F.LE.A.4 TOP: Exponential Decay

284 ANS:

$$-6(x+3)\left(\frac{-3}{x+3} - \frac{x}{6} + 1 = 0\right)$$

$$18 + x(x+3) - 6(x+3) = 0$$

$$18 + x^2 + 3x - 6x - 18 = 0$$

$$x^2 - 3x = 0$$

$$x(x-3) = 0$$

$$x = 0, 3$$

PTS: 2 REF: 081829aai NAT: A.REI.A.2 TOP: Solving Rationals  
KEY: rational solutions

285 ANS:

$$M = \frac{(152500 - 15250)\left(\frac{.036}{12}\right)\left(1 + \frac{.036}{12}\right)^{360}}{\left(1 + \frac{.036}{12}\right)^{360} - 1} \approx 624$$

PTS: 2 REF: 061831aai NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions  
286 ANS: 2 PTS: 2 REF: 081911aai NAT: F.BF.B.3  
TOP: Even and Odd Functions

287 ANS:

$2(0.042) = 0.084 \approx 0.08$  The percent of users making in-app purchases will be within 8% of 35%.

PTS: 2 REF: 081832aai NAT: S.IC.B.4 TOP: Analysis of Data  
288 ANS: 4 PTS: 2 REF: 061914aai NAT: A.REI.D.11  
TOP: Other Systems

289 ANS:

$$(2x^2 + x - 3) \cdot (x - 1) - \left[ (2x^2 + x - 3) + (x - 1) \right]$$

$$(2x^3 - 2x^2 + x^2 - x - 3x + 3) - (2x^2 + 2x - 4)$$

$$2x^3 - 3x^2 - 6x + 7$$

PTS: 4 REF: 011833aai NAT: F.BF.A.1 TOP: Operations with Functions

290 ANS:

$$3\sqrt{x} - 2x = -5 \quad 1 \text{ is extraneous.}$$

$$3\sqrt{x} = 2x - 5$$

$$9x = 4x^2 - 20x + 25$$

$$4x^2 - 29x + 25 = 0$$

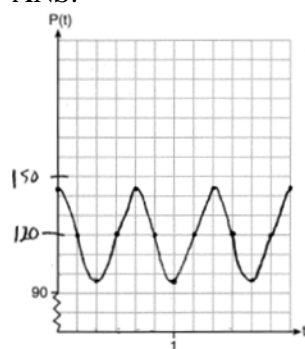
$$(4x - 25)(x - 1) = 0$$

$$x = \frac{25}{4}, 1$$

PTS: 4 REF: 011936aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

291 ANS:



The period of  $P$  is  $\frac{2}{3}$ , which means the patient's blood pressure reaches a high every  $\frac{2}{3}$  second and a low every  $\frac{2}{3}$  second. The patient's blood pressure is high because 144 over 96 is greater than 120 over 80.

PTS: 6 REF: 011837aii NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

292 ANS:

$$\frac{9}{6} = 1.5 \quad a_1 = 6$$

$$a_n = 1.5 \cdot a_{n-1}$$

PTS: 2 REF: 061931aii NAT: F.BF.A.1 TOP: Sequences

KEY: recursive

293 ANS: 1

$$1.025^{\frac{1}{12}} \approx 1.00206$$

PTS: 2 REF: 081924aii NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

294 ANS:

$250(1) + 2450 = 2700$  The maximum lung capacity of a person is 2700 mL.

PTS: 2 REF: 081928aii NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

295 ANS: 2  
 $x = 4y + 5$

$$x - 5 = 4y$$

$$\frac{1}{4}x - \frac{5}{4} = y$$

PTS: 2 REF: 061909aai NAT: F.BF.B.4 TOP: Inverse of Functions  
 KEY: linear

296 ANS: 2 PTS: 2 REF: 011806aai NAT: A.APR.C.4  
 TOP: Polynomial Identities

297 ANS:

$$a_1 = 3 \quad a_2 = 7 \quad a_3 = 15 \quad a_4 = 31; \text{ No, because there is no common ratio: } \frac{7}{3} \neq \frac{15}{7}$$

PTS: 2 REF: 061830aai NAT: F.BF.A.2 TOP: Sequences

298 ANS: 2

$$4x \cdot x^{\frac{2}{3}} + 2x^{\frac{5}{3}} = 4x^{\frac{5}{3}} + 2x^{\frac{5}{3}} = 6x^{\frac{5}{3}} = 6\sqrt[3]{x^5}$$

PTS: 2 REF: 061820aai NAT: N.RN.A.2 TOP: Operations with Radicals  
 KEY: with variables, index > 2

299 ANS: 2 PTS: 2 REF: 081908aai NAT: F.IF.B.4  
 TOP: Graphing Polynomial Functions

300 ANS:

$$\frac{10.1 - -2}{2} - \frac{2.5 - -0.1}{2} = 6.05 - 1.3 = 4.75$$

PTS: 2 REF: 081930aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions  
 KEY: amplitude

301 ANS: 1

$$(2x - i)^2 - (2x - i)(2x + 3i)$$

$$(2x - i)[(2x - i) - (2x + 3i)]$$

$$(2x - i)(-4i)$$

$$-8xi + 4i^2$$

$$-8xi - 4$$

PTS: 2 REF: 011911aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

302 ANS: 4 PTS: 2 REF: 011808aai NAT: A.SSE.B.3  
 TOP: Modeling Exponential Functions

303 ANS: 4

$$(x^6y^4 - 9)(x^4 - 16)$$

$$(x^3y^2 + 3)(x^3y^2 - 3)(x^2 + 4)(x^2 - 4)$$

PTS: 2 REF: 081814aai NAT: A.SSE.A.2 TOP: Factoring Polynomials  
 KEY: factoring by grouping

304 ANS: 1 PTS: 2 REF: 011815aai NAT: F.TF.A.2  
 TOP: Unit Circle

305 ANS: 1

$$9110 = 5000e^{30r}$$

$$\ln \frac{911}{500} = \ln e^{30r}$$

$$\frac{\ln \frac{911}{500}}{30} = r$$

$$r \approx .02$$

PTS: 2 REF: 011810aai NAT: F.LE.A.4 TOP: Exponential Growth

306 ANS: 3

$$2x^3 - 4x^2 - x + \frac{14}{x+6}$$

$$x+6 \overline{) 2x^4 + 8x^3 - 25x^2 - 6x + 14}$$

$$\underline{2x^4 + 12x^3}$$

$$-4x^3 - 25x^2$$

$$\underline{-4x^3 - 24x^2}$$

$$-x^2 - 6x$$

$$\underline{-x^2 - 6x}$$

PTS: 2 REF: 081805aai NAT: A.APR.D.6 TOP: Rational Expressions  
 KEY: division

307 ANS: 4

$$m^3 - 2m^2 + 4m - 8 = 0$$

$$m^2(m-2) + 4(m-2) = 0$$

$$(m^2 + 4)(m-2) = 0$$

PTS: 2 REF: 081821aai NAT: A.APR.B.3 TOP: Solving Polynomial Equations

308 ANS: 4

$$F = 325 - 185e^{-0.4(0)} = 325 - 185 = 140$$

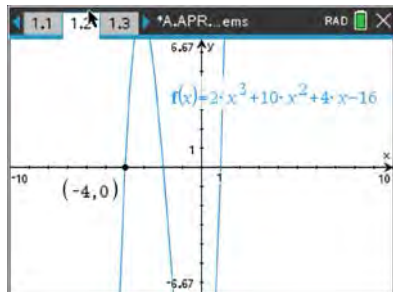
PTS: 2

REF: 012415aai

NAT: F.IF.B.4

TOP: Evaluating Exponential Expressions

309 ANS:



Since  $-4$  is a zero,  $x + 4$  is a factor.

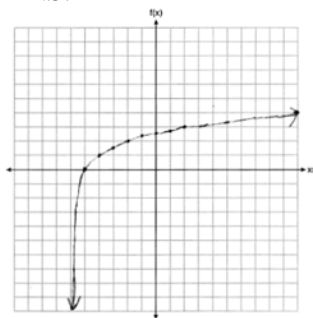
PTS: 2

REF: 012426aai

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

310 ANS:



PTS: 2

REF: 061927aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

311 ANS:

$$(a + b)^3 = a^3 + b^3$$

No. Erin's shortcut only works if  $a = 0$ ,  $b = 0$  or  $a = -b$ .

$$a^3 + 3a^2b + 3ab^2 + b^3 = a^3 + b^3$$

$$3ab^2 + 3a^2b = 0$$

$$3ab(b + a) = 0$$

$$a = 0, b = 0, a = -b$$

PTS: 2

REF: 011927aai

NAT: A.APR.C.4

TOP: Polynomial Identities

312 ANS: 3

$$T(19) = 8 \sin(0.3(19) - 3) + 74 \approx 77$$

PTS: 2

REF: 061922aai

NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

313 ANS:

$23 - 18 = 5$ ,  $\bar{x} \pm 2\sigma = -3.07 - 3.13$ , Yes, a difference of 5 or more occurred three times out of a thousand, which is statistically significant.

PTS: 4

REF: 061834aai

NAT: S.IC.B.5

TOP: Analysis of Data



314 ANS: 2  

$$\frac{85}{210+85}$$

PTS: 2 REF: 081818aai NAT: S.CP.A.1 TOP: Venn Diagrams

315 ANS: 2 PTS: 2 REF: 061802aai NAT: F.IF.C.7  
 TOP: Graphing Exponential Functions

316 ANS: 2  
 (1)  $0.4 \cdot 0.3 \neq 0.2$ , (2)  $0.8 \cdot 0.25 = 0.2$ , (3)  $P(A|B) = P(A) = 0.2$ , (4)  $0.2 \neq 0.15 \cdot 0.05$   
 $0.2 \neq 0.2 \cdot 0.2$

PTS: 2 REF: 011912aai NAT: S.CP.A.3 TOP: Conditional Probability

317 ANS: 3 PTS: 2 REF: 081819aai NAT: A.REI.D.11  
 TOP: Other Systems

318 ANS: 3  

$$-3 + 5i - (4 + 24i - 2i - 12i^2) = -3 + 5i - (16 + 22i) = -19 - 17i$$

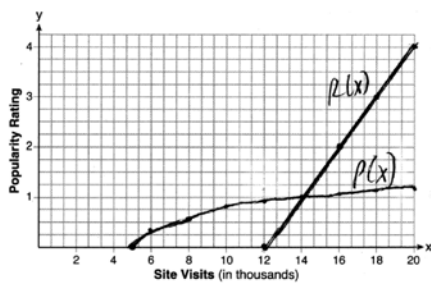
PTS: 2 REF: 081815aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

319 ANS: 4 PTS: 2 REF: 061921aai NAT: A.APR.B.3  
 TOP: Graphing Polynomial Functions

320 ANS:  
 $1200 \cdot 0.784 \approx 941$

PTS: 2 REF: 081828aai NAT: S.ID.A.4 TOP: Normal Distributions  
 KEY: predict

321 ANS:



$P(16) = \log(16 - 4) \approx 1.1$ , 14000

PTS: 6 REF: 061837aai NAT: A.REI.D.11 TOP: Other Systems

322 ANS: 4 PTS: 2 REF: 012423aai NAT: A.SSE.B.4  
 TOP: Series KEY: geometric

323 ANS: 3 PTS: 2 REF: 012418aai NAT: S.IC.B.6  
 TOP: Analysis of Data

324 ANS: 1

$$1) (x+3)^2 - 16 = x^2 + 6x + 9 - 16 = x^2 + 6x - 7 = (x+7)(x-1); \quad 2) \quad u = x+3 \quad ; \quad 3)$$

$$u^2 - 10u - 2u + 20$$

$$u(u-10) - 2(u-10)$$

$$(u-2)(u-10)$$

$$(x+3-2)(x+3-10)$$

$$(x+1)(x-7)$$

$$\frac{(x-1)(x-7)(x+1)}{(x+1)} = (x-1)(x-7); \quad 4) \frac{(x+7)(x+1)(x+3)}{(x+3)} = (x+7)(x+1)$$

PTS: 2 REF: 061808aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

325 ANS:

$$x+2 \overline{) \begin{array}{r} x^3 \phantom{+ 4} \\ x^4 + 2x^3 + 4x - 10 \end{array}} \quad x^3 + 4 - \frac{18}{x+2}. \quad \text{No, because there is a remainder.}$$

$$\underline{x^4 + 2x^3}$$

$$4x - 10$$

$$\underline{4x + 8}$$

$$-18$$

PTS: 4 REF: 011934aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

326 ANS: 1

$$100 \left( \frac{1}{2} \right)^{\frac{d}{8}} = 100e^{kd}$$

$$\left( \frac{1}{2} \right)^{\frac{1}{8}} = e^k$$

$$k \approx -0.087$$

PTS: 2 REF: 061818aai NAT: F.LE.A.4 TOP: Exponential Decay

327 ANS:

$$\frac{13.9 - 9.4}{4 - 1} = 1.5 \quad \text{The average rate of change in the number of hours of daylight from January 1-April 1 is 1.5.}$$

PTS: 2 REF: 061925aai NAT: F.IF.B.6 TOP: Rate of Change

328 ANS: 4

$$1 \text{ year} = 365 \text{ days}$$

PTS: 2 REF: 061823aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

329 ANS: 4                   PTS: 2                   REF: 011805aia           NAT: F.LE.B.5  
TOP: Modeling Exponential Functions

330 ANS:

$$\frac{7}{2x} - \frac{2}{x+1} = \frac{1}{4}$$

$$\frac{7x+7-4x}{2x^2+2x} = \frac{1}{4}$$

$$2x^2 + 2x = 12x + 28$$

$$x^2 - 5x - 14 = 0$$

$$(x-7)(x+2) = 0$$

$$x = 7, -2$$

PTS: 2                   REF: 061926aia           NAT: A.REI.A.2           TOP: Solving Rationals  
KEY: rational solutions

331 ANS: 1



PTS: 2                   REF: 081919aia           NAT: S.ID.A.4           TOP: Normal Distributions  
KEY: percent

332 ANS: 3                   PTS: 2                   REF: 061901aia           NAT: S.IC.B.3  
TOP: Analysis of Data           KEY: type

333 ANS: 3

$$8r^3 = 216 \quad S_{12} = \frac{8 - 8(3)^{12}}{1 - 3} = 2125760$$

$$r^3 = 27$$

$$r = 3$$

PTS: 2                   REF: 081902aia           NAT: A.SSE.B.4           TOP: Series  
KEY: geometric

334 ANS: 3

$$(x+4)^2 - 10 = 3x + 6 \quad y = 3(-5) + 6 = -9$$

$$x^2 + 8x + 16 - 10 = 3x + 6 \quad y = 3(0) + 6 = 6$$

$$x^2 + 5x = 0$$

$$x(x+5) = 0$$

$$x = -5, 0$$

PTS: 2 REF: 061903aia NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

335 ANS:

$$N(t) = 950e^{0.0475t} \quad \text{The base is } e \text{ because growth is continuous. } N\left(\frac{36}{24}\right) \approx 1020$$

PTS: 4 REF: 081933aia NAT: F.LE.A.2 TOP: Modeling Exponential Functions

336 ANS: 4

$$x(x-2)\left(\frac{10}{x^2-2x} + \frac{4}{x} = \frac{5}{x-2}\right) \quad 2 \text{ is extraneous.}$$

$$10 + 4(x-2) = 5x$$

$$10 + 4x - 8 = 5x$$

$$2 = x$$

PTS: 2 REF: 081915aia NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

337 ANS: 2

$$i = \frac{6.24\%}{12} = .52\% \quad R = \frac{(18000)(.52\%)}{1 - (1 + .52\%)^{-12 \cdot 6}} \approx 300.36$$

PTS: 2 REF: 012420aia NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

338 ANS: 4 PTS: 2 REF: 061907aia NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

339 ANS: 3

$$\frac{2}{3x+1} = \frac{1}{x} - \frac{6x}{3x+1} - \frac{1}{3} \text{ is extraneous.}$$

$$\frac{6x+2}{3x+1} = \frac{1}{x}$$

$$6x^2 + 2x = 3x + 1$$

$$6x^2 - x - 1 = 0$$

$$(2x-1)(3x+1) = 0$$

$$x = \frac{1}{2}, -\frac{1}{3}$$

PTS: 2 REF: 011915aai NAT: A.REI.A.2 TOP: Solving Rationals

340 ANS:

$$\frac{47}{108} = \frac{1}{4} + \frac{116}{459} - P(M \text{ and } J); \text{ No, because } \frac{31}{459} \neq \frac{1}{4} \cdot \frac{116}{459}$$

$$P(M \text{ and } J) = \frac{31}{459}$$

PTS: 4 REF: 011834aai NAT: S.CP.A.3 TOP: Conditional Probability

341 ANS: 4 PTS: 2 REF: 081810aai NAT: F.BF.A.2

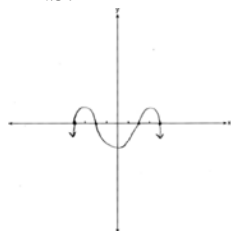
TOP: Sequences

342 ANS: 3

The vertex is  $(-3, 5)$  and  $p = 2$ .  $y = \frac{-1}{4(2)}(x+3)^2 + 5$

PTS: 2 REF: 011914aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

343 ANS:



PTS: 2 REF: 011926aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

344 ANS:

$$x^3 + 4x^2 - 9x - 36 = x^2(x+4) - 9(x+4) = (x^2 - 9)(x+4) = (x+3)(x-3)(x+4)$$

PTS: 2 REF: 012425aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

345 ANS: 3 PTS: 2 REF: 011917aai NAT: F.BF.B.4

TOP: Inverse of Functions KEY: exponential

346 ANS: 4

$$1 + \frac{.009}{12} = 1.00075$$

PTS: 2 REF: 011918aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

347 ANS: 4 PTS: 2 REF: 081803aai NAT: F.BF.A.1

TOP: Operations with Functions

348 ANS: 3 PTS: 2 REF: 061910aai NAT: F.IF.A.3

TOP: Sequences KEY: difference or ratio

349 ANS:

$$j(-1) = 2(-1)^4 - (-1)^3 - 35(-1)^2 + 16(-1) + 48 = 2 + 1 - 35 - 16 + 48 = 0; \quad x + 1 \text{ is a factor of } j(x);$$

$$2x^3 - 3x^2 - 32x + 48 = 0$$

$$x^2(2x - 3) - 16(2x - 3) = 0$$

$$(x^2 - 16)(2x - 3) = 0$$

$$x = \pm 4, \frac{3}{2}$$

PTS: 4 REF: 081834aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

350 ANS:

$$4x + 6y - 8z = -2 \quad 4x + 6y - 8z = -2 \quad 4x - 8y + 20z = 12 \quad z + 2 = 3z - 4 \quad y = 3 + 2 \quad -4x + 5 + 3 = 16$$

$$4x - 8y + 20z = 12 \quad \underline{-4x + y + z = 16} \quad \underline{-4x + y + z = 16} \quad 6 = 2z \quad = 5 \quad -4x = 8$$

$$-4x + y + z = 16 \quad 7y - 7z = 14 \quad -7y + 21z = 28 \quad z = 3 \quad x = -2$$

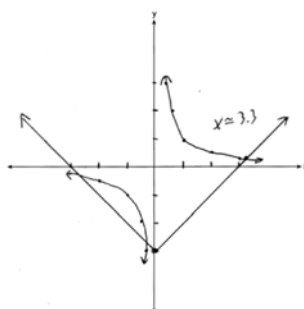
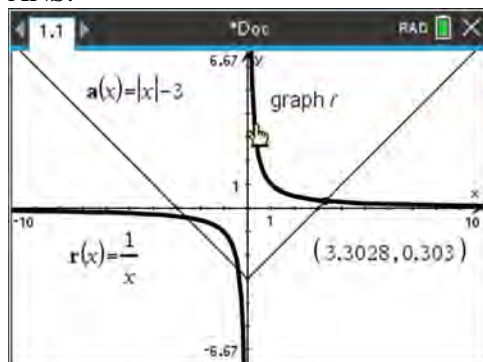
$$y - z = 2 \quad y - 3z = -4$$

$$y = z + 2 \quad y = 3z - 4$$

PTS: 4 REF: 081833aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

351 ANS:



PTS: 2 REF: 081932aai NAT: A.REI.D.11 TOP: Other Systems

352 ANS: 1

$$\cos \theta = -\frac{3}{5}; \sec \theta = -\frac{5}{3}$$

PTS: 2

REF: 012421aai

NAT: F.TF.C.8

TOP: Determining Trigonometric Functions

353 ANS: 2

PTS: 2

REF: 081904aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

KEY: higher power

354 ANS: 2

$$u = x + 2 \quad u^2 + 4u + 3$$

$$(u + 3)(u + 1)$$

$$(x + 2 + 3)(x + 2 + 1)$$

$$(x + 5)(x + 3)$$

PTS: 2

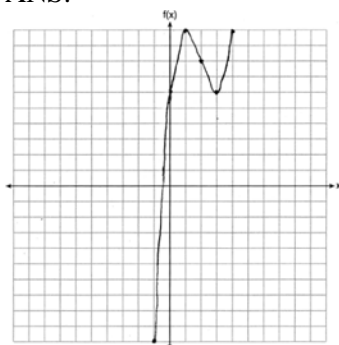
REF: 081901aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

KEY: higher power

355 ANS:



PTS: 2

REF: 061826aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

356 ANS:

$$x = \frac{-5 \pm \sqrt{5^2 - 4(2)(8)}}{2(2)} = -\frac{5}{4} \pm \frac{i\sqrt{39}}{4}$$

PTS: 2

REF: 061827aai

NAT: A.REI.B.4

TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

357 ANS: 4

$$p(5) = 2(5)^3 - 3(5) + 5 = 240$$

PTS: 2

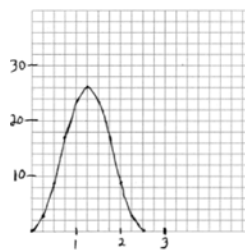
REF: 011819aai

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

358 ANS:

period =  $\frac{2\pi}{0.8\pi} = 2.5$ . The wheel rotates once every 2.5 seconds.  
of  $f(t) = 26$ .



No, because the maximum

PTS: 6 REF: 061937aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions  
KEY: graph

359 ANS: 2  
 $0.254 \pm 2(0.060) \rightarrow (0.134, 0.374)$

PTS: 2 REF: 061913aai NAT: S.IC.B.5 TOP: Analysis of Data

360 ANS:  
 $P(A+B) = P(A) \cdot P(B|A) = 0.8 \cdot 0.85 = 0.68$

PTS: 2 REF: 011928aai NAT: S.CP.A.3 TOP: Conditional Probability

361 ANS: 3  
 $x^2 + 6x + 9 = -10 + 9$   
 $(x+3)^2 = -1$   
 $x+3 = \pm i$   
 $x = -3 \pm i$

PTS: 2 REF: 012416aai NAT: A.REI.B.4 TOP: Solving Quadratics  
KEY: complex solutions | completing the square

362 ANS:  
 $3x^3 + x^2 + 3xy + y = x^2(3x+1) + y(3x+1) = (x^2 + y)(3x+1)$

PTS: 2 REF: 011828aai NAT: A.SSE.A.2 TOP: Factoring Polynomials  
KEY: factoring by grouping

363 ANS: 4  
 $\ln e^{0.3x} = \ln \frac{5918}{87}$   
 $x = \frac{\ln \frac{5918}{87}}{0.3}$

PTS: 2 REF: 081801aai NAT: F.LE.A.4 TOP: Exponential Equations  
KEY: without common base



364 ANS: 4

$$\frac{2}{x} = \frac{4x}{x+3}$$

$$2x+6 = 4x^2$$

$$4x^2 - 2x - 6 = 0$$

$$2(2x^2 - x - 3) = 0$$

$$(2x-3)(x+1) = 0$$

$$x = \frac{3}{2}, -1$$

PTS: 2 REF: 061809aai NAT: A.REI.A.2 TOP: Solving Rationals

365 ANS:

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{-7/25}{-24/25} \quad \cos \theta = \frac{-24}{25}$$

PTS: 2 REF: 061928aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

366 ANS: 4

The maximum of  $p$  is 5. The minimum of  $f$  is  $-\frac{21}{4}$  ( $x = \frac{-6}{2(4)} = -\frac{3}{4}$ )

$$f\left(-\frac{3}{4}\right) = 4\left(-\frac{3}{4}\right)^2 + 6\left(-\frac{3}{4}\right) - 3 = 4\left(\frac{9}{16}\right) - \frac{18}{4} - \frac{12}{4} = -\frac{21}{4}. \quad \frac{20}{4} - \left(-\frac{21}{4}\right) = \frac{41}{4} = 10.25$$

PTS: 2 REF: 011922aai NAT: F.IF.C.9 TOP: Comparing Functions

367 ANS: 3

Expression	Result
Define $r(a) = \frac{1}{0.0105} \cdot \ln\left(\frac{a}{5000}\right)$	Done
$\frac{r(8000) - r(6000)}{8000 - 6000}$	0.013699
$\frac{r(12000) - r(9000)}{12000 - 9000}$	0.009133

PTS: 2 REF: 081922aai NAT: F.IF.B.6 TOP: Rate of Change

368 ANS: 1

In vertex form, the parabola is  $y = -\frac{1}{4(2)}(x+4)^2 + 3$ . The vertex is  $(-4, 3)$  and  $p = 2$ .  $3 + 2 = 5$

PTS: 2 REF: 011816aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

369 ANS: 2

$$121(b)^2 = 64 \quad 64\left(\frac{8}{11}\right)^2 \approx 34$$

$$b = \frac{8}{11}$$

PTS: 2                      REF: 011904aai                      NAT: F.BF.A.1                      TOP: Sequences  
KEY: explicit

370 ANS: 4

$$(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$$

PTS: 2                      REF: 012417aai                      NAT: A.APR.C.4                      TOP: Polynomial Identities

371 ANS: 4

$$\sqrt{3x^2y} \cdot \sqrt[3]{27x^3y^2} = 3^{\frac{1}{2}}x^{\frac{1}{2}}y^{\frac{1}{2}} \cdot 3^{\frac{2}{3}}x^{\frac{2}{3}}y^{\frac{2}{3}} = 3^{\frac{3}{2}}x^2y^{\frac{7}{6}}$$

PTS: 2                      REF: 081914aai                      NAT: N.RN.A.2                      TOP: Operations with Radicals  
KEY: with variables, index > 2

372 ANS:

$$\frac{-1}{\sqrt{2^2 + (-1)^2}} = -\frac{1}{\sqrt{5}}$$

PTS: 2                      REF: 061832aai                      NAT: F.TF.A.2                      TOP: Determining Trigonometric Functions  
KEY: extension to reals

373 ANS:

$$\frac{p(8) - p(4)}{8 - 4} \approx 48.78$$

PTS: 2                      REF: 081827aai                      NAT: F.IF.B.6                      TOP: Rate of Change

374 ANS: 3

$$x^2 - 4x - 5 = 4x^2 - 40x + 100$$

$$3x^2 - 36x + 105 = 0$$

$$x^2 - 12x + 35 = 0$$

$$(x - 7)(x - 5) = 0$$

$$x = 5, 7$$

PTS: 2                      REF: 081807aai                      NAT: A.REI.A.2                      TOP: Solving Radicals  
KEY: extraneous solutions

375 ANS: 3

$$1^3 - k(1)^2 + 2(1) = 0$$

$$k = 3$$

PTS: 2                      REF: 061812aai                      NAT: A.APR.B.2                      TOP: Remainder and Factor Theorems

376 ANS:

 $x^2 - 6x = -17$  The solution is imaginary because the parabola and line do not intersect.

$$x^2 - 6x + 9 = -17 + 9$$

$$(x - 3)^2 = -8$$

$$x - 3 = \pm 2i\sqrt{2}$$

$$x = 3 \pm 2i\sqrt{2}$$

PTS: 4 REF: 081936aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

377 ANS: 4

There is no  $x$ -intercept.

PTS: 2 REF: 011823aai NAT: F.IF.C.7 TOP: Graphing Exponential Functions

378 ANS: 1 PTS: 2 REF: 061904aai NAT: F.IF.B.6

TOP: Rate of Change

379 ANS: 3

$$\frac{c^2 - d^2}{d^2 + cd - 2c^2} = \frac{(c+d)(c-d)}{(d+2c)(d-c)} = \frac{-(c+d)}{d+2c} = \frac{-c-d}{d+2c}$$

PTS: 2 REF: 011818aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

380 ANS: 2 PTS: 2 REF: 061816aai NAT: F.IF.C.7

TOP: Graphing Polynomial Functions KEY: bimodalgraph

381 ANS: 2 PTS: 2 REF: 081816aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions KEY: bimodalgraph

382 ANS:

The denominator of the rational exponent represents the index of a root, and the numerator of the rational exponent represents the power of the base.  $(\sqrt{9})^5 = 243$

PTS: 2 REF: 081926aai NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

383 ANS:

 $29.101 \pm 2 \cdot 0.934 = 27.23 - 30.97$ . Yes, since 30 falls within the 95% interval.

PTS: 4 REF: 011935aai NAT: S.IC.A.2 TOP: Analysis of Data

384 ANS:

 $P(-2) = 60$   $Q(-2) = 0$   $(x + 2)$  is a factor of  $Q(x)$  since  $Q(-2) = 0$ .

PTS: 2 REF: 081929aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

385 ANS:

$$\frac{165 + 66 - 33}{825} = \frac{198}{825}$$

PTS: 2 REF: 081925aai NAT: S.CP.B.6 TOP: Conditional Probability

386 ANS: 4

$$1.06^{\frac{1}{52}}$$

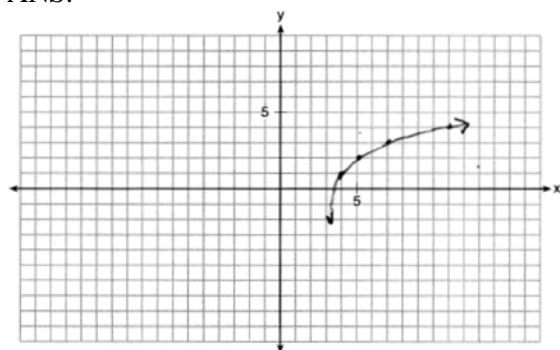
PTS: 2

REF: 061924aai

NAT: F.BF.A.1

TOP: Modeling Exponential Functions

387 ANS:



PTS: 2

REF: 011932aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

388 ANS:

$$\frac{103}{110+103} = \frac{103}{213}$$

PTS: 2

REF: 061825aai

NAT: S.CP.A.4

TOP: Conditional Probability

389 ANS:

$$\begin{array}{rclclcl}
 a + 4b + 6c = 23 & a + 2b + c = 2 & 8b + 3c = 16 & 2b + 5(4) = 21 & a + 4\left(\frac{1}{2}\right) + 6(4) = 23 \\
 a + 2b + c = 2 & -a + 6b + 2c = 14 & 8b + 20c = 84 & 2b = 1 & a + 2 + 24 = 23 \\
 2b + 5c = 21 & 8b + 3c = 16 & 17c = 68 & b = \frac{1}{2} & a = -3 \\
 & & c = 4 & & 
 \end{array}$$

PTS: 4

REF: 011933aai

NAT: A.REI.C.6

TOP: Solving Linear Systems

KEY: three variables

390 ANS: 3

$$\sqrt{x+1} = x+1$$

$$x+1 = x^2 + 2x + 1$$

$$0 = x^2 + x$$

$$0 = x(x+1)$$

$$x = -1, 0$$

PTS: 2

REF: 011802aai

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

391 ANS: 3

PTS: 2

REF: 061824aai

NAT: A.CED.A.1

TOP: Modeling Rationals

392 ANS:

$$f(x) = x^2(x+4)(x-3); \quad g(x) = (x+2)^2(x+6)(x-1)$$

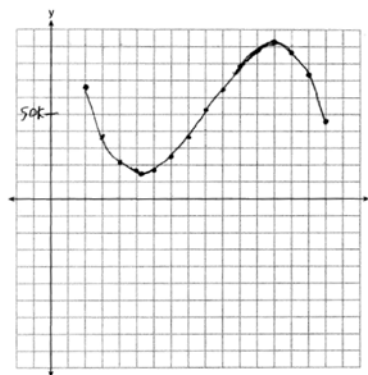
PTS: 4 REF: 011836aai NAT: F.BF.B.3 TOP: Graphing Polynomial Functions

393 ANS: 3

$$(x+3i)^2 - (2x-3i)^2 = x^2 + 6xi + 9i^2 - (4x^2 - 12xi + 9i^2) = -3x^2 + 18xi$$

PTS: 2 REF: 061805aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

394 ANS:



$P(x) = R(x) - C(x) = -330x^3 + 9000x^2 - 67000x + 167000$   
 Least profitable at year 5 because there is a minimum in  $P(x)$ . Most profitable at year 13 because there is a maximum in  $P(x)$ .

PTS: 6 REF: 081837aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

395 ANS: 1

$$50(1.19^{\frac{1}{12}})^{12t} \approx 50(1.015)^{12t}$$

PTS: 2 REF: 012424aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

396 ANS: 3

$$1.04^{\frac{1}{12}} \approx 1.0032737$$

PTS: 2 REF: 011906aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

397 ANS: 4

$$\frac{x^2 - 4x}{2x} = \frac{x(x-4)}{2x} = \frac{x-4}{2} = \frac{x}{2} - 2 \quad \frac{x-1}{2} - \frac{3}{2} = \frac{x-1-3}{2} = \frac{x-4}{2}$$

PTS: 2 REF: 011921aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

398 ANS: 2 PTS: 2 REF: 011901aai NAT: S.ID.A.4

TOP: Normal Distributions

KEY: mean and standard deviation

399 ANS: 4

$$a = \frac{14-4}{2} = 5, \quad d = \frac{14+4}{2} = 9$$

PTS: 2 REF: 061810aai NAT: F.TF.B.5 TOP: Modeling Trigonometric Functions

400 ANS:

$0.301 \pm 2(0.058) \rightarrow 0.185 - 0.417 \frac{14}{60} \approx 0.23$ . It is not unusual because 0.23 falls within this interval.

PTS: 4 REF: 081935aai NAT: S.IC.B.5 TOP: Analysis of Data

401 ANS: 2

$$b^2 = 2b^2 - 64 \quad -8 \text{ is extraneous.}$$

$$-b^2 = -64$$

$$b = \pm 8$$

PTS: 2 REF: 061919aai NAT: A.REI.A.2 TOP: Solving Radicals  
KEY: extraneous solutions

402 ANS: 4

$$a_1 = 2.5 + 0.5(1) = 3$$

PTS: 2 REF: 011916aai NAT: F.BF.A.2 TOP: Sequences

403 ANS: 3

$$x = \frac{-2 \pm \sqrt{2^2 - 4(3)(7)}}{2(3)} = \frac{-2 \pm \sqrt{-80}}{6} = \frac{-2 \pm i\sqrt{16}\sqrt{5}}{6} = -\frac{1}{3} \pm \frac{2i\sqrt{5}}{3}$$

PTS: 2 REF: 081809aai NAT: A.REI.B.4 TOP: Solving Quadratics  
KEY: complex solutions | quadratic formula

404 ANS: 4

$$wx^2 + w = 0$$

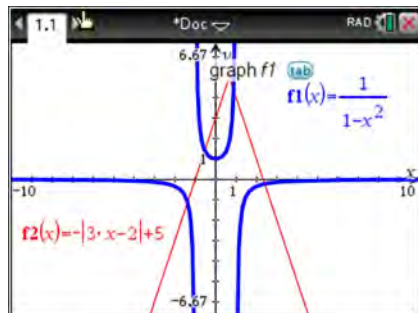
$$w(x^2 + 1) = 0$$

$$x^2 = -1$$

$$x = \pm i$$

PTS: 2 REF: 061912aai NAT: A.REI.B.4 TOP: Solving Quadratics  
KEY: complex solutions | taking square roots

405 ANS: 4



PTS: 2 REF: 011924aai NAT: A.REI.D.11 TOP: Other Systems

406 ANS: 4

$$f(x) = (x+1)(x-1)(x-2) = (x^2 - 1)(x-2) = x^3 - 2x^2 - x + 2$$

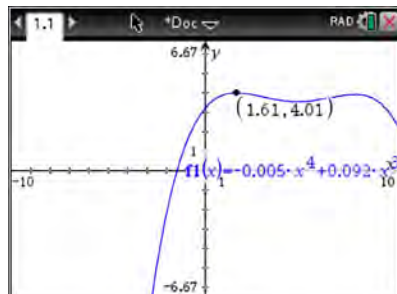
PTS: 2

REF: 081921aai

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

407 ANS: 3



PTS: 2

REF: 011817aai

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

408 ANS: 1

$$x - \frac{20}{x} = 8$$

$$x^2 - 8x - 20 = 0$$

$$(x-10)(x+2) = 0$$

$$x = 10, -2$$

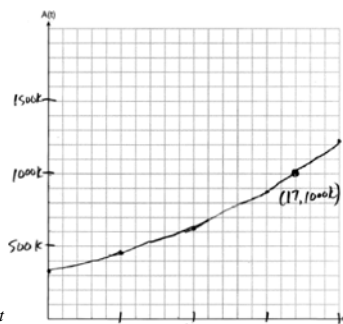
PTS: 2

REF: 061916aai

NAT: A.CED.A.1

TOP: Modeling Rationals

409 ANS:



$$A(t) = 318000(1.07)^t$$

$$318000(1.07)^t = 1000000$$

The graph of  $A(t)$  nearly intersects

$$1.07^t = \frac{1000}{318}$$

$$t \log 1.07 = \log \frac{1000}{318}$$

$$t = \frac{\log \frac{1000}{318}}{\log 1.07}$$

$$t \approx 17$$

the point (17, 1000000).

PTS: 6

REF: 011937aai

NAT: A.CED.A.1

TOP: Exponential Growth

410 ANS: 3

$$x^2 + (2x)^2 = 5 \quad y = 2x = \pm 2$$

$$x^2 + 4x^2 = 5$$

$$5x^2 = 5$$

$$x = \pm 1$$

PTS: 2

REF: 081916aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems



411 ANS:

$B = 1.69\sqrt{30+4.45} - 3.49 \approx 6$ , which is a steady breeze.

$$15 = 1.69\sqrt{s+4.45} - 3.49$$

$$18.49 = 1.69\sqrt{s+4.45}$$

$$\frac{18.49}{1.69} = \sqrt{s+4.45}$$

$$\left(\frac{18.49}{1.69}\right)^2 = s+4.45$$

$$s = \left(\frac{18.49}{1.69}\right)^2 - 4.45$$

$$s \approx 115$$

$$9.5 = 1.69\sqrt{s+4.45} - 3.49$$

$$10.49 = 1.69\sqrt{s+4.45} - 3.49 \quad 55-64$$

$$12.99 = 1.69\sqrt{s+4.45}$$

$$13.98 = 1.69\sqrt{s+4.45}$$

$$\frac{12.99}{1.69} = \sqrt{s+4.45}$$

$$\frac{13.98}{1.69} = \sqrt{s+4.45}$$

$$\left(\frac{12.99}{1.69}\right)^2 = s+4.45$$

$$\left(\frac{13.98}{1.69}\right)^2 = s+4.45$$

$$s = \left(\frac{12.99}{1.69}\right)^2 - 4.45$$

$$s = \left(\frac{13.98}{1.69}\right)^2 - 4.45$$

$$s \approx 55$$

$$s \approx 64$$

PTS: 6

REF: 081937aii

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: context

412 ANS: 2

$$y = x^3 - 3$$

$$x = y^3 - 3$$

$$x + 3 = y^3$$

$$\sqrt[3]{x+3} = y$$

PTS: 2

REF: 012419aii

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: polynomial

413 ANS:

$$\frac{p(x)}{x-1} = x^2 + 7 + \frac{5}{x-1}$$

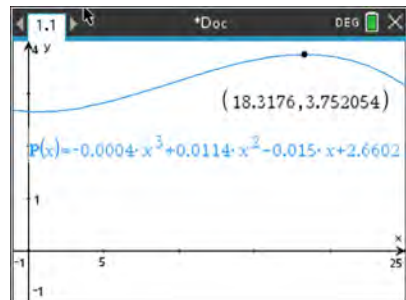
$$p(x) = x^3 - x^2 + 7x - 7 + 5$$

$$p(x) = x^3 - x^2 + 7x - 2$$

PTS: 2 REF: 061930aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

414 ANS: 2



PTS: 2 REF: 012414aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

415 ANS:

$$(x^2 - 6)(x^2 + 2)$$

PTS: 2 REF: 081825aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: higher power

416 ANS: 2

$$P(B) \cdot P(A|B) = P(A \text{ and } B)$$

$$P(B) \cdot 0.8 = 0.2$$

$$P(B) = 0.25$$

PTS: 2 REF: 081913aai NAT: S.CP.A.3 TOP: Conditional Probability

417 ANS:

No.  $0.499 \pm 2(0.049) \rightarrow 0.401 - 0.597$ . Since 0.43 falls within this interval, Robin's coin is likely not unfair.

PTS: 2 REF: 061932aai NAT: S.IC.A.2 TOP: Analysis of Data

418 ANS: 3

$$(x^2 - 49) \left( \frac{7}{x+7} + \frac{4x}{x-7} = \frac{3x+7}{x-7} \right)$$

$$7(x-7) + 4x(x+7) = (3x+7)(x+7)$$

$$7x - 49 + 4x^2 + 28x = 3x^2 + 21x + 7x + 49$$

$$4x^2 + 35x - 49 = 3x^2 + 28x + 49$$

$$x^2 + 7x - 98 = 0$$

$$(x+14)(x-7) = 0$$

$$x = -14, 7$$

PTS: 2

REF: 012422aaii

NAT: A.REI.A.2

TOP: Solving Rationals

419 ANS: 1

$$p(x) = r(x) - c(x)$$

$$-0.5x^2 + 250x - 300 = -0.3x^2 + 150x - c(x)$$

$$c(x) = 0.2x^2 - 100x + 300$$

PTS: 2

REF: 061813aaii

NAT: F.BF.A.1

TOP: Operations with Functions

420 ANS: 1

PTS: 2

REF: 081903aaii

NAT: F.LE.A.2

TOP: Families of Functions

421 ANS:

$$a_1 = 4$$

$$a_n = 3a_{n-1}$$

PTS: 2

REF: 081931aaii

NAT: F.BF.A.1

TOP: Sequences

KEY: recursive

422 ANS: 1

2) linear, 3) quadratic, 4) cubic

PTS: 2

REF: 061920aaii

NAT: F.LE.A.2

TOP: Families of Functions

423 ANS:

$$\frac{2x^{\frac{3}{2}}}{2x^{\frac{1}{2}}} = x^{\frac{1}{2}} = \sqrt{x}$$

PTS: 2

REF: 081826aaii

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: variables

424 ANS: 3

$$\frac{x^2(x+2) - 9(x+2)}{x(x^2 - x - 6)} = \frac{(x^2 - 9)(x+2)}{x(x-3)(x+2)} = \frac{(x+3)(x-3)}{x(x-3)} = \frac{x+3}{x}$$

PTS: 2 REF: 061803aai NAT: A.APR.D.6 TOP: Rational Expressions  
KEY: factoring

425 ANS: 2

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(5)(4)}}{2(5)} = \frac{2 \pm \sqrt{-76}}{10} = \frac{2 \pm i\sqrt{4}\sqrt{19}}{10} = \frac{1}{5} \pm \frac{i\sqrt{19}}{5}$$

PTS: 2 REF: 011905aai NAT: A.REI.B.4 TOP: Solving Quadratics  
KEY: complex solutions | quadratic formula

426 ANS: 2

$$\begin{aligned} & n^2(n^2 - 9) + 4n(n^2 - 9) - 12(n^2 - 9) \\ & \quad (n^2 + 4n - 12)(n^2 - 9) \\ & \quad (n + 6)(n - 2)(n + 3)(n - 3) \end{aligned}$$

PTS: 2 REF: 061911aai NAT: A.SSE.A.2 TOP: Factoring Polynomials  
KEY: factoring by grouping

427 ANS:

$$S_{10} = \frac{15 - 15(1.03)^{10}}{1 - 1.03} \approx 171.958$$

PTS: 2 REF: 011929aai NAT: A.SSE.B.4 TOP: Series  
KEY: geometric

428 ANS: 4

$$\frac{n}{m} = \frac{\sqrt{a^5}}{a} = \frac{a^{\frac{5}{2}}}{a^{\frac{2}{2}}} = a^{\frac{3}{2}} = \sqrt{a^3}$$

PTS: 2 REF: 011811aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents  
KEY: variables

429 ANS: 1

$$-\sqrt{1 - \left(-\frac{3}{4}\right)^2} = -\sqrt{\frac{16}{16} - \frac{9}{16}} = -\sqrt{\frac{7}{16}} = -\frac{\sqrt{7}}{4}$$

PTS: 2 REF: 081905aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

430 ANS: 4  
 $0.48 \cdot 0.25 = 0.12$

PTS: 1 REF: 061811aii NAT: S.CP.A.2 TOP: Probability of Compound Events  
 KEY: probability

431 ANS:

$$\begin{array}{r} 2a^2 + 5a + 2 \\ 3a - 2 \overline{) 6a^3 + 11a^2 - 4a - 9} \quad 2a^2 + 5a + 2 - \frac{5}{3a - 2} \\ \underline{6a^3 - 4a^2} \\ 15a^2 - 4a \\ \underline{15a^2 - 10a} \\ 6a - 9 \\ \underline{6a - 4} \\ -5 \end{array}$$

PTS: 2 REF: 061829aii NAT: A.APR.D.6 TOP: Rational Expressions  
 KEY: division

432 ANS: 1

$$6 - (3x - 2i)(3x - 2i) = 6 - (9x^2 - 12xi + 4i^2) = 6 - 9x^2 + 12xi + 4 = -9x^2 + 12xi + 10$$

PTS: 2 REF: 061915aii NAT: N.CN.A.2 TOP: Operations with Complex Numbers

433 ANS:

The denominator of the rational exponent represents the index of a root, and the 4th root of 81 is 3 and  $3^3$  is 27.

PTS: 2 REF: 011832aii NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

434 ANS: 1

$$84.1\% \times 750 \approx 631$$

PTS: 2 REF: 011923aii NAT: S.ID.A.4 TOP: Normal Distributions  
 KEY: predict

435 ANS: 4

PTS: 2 REF: 081912aii NAT: F.IF.C.7  
 TOP: Graphing Trigonometric Functions KEY: mixed

436 ANS:

$$t^2 + \left(\frac{4}{7}\right)^2 = 1 \quad -\frac{\sqrt{33}}{7}$$

$$t^2 + \frac{16}{49} = \frac{49}{49}$$

$$t^2 = \frac{33}{49}$$

$$t = \frac{\pm\sqrt{33}}{7}$$

PTS: 2 REF: 011931aai NAT: F.TF.A.2 TOP: Unit Circle

437 ANS: 1 PTS: 2 REF: 081813aai NAT: A.SSE.B.4  
TOP: Series KEY: geometric

438 ANS: 2

$$x + y - z = 6 \quad 2x + 2y - 2z = 12 \quad 5y - 4z = 31 \quad 5y - 2(-4) = 23 \quad x + 3 - (-4) = 6$$

$$\underline{-x + 4y - z = 17} \quad \underline{2x - 3y + 2z = -19} \quad \underline{5y - 2z = 23} \quad 5y = 15 \quad x = -1$$

$$5y - 2z = 23 \quad 5y - 4z = 31 \quad -2z = 8 \quad y = 3$$

$$z = -4$$

PTS: 2 REF: 061923aai NAT: A.REI.C.6 TOP: Solving Linear Systems  
KEY: three variables

439 ANS:

Self selection is a cause of bias because people with more free time are more likely to respond.

PTS: 2 REF: 061828aai NAT: S.IC.B.3 TOP: Analysis of Data  
KEY: bias440 ANS: 2 PTS: 2 REF: 061804aai NAT: S.ID.B.6  
TOP: Regression KEY: choose model441 ANS: 2 PTS: 2 REF: 011910aai NAT: S.IC.B.3  
TOP: Analysis of Data KEY: bias

442 ANS:

 $q$  has the smaller minimum value for the domain  $[-2, 2]$ .  $h$ 's minimum is  $-1(2(-1) + 1)$  and  $q$ 's minimum is  $-8$ .

PTS: 2 REF: 011830aai NAT: F.IF.C.9 TOP: Comparing Functions

443 ANS:

$$P(F|L) = \frac{12}{27} \quad P(F) = \frac{22}{45} \quad \text{Since } P(F|L) \neq P(F), \text{ the events are not independent.}$$

PTS: 4 REF: 061936aai NAT: S.CP.A.4 TOP: Conditional Probability

444 ANS: 4 PTS: 2 REF: 011801aai NAT: S.IC.B.3  
TOP: Analysis of Data KEY: bias

445 ANS:

$$\sqrt{6-2x} + x = 2x + 30 - 9 \quad \sqrt{6-2(-29)} \neq -29 + 21, \text{ so } -29 \text{ is extraneous.}$$

$$\sqrt{6-2x} = x + 21 \quad \sqrt{64} \neq -8$$

$$6 - 2x = x^2 + 42x + 441$$

$$x^2 + 44x + 435 = 0$$

$$(x + 29)(x + 15) = 0$$

$$x = -29, -15$$

PTS: 4 REF: 061833aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

446 ANS: 4

$$400 \cdot .954 \approx 380$$

PTS: 2 REF: 061918aii NAT: S.ID.A.4 TOP: Normal Distributions

KEY: predict

447 ANS: 4

$$\log_2(x - 1) - 1 = 0$$

$$\log_2(x - 1) = 1$$

$$x - 1 = 2^1$$

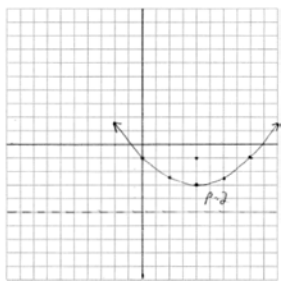
$$x = 3$$

PTS: 2 REF: 061819aii NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

448 ANS: 4 PTS: 2 REF: 081906aii NAT: S.IC.B.3

TOP: Analysis of Data KEY: type

449 ANS:



$$y = \frac{1}{4(2)}(x - 4)^2 - 3$$

$$y = \frac{-1 + -5}{2} = -3. \text{ The vertex is } (4, -3) \text{ and } p = 2.$$

PTS: 4 REF: 061935aii NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

450 ANS: 2  
 $x = -6(y - 2)$

$$-\frac{x}{6} = y - 2$$

$$-\frac{x}{6} + 2 = y$$

PTS: 2 REF: 011821aii NAT: F.BF.B.4 TOP: Inverse of Functions  
 KEY: linear

451 ANS: 2

If  $\cos \theta = \frac{7}{25}$ ,  $\sin \theta = \pm \frac{24}{25}$ , and  $\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{-\frac{24}{25}}{\frac{7}{25}} = -\frac{24}{7}$

PTS: 2 REF: 081811aii NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

452 ANS: 2

$$y = \frac{1}{2}x + 8 \quad x = \frac{1}{2}y + 8$$

$$2x = y + 16$$

$$y = 2x - 16$$

PTS: 2 REF: 081806aii NAT: F.BF.B.4 TOP: Inverse of Functions  
 KEY: linear

453 ANS: 2 PTS: 2 REF: 061917aii NAT: F.LE.B.5  
 TOP: Modeling Exponential Functions

454 ANS: 3

$$y = 278(0.5)^{\frac{18}{1.8}} \approx 0.271$$

PTS: 2 REF: 011920aii NAT: F.LE.A.2 TOP: Modeling Exponential Functions

455 ANS: 4

(1) quadratic has two roots and both are real  $(-2,0)$  and  $(-0.5,0)$ , (2)  $x = \pm\sqrt{32} - 3$ , (3) the real root is 3, with a multiplicity of 2, (4)  $x = \pm 4i$

PTS: 2 REF: 011909aii NAT: A.REI.B.4 TOP: Using the Discriminant  
 KEY: determine nature of roots given equation, graph, table

456 ANS: 1

$$x^3 + 2x^2 - 9x - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0$$

$$x^2(x+2) - 9(x+2) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0$$

$$(x+2)(x^2 - 9) = 0$$

PTS: 2 REF: 011903aii NAT: A.APR.B.3 TOP: Solving Polynomial Equations



457 ANS: 4

$$(x-y)^2 = x^2 - 2xy + y^2 \quad (x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$$

PTS: 2 REF: 061902aia NAT: A.APR.C.4 TOP: Polynomial Identities

458 ANS:

$$x^2 + (x-28)^2 = 400 \quad y = 12 - 28 = -16 \quad y = 16 - 28 = -12$$

$$x^2 + x^2 - 56x + 784 = 400$$

$$2x^2 - 56x + 384 = 0$$

$$x^2 - 28x + 192 = 0$$

$$(x-16)(x-12) = 0$$

$$x = 12, 16$$

PTS: 2 REF: 081831aia NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

459 ANS: 1

PTS: 2

REF: 081804aia

NAT: F.IF.C.9

TOP: Comparing Functions

460 ANS: 4

$$5000 \left( 1 + \frac{.035}{12} \right)^{12 \cdot 6} \approx 6166.50$$

PTS: 2 REF: 081917aia NAT: F.LE.A.2 TOP: Modeling Exponential Functions

461 ANS: 2

$$f(x) = f(-x)$$

$$x^2 - 4 = (-x)^2 - 4$$

$$x^2 - 4 = x^2 - 4$$

PTS: 2 REF: 061806aia NAT: F.BF.B.3 TOP: Even and Odd Functions

462 ANS: 4

PTS: 2

REF: 081824aia

NAT: S.CP.A.3

TOP: Conditional Probability

463 ANS: 3

$$\frac{x^{\frac{2}{3}} \cdot x^{\frac{5}{2}}}{x^{\frac{1}{6}}} = \frac{x^{\frac{4}{6}} \cdot x^{\frac{15}{6}}}{x^{\frac{1}{6}}} = x^{\frac{18}{6}} = x^3$$

PTS: 2 REF: 081812aia NAT: N.RN.A.2 TOP: Operations with Radicals

KEY: with variables, index &gt; 2

464 ANS: 4

$$3x - (-2x + 14) = 16 \quad 3(6) - 4z = 2$$

$$5x = 30 \quad -4z = -16$$

$$x = 6 \quad z = 4$$

PTS: 2

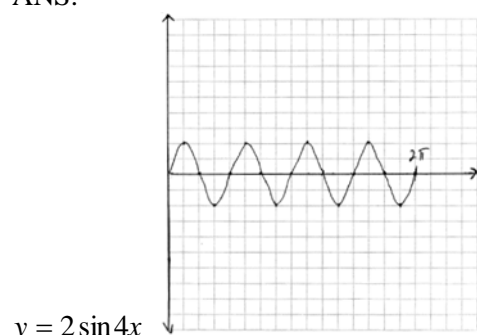
REF: 011803aai

NAT: A.REI.C.6

TOP: Solving Linear Systems

KEY: three variables

465 ANS:



PTS: 4

REF: 081934aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

466 ANS: 1

The time of the next high tide will be the midpoint of consecutive low tides.

PTS: 2

REF: 011907aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: mixed

467 ANS: 1

$$\begin{array}{r} 3x - 1 \\ 3x + 1 \overline{) 9x^2 + 0x - 2} \\ \underline{9x^2 + 3x} \phantom{- 2} \\ -3x - 2 \\ \underline{-3x - 1} \\ -1 \end{array}$$

PTS: 2

REF: 081910aai

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: division

468 ANS: 2

PTS: 2

REF: 011820aai

NAT: S.IC.A.2

TOP: Analysis of Data

469 ANS:

$$s(t) = 200(0.5)^{\frac{t}{15}} \quad \frac{1}{10} = (0.5)^{\frac{t}{15}}$$

$$\log \frac{1}{10} = \log(0.5)^{\frac{t}{15}}$$

$$-1 = \frac{t \cdot \log(0.5)}{15}$$

$$t = \frac{-15}{\log(0.5)} \approx 50$$

PTS: 4      REF: 061934aai      NAT: F.LE.A.4      TOP: Exponential Decay

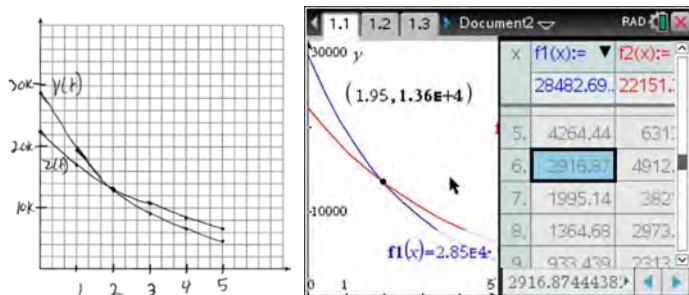
470 ANS:

$$\frac{h(2) - h(1)}{2 - 1} = -12, \quad h(t) = 0 \text{ at } t \approx 2.2, 3.8, \text{ using a graphing calculator to find where } h(t) = 0.$$

PTS: 4      REF: 061836aai      NAT: F.IF.B.4      TOP: Graphing Trigonometric Functions

## Algebra II Regents at Random Worksheets Answer Section

471 ANS:



At 1.95 years, the value of the car equals the loan balance. Zach can cancel the policy after 6 years.

PTS: 4 REF: 081737aai NAT: A.REI.D.11 TOP: Other Systems

472 ANS:

$$4\% \quad 8.75 = 1.25(1+r)^{49} \text{ or } 8.75 = 1.25e^{49r}$$

$$7 = (1+r)^{49} \quad \ln 7 = \ln e^{49r}$$

$$r+1 = \sqrt[49]{7} \quad \ln 7 = 49r$$

$$r \approx .04 \quad r = \frac{\ln 7}{49}$$

$$r \approx .04$$

PTS: 2 REF: 081730aai NAT: F.LE.A.4 TOP: Exponential Growth

473 ANS: 3

$$2d(d^3 + 3d^2 - 9d - 27)$$

$$2d(d^2(d+3) - 9(d+3))$$

$$2d(d^2 - 9)(d+3)$$

$$2d(d+3)(d-3)(d+3)$$

$$2d(d+3)^2(d-3)$$

PTS: 2 REF: 081615aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

474 ANS:

Since there are six flavors, each flavor can be assigned a number, 1-6. Use the simulation to see the number of times the same number is rolled 4 times in a row.

PTS: 2 REF: 081728aai NAT: S.IC.A.2 TOP: Analysis of Data

475 ANS:

About 38%  $\left(\frac{475}{1250}\right)$  of high school juniors in the population will choose a four-year college.

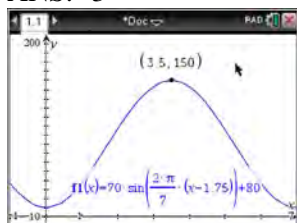
PTS: 2

REF: 012432aai

NAT: S.IC.A.2

TOP: Analysis of Data

476 ANS: 3



$H(t)$  is at a minimum at  $70(-1) + 80 = 10$

PTS: 2

REF: 061613aai

NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

KEY: maximum/minimum

477 ANS:

No, because  $P(M/R) \neq P(M)$

$$\frac{70}{180} \neq \frac{230}{490}$$

$$0.38 \neq 0.47$$

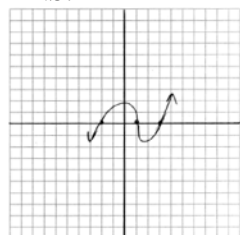
PTS: 2

REF: 011731aai

NAT: S.CP.A.4

TOP: Conditional Probability

478 ANS:



PTS: 2

REF: 011729aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

479 ANS: 1

$$\begin{array}{r|rrrrr} 2 & 1 & 0 & -4 & -4 & 8 \\ & & 2 & 4 & 0 & -8 \\ \hline & 1 & 2 & 0 & -4 & 0 \end{array}$$

Since there is no remainder when the quartic is divided by  $x - 2$ , this binomial is a factor.

PTS: 2

REF: 061711aai

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

480 ANS: 3

PTS: 2

REF: 011708aai

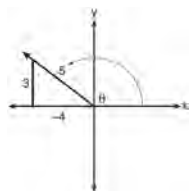
NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: exponential

481 ANS: 1

A reference triangle can be sketched using the coordinates  $(-4, 3)$  in the second quadrant to find the value of  $\sin \theta$ .



PTS: 2 REF: spr1503aai NAT: F.TF.A.2 TOP: Determining Trigonometric Functions  
KEY: extension to reals

482 ANS:

$$P(S \cap M) = P(S) + P(M) - P(S \cup M) = \frac{649}{1376} + \frac{433}{1376} - \frac{974}{1376} = \frac{108}{1376}$$

PTS: 2 REF: 061629aai NAT: S.CP.B.7 TOP: Theoretical Probability

483 ANS: 2 PTS: 2 REF: 011701aai NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

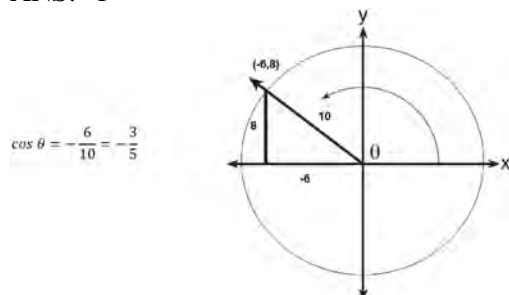
484 ANS: 2 PTS: 2 REF: 061620aai NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

485 ANS: 1 PTS: 2 REF: 081722aai NAT: S.IC.B.6

TOP: Analysis of Data

486 ANS: 1



PTS: 2 REF: 061617aai NAT: F.TF.A.2 TOP: Determining Trigonometric Functions  
KEY: extension to reals

487 ANS: 4

$$(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3 \neq x^3 + 3xy + y^3$$

PTS: 2 REF: 081620aai NAT: A.APR.C.4 TOP: Polynomial Identities

488 ANS: 4 PTS: 2 REF: 061716aai NAT: N.RN.A.2

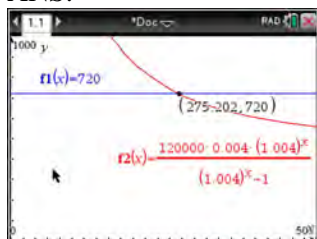
TOP: Radicals and Rational Exponents KEY: variables

489 ANS: 1

$$d = 18; r = \pm \frac{5}{4}$$

PTS: 2 REF: 011714aai NAT: F.BF.A.1 TOP: Sequences  
KEY: explicit

490 ANS:



$$720 = \frac{120000 \left( \frac{.048}{12} \right) \left( 1 + \frac{.048}{12} \right)^n}{\left( 1 + \frac{.048}{12} \right)^n - 1} \frac{275.2}{12} \approx 23 \text{ years}$$

$$720(1.004)^n - 720 = 480(1.004)^n$$

$$240(1.004)^n = 720$$

$$1.004^n = 3$$

$$n \log 1.004 = \log 3$$

$$n \approx 275.2 \text{ months}$$

PTS: 4 REF: spr1509aii NAT: A.CED.A.1 TOP: Exponential Growth

491 ANS: 1

$$\frac{2(x-4)}{(x+3)(x-4)} + \frac{3(x+3)}{(x-4)(x+3)} = \frac{2x-2}{x^2-x-12}$$

$$2x - 8 + 3x + 9 = 2x - 2$$

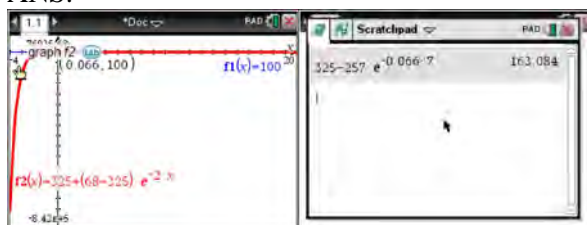
$$3x = -3$$

$$x = -1$$

PTS: 2 REF: 011717aii NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

492 ANS:



$$100 = 325 + (68 - 325)e^{-2k} \quad T = 325 - 257e^{-0.066t}$$

$$-225 = -257e^{-2k}$$

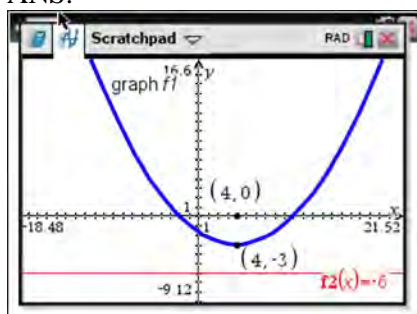
$$T = 325 - 257e^{-0.066(7)} \approx 163$$

$$k = \frac{\ln\left(\frac{-225}{-257}\right)}{-2}$$

$$k \approx 0.066$$

PTS: 4 REF: fall1513aii NAT: F.LE.A.4 TOP: Exponential Growth

493 ANS:



The vertex of the parabola is  $(4, -3)$ . The  $x$ -coordinate of the focus and the vertex is the same. Since the distance from the vertex to the directrix is 3, the distance from the vertex to the focus is 3, so the  $y$ -coordinate of the focus is 0. The coordinates of the focus are  $(4, 0)$ .

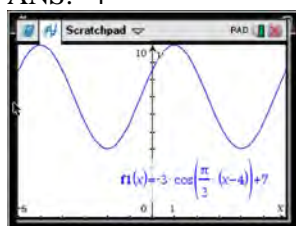
PTS: 2 REF: 061630aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

494 ANS: 4

The maximum volume of  $p(x) = -(x+2)(x-10)(x-14)$  is about 56, at  $x = 12.1$

PTS: 2 REF: 081712aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

495 ANS: 4



As the range is  $[4, 10]$ , the midline is  $y = \frac{4+10}{2} = 7$ .

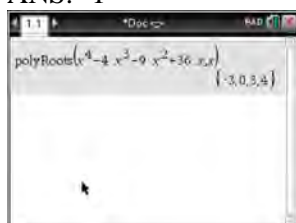
PTS: 2 REF: fall1506aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: mixed

496 ANS: 2 PTS: 2 REF: 011720aai NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

497 ANS: 1



$$x^4 - 4x^3 - 9x^2 + 36x = 0$$

$$x^3(x-4) - 9x(x-4) = 0$$

$$(x^3 - 9x)(x-4) = 0$$

$$x(x^2 - 9)(x-4) = 0$$

$$x(x+3)(x-3)(x-4) = 0$$

$$x = 0, \pm 3, 4$$

PTS: 2 REF: 061606aai NAT: A.APR.B.3 TOP: Solving Polynomial Equations



498 ANS: 2

The 2010 population is 110 million.

PTS: 2

REF: 061718aai

NAT: F.LE.B.5

TOP: Modeling Exponential Functions

499 ANS:

$$\begin{array}{r}
 x + y + z = 1 \quad x + y + z = 1 \quad x + y + z = 1 \quad -2z - z = 3 \quad y - (-1) = 3 \quad x + 2 - 1 = 1 \\
 x + 2y + 3z = 1 \quad \underline{x + 2y + 3z = 1} \quad \underline{-x + 3y - 5z = 11} \quad -3z = 3 \quad y = 2 \quad x = 0 \\
 -x + 3y - 5z = 11 \quad y + 2z = 0 \quad 4y - 4z = 12 \quad z = -1 \\
 y = -2z \quad y - z = 3
 \end{array}$$

PTS: 4

REF: 061733aai

NAT: A.REI.C.6

TOP: Solving Linear Systems

KEY: three variables

500 ANS: 3

PTS: 2

REF: 061602aai

NAT: A.CED.A.1

TOP: Modeling Rationals

501 ANS: 2

PTS: 2

REF: 081610aai

NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

502 ANS:

Jillian's plan, because distance increases by one mile each week.  $a_1 = 10$   $a_n = n + 12$ 

$$a_n = a_{n-1} + 1$$

PTS: 4

REF: 011734aai

NAT: F.BF.A.2

TOP: Sequences

503 ANS:

$$\frac{x^{\frac{8}{3}}}{x^{\frac{4}{3}}} = x^y$$

$$x^{\frac{4}{3}} = x^y$$

$$\frac{4}{3} = y$$

PTS: 2

REF: spr1505aai

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: numbers

504 ANS: 3

PTS: 2

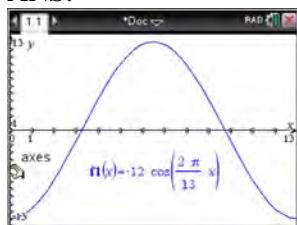
REF: 061720aai

NAT: F.BF.A.1

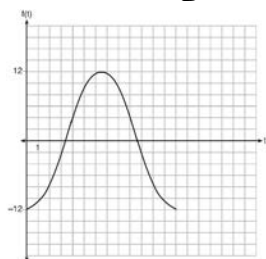
TOP: Sequences

KEY: function notation

505 ANS:



The amplitude, 12, can be interpreted from the situation, since the water level has a minimum of  $-12$  and a maximum of  $12$ . The value of  $A$  is  $-12$  since at 8:30 it is low tide. The period of the function is 13 hours, and is expressed in the function through the parameter  $B$ . By experimentation with technology or using the relation  $P = \frac{2\pi}{B}$  (where  $P$  is the period), it is determined that  $B = \frac{2\pi}{13}$ .



$$f(t) = -12 \cos\left(\frac{2\pi}{13} t\right)$$

In order to answer the question about when to fish, the student must interpret the function and determine which choice, 7:30 pm or 10:30 pm, is on an increasing interval. Since the function is increasing from  $t = 13$  to  $t = 19.5$  (which corresponds to 9:30 pm to 4:00 am), 10:30 is the appropriate choice.

PTS: 6      REF: spr1514aai      NAT: F.IF.C.7      TOP: Graphing Trigonometric Functions  
KEY: graph

506 ANS:

$$(4 - 3i)(5 + 2yi - 5 + 2yi)$$

$$(4 - 3i)(4yi)$$

$$16yi - 12yi^2$$

$$12y + 16yi$$

PTS: 2      REF: spr1506aai      NAT: N.CN.A.2      TOP: Operations with Complex Numbers  
507 ANS: 2      PTS: 2      REF: 081717aai      NAT: S.IC.B.3  
TOP: Analysis of Data      KEY: type

508 ANS: 1

The probability of rain equals the probability of rain, given that Sean pitches.

PTS: 2      REF: 061611aai      NAT: S.CP.A.3      TOP: Conditional Probability

509 ANS:

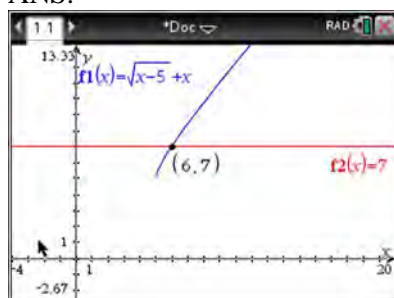
$$(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$$

$$x^4 + 2x^2y^2 + y^4 = x^4 - 2x^2y^2 + y^4 + 4x^2y^2$$

$$x^4 + 2x^2y^2 + y^4 = x^4 + 2x^2y^2 + y^4$$

PTS: 2      REF: 081727aai      NAT: A.APR.C.4      TOP: Polynomial Identities

510 ANS:



$$\sqrt{x-5} = -x+7 \quad \sqrt{x-5} = -9+7 = -2 \text{ is extraneous.}$$

$$x-5 = x^2 - 14x + 49$$

$$0 = x^2 - 15x + 54$$

$$0 = (x-6)(x-9)$$

$$x = 6, 9$$

PTS: 2 REF: spr1508aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

511 ANS: 3 PTS: 2 REF: 061623aii NAT: F.BF.A.2

TOP: Sequences

512 ANS: 2

$$\left(m^{\frac{5}{3}}\right)^{-\frac{1}{2}} = m^{-\frac{5}{6}} = \frac{1}{\sqrt[6]{m^5}}$$

PTS: 2 REF: 011707aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

513 ANS:

$\csc \theta = \frac{1}{\sin \theta}$ , and  $\sin \theta$  on a unit circle represents the  $y$  value of a point on the unit circle. Since  $y = \sin \theta$ ,

$$\csc \theta = \frac{1}{y}.$$

PTS: 2 REF: 011727aii NAT: F.TF.A.2 TOP: Reciprocal Trigonometric Relationships

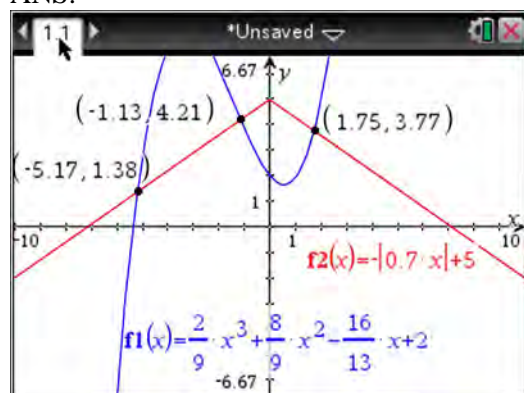
514 ANS: 3

The graph shows three real zeros, and has end behavior matching the given end behavior.

PTS: 2 REF: 061604aii NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

KEY: bimodalgraph

515 ANS:



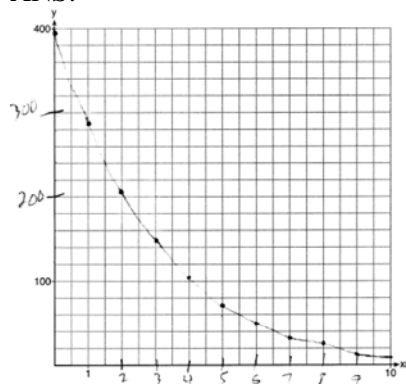
PTS: 2

REF: fall1510aai

NAT: A.REI.D.11

TOP: Other Systems

516 ANS:



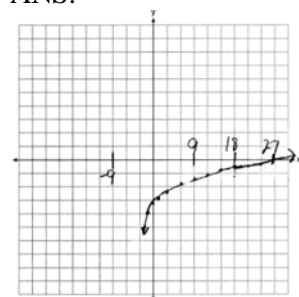
PTS: 2

REF: 061729aai

NAT: F.IF.C.7

TOP: Graphing Exponential Functions

517 ANS:

As  $x \rightarrow -3, y \rightarrow -\infty$ . As  $x \rightarrow \infty, y \rightarrow \infty$ .

PTS: 4

REF: 061735aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

518 ANS: 3

Self selection causes bias.

PTS: 2

REF: 061703aai

NAT: S.IC.B.3

TOP: Analysis of Data

KEY: bias

519 ANS: 3

$$(3k - 2i)^2 = 9k^2 - 12ki + 4i^2 = 9k^2 - 12ki - 4$$

PTS: 2

REF: 081702aai

NAT: N.CN.A.2

TOP: Operations with Complex Numbers

520 ANS:

$$\frac{3p}{p-5} = \frac{p+2}{p+3}$$

$$3p^2 + 9p = p^2 - 3p - 10$$

$$2p^2 + 12p + 10 = 0$$

$$p^2 + 6p + 5 = 0$$

$$(p+5)(p+1) = 0$$

$$p = -5, -1$$

PTS: 4 REF: 081733aii NAT: A.REI.A.2 TOP: Solving Rationals  
KEY: rational solutions

521 ANS:

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$   $A$  and  $B$  are independent since  $P(A \cap B) = P(A) \cdot P(B)$

$$0.8 = 0.6 + 0.5 - P(A \cap B)$$

$$0.3 = 0.6 \cdot 0.5$$

$$P(A \cap B) = 0.3$$

$$0.3 = 0.3$$

PTS: 2 REF: 081632aii NAT: S.CP.A.2 TOP: Probability of Compound Events  
KEY: independence

522 ANS:

$$(2xi^3 - 3y)^2 = 4x^2i^6 - 12xyi^3 + 9y^2 = -4x^2 + 12xyi + 9y^2$$

PTS: 2 REF: 012431aii NAT: N.CN.A.2 TOP: Operations with Complex Numbers

523 ANS:



69

PTS: 2 REF: 061726aii NAT: S.ID.A.4 TOP: Normal Distributions  
KEY: percent

524 ANS: 3

$$d = 10 \log \frac{6.3 \times 10^{-3}}{1.0 \times 10^{-12}} \approx 98$$

PTS: 2 REF: 011715aii NAT: F.IF.B.4 TOP: Evaluating Logarithmic Expressions

525 ANS:

$$20000 = PMT \left( \frac{1 - (1 + 0.00625)^{-60}}{0.00625} \right) \quad 21000 - x = 300 \left( \frac{1 - (1 + 0.00625)^{-60}}{0.00625} \right)$$

$$PMT \approx 400.76$$

$$x \approx 6028$$

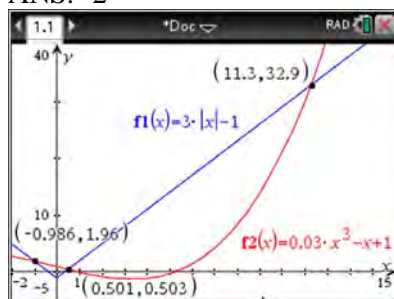
PTS: 4

REF: 011736aai

NAT: F.IF.B.4

TOP: Evaluating Exponential Expressions

526 ANS: 2



PTS: 2

REF: 061705aai

NAT: A.REI.D.11

TOP: Other Systems

527 ANS: 4

The vertex is (1,0) and  $p = 2$ .  $y = \frac{1}{4(2)}(x-1)^2 + 0$

PTS: 2

REF: 061717aai

NAT: G.GPE.A.2

TOP: Graphing Quadratic Functions

528 ANS:

$A(t) = 100(0.5)^{\frac{t}{63}}$ , where  $t$  is time in years, and  $A(t)$  is the amount of titanium-44 left after  $t$  years.

$\frac{A(10) - A(0)}{10 - 0} = \frac{89.58132 - 100}{10} = -1.041868$  The estimated mass at  $t = 40$  is  $100 - 40(-1.041868) \approx 58.3$ . The

actual mass is  $A(40) = 100(0.5)^{\frac{40}{63}} \approx 64.3976$ . The estimated mass is less than the actual mass.

PTS: 6

REF: fall1517aai

NAT: F.LE.A.2

TOP: Modeling Exponential Functions

529 ANS: 3

$f(x) = -f(x)$ , so  $f(x)$  is odd.  $g(-x) \neq g(x)$ , so  $g(x)$  is not even.  $g(-x) \neq -g(x)$ , so  $g(x)$  is not odd.  $h(-x) = h(x)$ , so  $h(x)$  is even.

PTS: 2

REF: fall1502aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

530 ANS: 1



PTS: 2 REF: 081711aia NAT: S.ID.A.4 TOP: Normal Distributions  
 KEY: percent

531 ANS: 2

$B(t) = 750 \left( 1.16^{\frac{1}{12}} \right)^{12t} \approx 750(1.012)^{12t}$   $B(t) = 750 \left( 1 + \frac{0.16}{12} \right)^{12t}$  is wrong, because the growth is an annual rate that is not compounded monthly.

PTS: 2 REF: spr1504aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

532 ANS: 3

$$\frac{f(7) - f(-7)}{7 - (-7)} = \frac{2^{-0.25(7)} \cdot \sin\left(\frac{\pi}{2}(7)\right) - 2^{-0.25(-7)} \cdot \sin\left(\frac{\pi}{2}(-7)\right)}{14} \approx -0.26$$

PTS: 2 REF: 061721aia NAT: F.IF.B.6 TOP: Rate of Change

533 ANS:

$$\sqrt{x-4} = -x+6 \quad \sqrt{x-4} = -8+6 = -2 \text{ is extraneous.}$$

$$x-4 = x^2 - 12x + 36$$

$$0 = x^2 - 13x + 40$$

$$0 = (x-8)(x-5)$$

$$x = 5, 8$$

PTS: 2 REF: 061730aia NAT: A.REI.A.2 TOP: Solving Radicals  
 KEY: extraneous solutions

534 ANS: 1  
 $8(2^{x+3}) = 48$

$$2^{x+3} = 6$$

$$(x+3)\ln 2 = \ln 6$$

$$x+3 = \frac{\ln 6}{\ln 2}$$

$$x = \frac{\ln 6}{\ln 2} - 3$$

PTS: 2 REF: 061702aai NAT: F.LE.A.4 TOP: Exponential Equations  
 KEY: without common base

535 ANS:  
 period is  $\frac{2}{3}$ . The wheel rotates once every  $\frac{2}{3}$  second.

PTS: 2 REF: 061728aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions  
 KEY: period

536 ANS: 2  
 $h(x)$  does not have a  $y$ -intercept.

PTS: 2 REF: 011719aai NAT: F.IF.C.9 TOP: Comparing Functions

537 ANS: 1  
 $\frac{A}{P} = e^{rt}$

$$0.42 = e^{rt}$$

$$\ln 0.42 = \ln e^{rt}$$

$$-0.87 \approx rt$$

PTS: 2 REF: 011723aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

538 ANS:  
 $M = 172600 \cdot \frac{0.00305(1 + 0.00305)^{12 \cdot 15}}{(1 + 0.00305)^{12 \cdot 15} - 1} \approx 1247$       $1100 = (172600 - x) \cdot \frac{0.00305(1 + 0.00305)^{12 \cdot 15}}{(1 + 0.00305)^{12 \cdot 15} - 1}$

$$1100 \approx (172600 - x) \cdot (0.007228)$$

$$152193 \approx 172600 - x$$

$$20407 \approx x$$

PTS: 4 REF: 061734aai NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions



539 ANS: 1

$$(x+3)^2 + (2x-4)^2 = 8 \quad b^2 - 4ac$$

$$x^2 + 6x + 9 + 4x^2 - 16x + 16 = 8 \quad 100 - 4(5)(17) < 0$$

$$5x^2 - 10x + 17 = 0$$

PTS: 2 REF: 081719aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

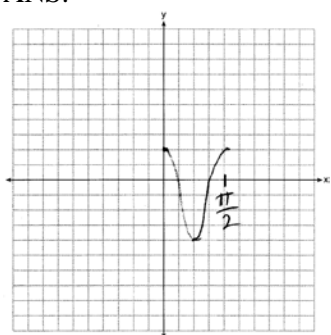
540 ANS: 3

(3) repeats 3 times over  $2\pi$ .

PTS: 2 REF: 011722aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: recognize | bimodalgraph

541 ANS:



PTS: 2 REF: 061628aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

542 ANS:

Yes. The margin of error from this simulation indicates that 95% of the observations fall within  $\pm 0.12$  of the simulated proportion, 0.25. The margin of error can be estimated by multiplying the standard deviation, shown to

be 0.06 in the dotplot, by 2, or applying the estimated standard error formula,  $\left( \sqrt{\frac{p(1-p)}{n}} \right)$  or  $\left( \sqrt{\frac{(0.25)(0.75)}{50}} \right)$

and multiplying by 2. The interval  $0.25 \pm 0.12$  includes plausible values for the true proportion of people who prefer Stephen's new product. The company has evidence that the population proportion could be at least 25%. As seen in the dotplot, it can be expected to obtain a sample proportion of 0.18 (9 out of 50) or less several times, even when the population proportion is 0.25, due to sampling variability. Given this information, the results of the survey do not provide enough evidence to suggest that the true proportion is not at least 0.25, so the development of the product should continue at this time.

PTS: 4 REF: spr1512aai NAT: S.IC.B.4 TOP: Analysis of Data

543 ANS: 2

Combining (1) and (3):  $-6c = -18$  Combining (1) and (2):  $5a + 3c = -1$  Using (3):  $-(-2) - 5b - 5(3) = 2$ 

$$c = 3$$

$$5a + 3(3) = -1$$

$$2 - 5b - 15 = 2$$

$$5a = -10$$

$$b = -3$$

$$a = -2$$

PTS: 2 REF: 081623aia NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

544 ANS: 2



PTS: 2 REF: 081603aia NAT: A.REI.D.11 TOP: Other Systems

545 ANS:

$$(1-i)(1-i)(1-i) = (1-2i+i^2)(1-i) = -2i(1-i) = -2i+2i^2 = -2-2i$$

PTS: 2 REF: 011725aia NAT: N.CN.A.2 TOP: Operations with Complex Numbers

546 ANS: 3

Since  $x + 4$  is a factor of  $p(x)$ , there is no remainder.

PTS: 2 REF: 081621aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

547 ANS:

$$a_1 = 4 \quad a_8 = 639$$

$$a_n = 2a_{n-1} + 1$$

PTS: 2 REF: 081729aia NAT: F.BF.A.1 TOP: Sequences

KEY: recursive

548 ANS: 3

$$\frac{1}{J} = \frac{1}{F} - \frac{1}{W}$$

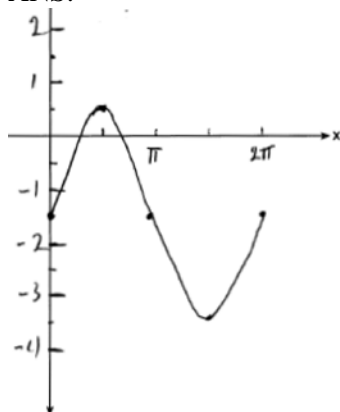
$$\frac{1}{J} = \frac{W-F}{FW}$$

$$J = \frac{FW}{W-F}$$

PTS: 2 REF: 081617aia NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

549 ANS:

Part a sketch is shifted  $\frac{\pi}{3}$  units right.

PTS: 4 REF: 081735aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

550 ANS: 1

$$\frac{157}{25 + 47 + 157}$$

PTS: 2 REF: 081607aai NAT: S.CP.A.4 TOP: Conditional Probability

551 ANS: 4

	Bar Harbor	Phoenix
<b>Minimum</b>	31.386	66.491
<b>Midline</b>	55.3	86.729
<b>Maximum</b>	79.214	106.967
<b>Range</b>	47.828	40.476

PTS: 2 REF: 061715aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

KEY: maximum/minimum

552 ANS:

Applying the commutative property,  $\left(3^{\frac{1}{5}}\right)^2$  can be rewritten as  $\left(3^2\right)^{\frac{1}{5}}$  or  $9^{\frac{1}{5}}$ . A fractional exponent can be

rewritten as a radical with the denominator as the index, or  $9^{\frac{1}{5}} = \sqrt[5]{9}$ .

PTS: 2 REF: 081626aai NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

553 ANS: 3

$$\left(\frac{1}{2}\right)^{\frac{1}{73.83}} \approx 0.990656$$

PTS: 2 REF: 081710aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

554 ANS:

$$\frac{306.25 - 156.25}{70 - 50} = \frac{150}{20} = 7.5 \text{ Between 50-70 mph, each additional mph in speed requires 7.5 more feet to stop.}$$

PTS: 2 REF: 081631aai NAT: F.IF.B.6 TOP: Rate of Change

555 ANS: 4

$$4x^2 = -98$$

$$x^2 = -\frac{98}{4}$$

$$x^2 = -\frac{49}{2}$$

$$x = \pm \sqrt{-\frac{49}{2}} = \pm \frac{7i}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \pm \frac{7i\sqrt{2}}{2}$$

PTS: 2 REF: 061707aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | taking square roots

556 ANS: 1

$$2x - 1 \overline{) \begin{array}{r} 2x^2 + x + 5 \\ 4x^3 + 0x^2 + 9x - 5 \end{array}}$$

$$\underline{4x^3 - 2x^2}$$

$$2x^2 + 9x$$

$$\underline{2x^2 - x}$$

$$10x - 5$$

$$\underline{10x - 5}$$

PTS: 2 REF: 081713aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

557 ANS: 4

$$\frac{m(c)}{g(c)} = \frac{c+1}{1-c^2} = \frac{c+1}{(1+c)(1-c)} = \frac{1}{1-c}$$

PTS: 2 REF: 061608aai NAT: F.BF.A.1 TOP: Operations with Functions

558 ANS: 4

$$\left( \frac{-54x^9}{y^4} \right)^{\frac{2}{3}} = \frac{(2 \cdot -27)^{\frac{2}{3}} x^{\frac{18}{3}}}{y^{\frac{8}{3}}} = \frac{2^{\frac{2}{3}} \cdot 9x^6}{y^2 \cdot y^{\frac{2}{3}}} = \frac{9x^6 \sqrt[3]{4}}{y^2 \sqrt[3]{y^2}}$$

PTS: 2 REF: 081723aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

559 ANS: 3

$$\log_{0.8} \left( \frac{V}{17000} \right) = t \quad \frac{17,000(0.8)^3 - 17,000(0.8)^1}{3-1} \approx -2450$$

$$0.8^t = \frac{V}{17000}$$

$$V = 17000(0.8)^t$$

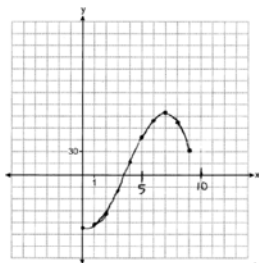
PTS: 2

REF: 081709aai

NAT: F.IF.B.6

TOP: Rate of Change

560 ANS:



(7,78) If 7000 sweatshirts are sold, the profit is \$78,000. 3,549, because that is when  $p(x)$  is first greater than 0.

PTS: 6

REF: 012437aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

561 ANS: 3

$$x^2 + 2x + 1 = -5 + 1$$

$$(x + 1)^2 = -4$$

$$x + 1 = \pm 2i$$

$$x = -1 \pm 2i$$

PTS: 2

REF: 081703aai

NAT: A.REI.B.4

TOP: Solving Quadratics

KEY: complex solutions | completing the square

562 ANS: 4

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(6)(29)}}{2(6)} = \frac{8 \pm \sqrt{-632}}{12} = \frac{8 \pm i\sqrt{4}\sqrt{158}}{12} = \frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$$

PTS: 2

REF: 011711aai

NAT: A.REI.B.4

TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

563 ANS: 4

PTS: 2

REF: 081718aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions KEY: amplitude

564 ANS: 4

$$m^5 + m^3 - 6m = m(m^4 + m^2 - 6) = m(m^2 + 3)(m^2 - 2)$$

PTS: 2

REF: 011703aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

KEY: higher power

565 ANS: 2

$$\cos \theta = \pm \sqrt{1 - \left(\frac{-\sqrt{2}}{5}\right)^2} = \pm \sqrt{\frac{25}{25} - \frac{2}{25}} = \pm \frac{\sqrt{23}}{5}$$

PTS: 2

REF: 061712aai

NAT: F.TF.C.8

TOP: Determining Trigonometric Functions

566 ANS: 1

$$P(28) = 5(2)^{\frac{98}{28}} \approx 56$$

PTS: 2

REF: 011702aai

NAT: F.LE.A.2

TOP: Modeling Exponential Functions

567 ANS: 3



PTS: 2

REF: 081604aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: probability

568 ANS: 3

$$1.0525^{\frac{1}{12}} \approx 1.00427$$

PTS: 2

REF: 061621aai

NAT: F.BF.A.1

TOP: Modeling Exponential Functions

569 ANS: 2

$$ME = \left( z \sqrt{\frac{p(1-p)}{n}} \right) = \left( 1.96 \sqrt{\frac{(0.55)(0.45)}{900}} \right) \approx 0.03 \text{ or } \frac{1}{\sqrt{900}} \approx 0.03$$

PTS: 2

REF: 081612aai

NAT: S.IC.B.4

TOP: Analysis of Data

570 ANS:

A student is more likely to jog if both siblings jog. 1 jogs:  $\frac{416}{2239} \approx 0.19$ . both jog:  $\frac{400}{1780} \approx 0.22$

PTS: 2

REF: 061732aai

NAT: S.CP.A.4

TOP: Conditional Probability

571 ANS: 2

The vertex of the parabola is  $(0,0)$ . The distance,  $p$ , between the vertex and the focus or the vertex and the

directrix is 1.  $y = \frac{-1}{4p}(x-h)^2 + k$

$$y = \frac{-1}{4(1)}(x-0)^2 + 0$$

$$y = -\frac{1}{4}x^2$$

PTS: 2 REF: 081706aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

572 ANS:

$$x^2(4x-1) + 4(4x-1) = (x^2+4)(4x-1)$$

PTS: 2 REF: 061727aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

573 ANS:

Amplitude, because the height of the graph shows the volume of the air.

PTS: 2 REF: 081625aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: mixed

574 ANS:

$$S_n = \frac{33000 - 33000(1.04)^n}{1 - 1.04} \quad S_{15} = \frac{33000 - 33000(1.04)^{15}}{1 - 1.04} \approx 660778.39$$

PTS: 4 REF: 061634aai NAT: A.SSE.B.4 TOP: Series

KEY: geometric

575 ANS: 4 PTS: 2 REF: 081624aai NAT: F.BF.A.2

TOP: Sequences

576 ANS: 4 PTS: 2 REF: 081622aai NAT: F.BF.A.1

TOP: Modeling Exponential Functions

577 ANS: 4

$$(1) \frac{B(60) - B(10)}{60 - 10} \approx 28\% \quad (2) \frac{B(69) - B(19)}{69 - 19} \approx 33\% \quad (3) \frac{B(72) - B(36)}{72 - 36} \approx 38\% \quad (4) \frac{B(73) - B(60)}{73 - 60} \approx 46\%$$

PTS: 2 REF: 011721aai NAT: F.IF.B.6 TOP: Rate of Change

578 ANS: 1

The car lost approximately 19% of its value each year.

PTS: 2 REF: 081613aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions

579 ANS:

$$\left(x^{\frac{5}{3}}\right)^{\frac{6}{5}} = \left(y^{\frac{5}{6}}\right)^{\frac{6}{5}}$$

$$x^2 = y$$

PTS: 2 REF: 011730aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents  
KEY: variables

580 ANS:

$$0 = 6(-5)^3 + b(-5)^2 - 52(-5) + 15 \quad z(x) = 6x^3 + 19x^2 - 52x + 15$$

$$0 = -750 + 25b + 260 + 15$$

$$475 = 25b$$

$$19 = b$$

$$\begin{array}{r|rrrr} -5 & 6 & 19 & -52 & 15 \\ & & -30 & 55 & 15 \\ \hline & 6 & -11 & 3 & 0 \end{array}$$

$$6x^2 - 11x + 3 = 0$$

$$(2x - 3)(3x - 1) = 0$$

$$x = \frac{3}{2}, \frac{1}{3}, -5$$

PTS: 4 REF: fall1515aai NAT: A.APR.B.3 TOP: Solving Polynomial Equations

581 ANS:

sample: pails of oranges; population: truckload of oranges. It is likely that about 5% of all the oranges are unsatisfactory.

PTS: 2 REF: 011726aai NAT: S.IC.A.2 TOP: Analysis of Data

582 ANS:

$$2x^3 - 10x^2 + 11x - 7 = 2x^3 + hx^2 + 3x - 8x^2 - 4hx - 12 + k \quad h = -2$$

$$-2x^2 + 8x + 5 = hx^2 - 4hx + k \quad k = 5$$

PTS: 4 REF: 011733aai NAT: A.APR.C.4 TOP: Polynomial Identities

583 ANS: 4

$$d = 32(.8)^{b-1} \quad S_n = \frac{32 - 32(.8)^{12}}{1 - .8} \approx 149$$

PTS: 2 REF: 081721aai NAT: A.SSE.B.4 TOP: Series  
KEY: geometric



584 ANS:  
 $0.602 \pm 2 \cdot 0.066 = 0.47 - 0.73$ . Since 0.50 falls within the 95% interval, this supports the concern there may be an even split.

PTS: 4 REF: 061635aai NAT: S.IC.B.5 TOP: Analysis of Data

585 ANS:

$$0 = \sqrt{t} - 2t + 6 \quad 2\left(\frac{9}{4}\right) - 6 < 0, \text{ so } \frac{9}{4} \text{ is extraneous.}$$

$$2t - 6 = \sqrt{t}$$

$$4t^2 - 24t + 36 = t$$

$$4t^2 - 25t + 36 = 0$$

$$(4t - 9)(t - 4) = 0$$

$$t = \frac{9}{4}, 4$$

$$(\sqrt{1} - 2(1) + 6) - (\sqrt{3} - 2(3) + 6) = 5 - \sqrt{3} \approx 3.268 \quad 327 \text{ mph}$$

PTS: 6 REF: 011737aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: context

586 ANS:

Let  $x$  equal the first integer and  $x + 1$  equal the next.  $(x + 1)^2 - x^2 = x^2 + 2x + 1 - x^2 = 2x + 1$ .  $2x + 1$  is an odd integer.

PTS: 2 REF: fall1511aai NAT: A.APR.C.4 TOP: Polynomial Identities

587 ANS: 2

$$\begin{array}{r} x^2 + 0x + 1 \\ x + 2 \overline{) x^3 + 2x^2 + x + 6} \end{array}$$

$$\underline{x^3 + 2x^2}$$

$$0x^2 + x$$

$$\underline{0x^2 + 0x}$$

$$x + 6$$

$$\underline{x + 2}$$

$$4$$

PTS: 2 REF: 081611aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

588 ANS: 3 PTS: 2 REF: 011710aai NAT: F.BF.A.1

TOP: Operations with Functions

589 ANS:

$$\sin^2 \theta + (-0.7)^2 = 1 \quad \text{Since } \theta \text{ is in Quadrant II, } \sin \theta = \sqrt{.51} \text{ and } \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\sqrt{.51}}{-0.7} \approx -1.02$$

$$\sin^2 \theta = .51$$

$$\sin \theta = \pm \sqrt{.51}$$

PTS: 2 REF: 081628aii NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

590 ANS:

$$A = Pe^{rt}$$

$$135000 = 100000e^{5r}$$

$$1.35 = e^{5r}$$

$$\ln 1.35 = \ln e^{5r}$$

$$\ln 1.35 = 5r$$

$$.06 \approx r \text{ or } 6\%$$

PTS: 2 REF: 061632aii NAT: F.LE.A.4 TOP: Exponential Growth

591 ANS:

$$7 = 20(0.5)^{\frac{t}{8.02}}$$

$$\log 0.35 = \log 0.5^{\frac{t}{8.02}}$$

$$\log 0.35 = \frac{t \log 0.5}{8.02}$$

$$\frac{8.02 \log 0.35}{\log 0.5} = t$$

$$t \approx 12$$

PTS: 4 REF: 081634aii NAT: F.LE.A.4 TOP: Exponential Decay

592 ANS:

$$\sqrt[3]{x} \cdot \sqrt{x} = x^{\frac{1}{3}} \cdot x^{\frac{1}{2}} = x^{\frac{2}{6}} \cdot x^{\frac{3}{6}} = x^{\frac{5}{6}}$$

PTS: 2 REF: 061731aii NAT: N.RN.A.2 TOP: Operations with Radicals  
KEY: with variables, index > 2

593 ANS: 3 PTS: 2 REF: 061710aii NAT: S.IC.A.2

TOP: Analysis of Data

594 ANS: 3

$$-2\left(-\frac{1}{2}x^2 = -6x + 20\right)$$

$$x^2 - 12x = -40$$

$$x^2 - 12x + 36 = -40 + 36$$

$$(x - 6)^2 = -4$$

$$x - 6 = \pm 2i$$

$$x = 6 \pm 2i$$

PTS: 2 REF: fall1504aii NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

595 ANS: 3

$$(m - 2)^2(m + 3) = (m^2 - 4m + 4)(m + 3) = m^3 + 3m^2 - 4m^2 - 12m + 4m + 12 = m^3 - m^2 - 8m + 12$$

PTS: 2 REF: 081605aii NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

596 ANS:

$$\text{normcdf}(510, 540, 480, 24) = 0.0994 \quad z = \frac{510 - 480}{24} = 1.25 \quad 1.25 = \frac{x - 510}{20} \quad 2.5 = \frac{x - 510}{20} \quad 535-560$$

$$z = \frac{540 - 480}{24} = 2.5 \quad x = 535 \quad x = 560$$

PTS: 4 REF: fall1516aii NAT: S.ID.A.4 TOP: Normal Distributions

KEY: probability

597 ANS: 2

The events are independent because  $P(A \text{ and } B) = P(A) \cdot P(B)$ .

$$0.125 = 0.5 \cdot 0.25$$

If  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = 0.25 + 0.5 - .125 = 0.625$ , then the events are not mutually exclusive because  $P(A \text{ or } B) = P(A) + P(B)$ 

$$0.625 \neq 0.5 + 0.25$$

PTS: 2 REF: 061714aii NAT: S.CP.B.7 TOP: Theoretical Probability

598 ANS: 1

The zeros of the polynomial are at  $-b$ , and  $c$ . The sketch of a polynomial of degree 3 with a negative leading coefficient should have end behavior showing as  $x$  goes to negative infinity,  $f(x)$  goes to positive infinity. The multiplicities of the roots are correctly represented in the graph.

PTS: 2 REF: spr1501aii NAT: A.APR.B.3 TOP: Graphing Polynomial Functions

KEY: bimodalgraph

599 ANS: 3

PTS: 2

REF: 081618aii

NAT: F.BF.A.2

TOP: Sequences

600 ANS:

$$A(t) = 4000 \left( 1 + \frac{2.4\%}{12} \right)^{12t} \quad B(t) = 3500 \left( 1 + \frac{4\%}{4} \right)^{4t} \quad 8.4, \text{ the value of } t \text{ for which } A(t) = B(t)$$

PTS: 4 REF: 012435aia NAT: A.REI.D.11 TOP: Other Systems

601 ANS:

$$0 < e^{\frac{\ln \frac{1}{2}}{1590}} < 1, \text{ so } M(t) \text{ represents decay.}$$

PTS: 2 REF: 011728aia NAT: F.IF.C.7 TOP: Graphing Exponential Functions

602 ANS:

$$\frac{V(7) - V(2)}{7 - 2} \approx 48$$

PTS: 2 REF: 012427aia NAT: F.IF.B.6 TOP: Rate of Change

603 ANS: 1

$$\begin{aligned} 1) \text{ let } y = x + 2, \text{ then } y^2 + 2y - 8 \\ (y + 4)(y - 2) \\ (x + 2 + 4)(x + 2 - 2) \\ (x + 6)x \end{aligned}$$

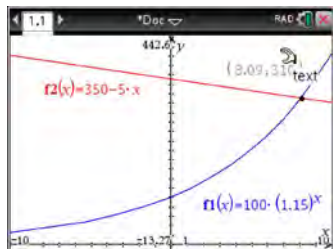
PTS: 2 REF: 081715aia NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: multivariable

604 ANS: 1 PTS: 2 REF: 061708aia NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

605 ANS: 2



PTS: 2 REF: 011716aia NAT: A.REI.D.11 TOP: Other Systems

606 ANS:

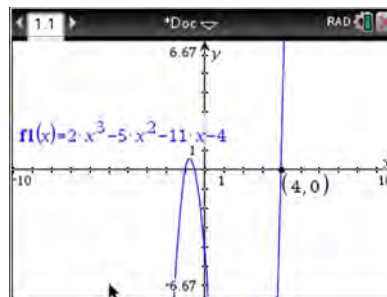
Randomly assign participants to two groups. One group uses the toothpaste with ingredient X and the other group uses the toothpaste without ingredient X.

PTS: 2 REF: 061626aia NAT: S.IC.B.3 TOP: Analysis of Data

KEY: type

607 ANS:

$f(4) = 2(4)^3 - 5(4)^2 - 11(4) - 4 = 128 - 80 - 44 - 4 = 0$  Any method that demonstrates 4 is a zero of  $f(x)$  confirms



that  $x - 4$  is a factor, as suggested by the Remainder Theorem.

PTS: 2

REF: spr1507aii

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

608 ANS: 3

$\sqrt{56-x} = x$                        $-8$  is extraneous.

$$56 - x = x^2$$

$$0 = x^2 + x - 56$$

$$0 = (x + 8)(x - 7)$$

$$x = 7$$

PTS: 2

REF: 061605aii

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

609 ANS: 3

The pattern suggests an exponential pattern, not linear or sinusoidal. A 4% growth rate is accurate, while a 43% growth rate is not.

PTS: 2

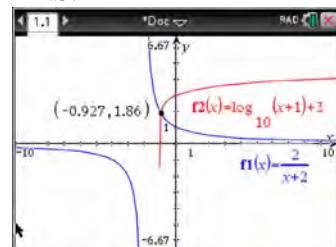
REF: 011713aii

NAT: S.ID.B.6

TOP: Regression

KEY: choose model

610 ANS: 2



PTS: 2

REF: 011712aii

NAT: A.REI.D.11

TOP: Other Systems

611 ANS:

$$y = 4.168(3.981)^x \quad 100 = 4.168(3.981)^x$$

$$\log \frac{100}{4.168} = \log(3.981)^x$$

$$\log \frac{100}{4.168} = x \log(3.981)$$

$$\frac{\log \frac{100}{4.168}}{\log(3.981)} = x$$

$$x \approx 2.25$$

PTS: 4

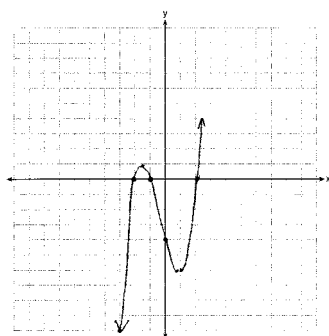
REF: 081736aai

NAT: S.ID.B.6

TOP: Regression

KEY: exponential

612 ANS:



$$0 = x^2(x+1) - 4(x+1)$$

$$0 = (x^2 - 4)(x+1)$$

$$0 = (x+2)(x-2)(x+1)$$

$$x = -2, -1, 2$$

PTS: 4

REF: 081633aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

613 ANS: 3

$$0.75^{\frac{1}{10}} \approx .9716$$

PTS: 2

REF: 061713aai

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

614 ANS:

$$\begin{aligned} (\sqrt{2x-7})^2 &= (5-x)^2 & \sqrt{2(4)-7}+4=5 & \sqrt{2(8)-7}+8=5 \\ 2x-7 &= 25-10x+x^2 & \sqrt{1} &= 1 & \sqrt{9} &\neq -3 \\ 0 &= x^2-12x+32 \\ 0 &= (x-8)(x-4) \\ x &= 4,8 \end{aligned}$$

PTS: 4 REF: 081635aai NAT: A.REI.A.2 TOP: Solving Radicals  
KEY: extraneous solutions

615 ANS:

Rewrite  $\frac{4}{3}$  as  $\frac{1}{3} \cdot \frac{4}{1}$ , using the power of a power rule.

PTS: 2 REF: 081725aai NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

616 ANS:

Some of the students who did not drink energy drinks read faster than those who did drink energy drinks.

$17.7 - 19.1 = -1.4$  Differences of -1.4 and less occur  $\frac{25}{232}$  or about 10% of the time, so the difference is not unusual.

PTS: 4 REF: 081636aai NAT: S.IC.B.5 TOP: Analysis of Data

617 ANS:

$\frac{3+42}{1500} = 3\%$   $\frac{3}{3+12} = 20\%$  No, because a person is more likely to be allergic milk if he is also allergic to nuts.

PTS: 4 REF: 012433aai NAT: S.CP.A.4 TOP: Conditional Probability

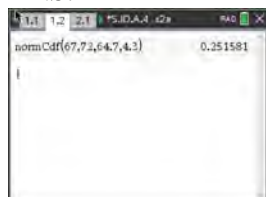
618 ANS:

Based on these data, the two events do not appear to be independent.  $P(F) = \frac{106}{200} = 0.53$ , while

$P(F|T) = \frac{54}{90} = 0.6$ ,  $P(F|R) = \frac{25}{65} = 0.39$ , and  $P(F|C) = \frac{27}{45} = 0.6$ . The probability of being female are not the same as the conditional probabilities. This suggests that the events are not independent.

PTS: 2 REF: fall1508aai NAT: S.CP.A.4 TOP: Conditional Probability

619 ANS:



25

PTS: 2 REF: 012429aai NAT: S.ID.A.4 TOP: Normal Distributions  
KEY: percent

620 ANS: 1

$$\frac{2x}{x-2} \left( \frac{x}{x} \right) - \frac{11}{x} \left( \frac{x-2}{x-2} \right) = \frac{8}{x^2 - 2x}$$

$$2x^2 - 11x + 22 = 8$$

$$2x^2 - 11x + 14 = 0$$

$$(2x - 7)(x - 2) = 0$$

$$x = \frac{7}{2}, 2$$

PTS: 2 REF: 061719aai NAT: A.REI.A.2 TOP: Solving Rationals

621 ANS:

Using a 95% level of confidence,  $x \pm 2$  standard deviations sets the usual wait time as 150-302 seconds. 360 seconds is unusual.

PTS: 2 REF: 081629aai NAT: S.IC.B.6 TOP: Analysis of Data

622 ANS:

$$\frac{6.25 - 2.25}{21 - 5} = \frac{4}{16} = \$0.25 \text{ fine per day. } 2.25 - 5(.25) = \$1 \text{ replacement fee. } a_n = 1.25 + (n - 1)(.25). a_{60} = \$16$$

PTS: 4 REF: 081734aai NAT: F.BF.A.1 TOP: Sequences

KEY: explicit

623 ANS: 1

II. Ninth graders drive to school less often; III. Students know little about adults; IV. Calculus students love math!

PTS: 2 REF: 081602aai NAT: S.IC.B.3 TOP: Analysis of Data

KEY: bias

624 ANS: 4 PTS: 2 REF: 061706aai NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

625 ANS: 4 PTS: 2 REF: 061601aai NAT: N.RN.A.2

TOP: Radicals and Rational Exponents KEY: variables

626 ANS: 3 PTS: 2 REF: 061607aai NAT: S.IC.A.2

TOP: Analysis of Data

627 ANS:

$$P(W/D) = \frac{P(W \wedge D)}{P(D)} = \frac{.4}{.5} = .8$$

PTS: 2 REF: 081726aai NAT: S.CP.B.6 TOP: Conditional Probability

628 ANS: 4 PTS: 2 REF: 081707aai NAT: F.TF.A.2

TOP: Reference Angles KEY: bimodalgraph



629 ANS: 4

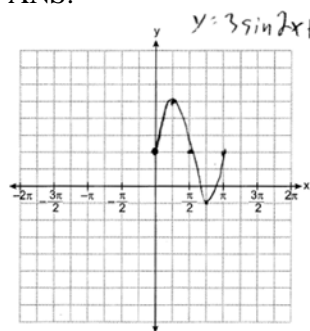
$$4(x^2 - 6x + 9) + 4(y^2 + 18y + 81) = 76 + 36 + 324$$

$$4(x - 3)^2 + 4(y + 9)^2 = 436$$

PTS: 2 REF: 061619aai NAT: G.GPE.A.1 TOP: Equations of Circles

KEY: completing the square

630 ANS:



$$0 < x < \frac{\pi}{4}$$

PTS: 4 REF: 012436aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

631 ANS: 2

$$x = \frac{y+1}{y-2}$$

$$xy - 2x = y + 1$$

$$xy - y = 2x + 1$$

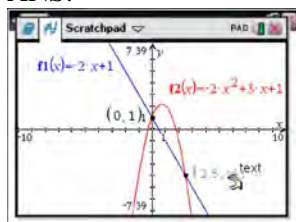
$$y(x - 1) = 2x + 1$$

$$y = \frac{2x+1}{x-1}$$

PTS: 2 REF: 081714aai NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: rational

632 ANS:



$$-2x + 1 = -2x^2 + 3x + 1$$

$$2x^2 - 5x = 0$$

$$x(2x - 5) = 0$$

$$x = 0, \frac{5}{2}$$

PTS: 2 REF: fall1507aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

633 ANS:

$0.506 \pm 2 \cdot 0.078 = 0.35 - 0.66$ . The 32.5% value falls below the 95% confidence level.

PTS: 4 REF: 061736aai NAT: S.IC.B.5 TOP: Analysis of Data

634 ANS:

$0 = \log_{10}(x - 4)$  The  $x$ -intercept of  $h$  is  $(2, 0)$ .  $f$  has the larger value.

$$10^0 = x - 4$$

$$1 = x - 4$$

$$x = 5$$

PTS: 2 REF: 081630aai NAT: F.IF.C.9 TOP: Comparing Functions

635 ANS:

$$xi(-6i)^2 = xi(36i^2) = 36xi^3 = -36xi$$

PTS: 2 REF: 081627aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

636 ANS:

$$x = (y - 3)^3 + 1$$

$$x - 1 = (y - 3)^3$$

$$\sqrt[3]{x - 1} = y - 3$$

$$\sqrt[3]{x - 1} + 3 = y$$

$$f^{-1}(x) = \sqrt[3]{x - 1} + 3$$

PTS: 2 REF: fall1509aai NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: polynomial

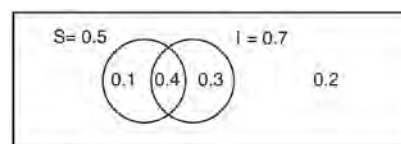
637 ANS:

$$a_n = x^{n-1}(x+1) \quad x^{n-1} = 0 \quad x+1 = 0$$

$$x = 0 \quad x = -1$$

PTS: 4 REF: spr1511aii NAT: F.BF.A.2 TOP: Sequences

638 ANS:



This scenario can be modeled with a Venn Diagram: Since  $P(S \cup I) = 0.2$ ,  $P(S \cup I) = 0.8$ . Then,  $P(S \cap I) = P(S) + P(I) - P(S \cup I)$  If  $S$  and  $I$  are independent, then the

$$= 0.5 + 0.7 - 0.8$$

$$= 0.4$$

Product Rule must be satisfied. However,  $(0.5)(0.7) \neq 0.4$ . Therefore, salary and insurance have not been treated independently.

PTS: 4 REF: spr1513aii NAT: S.CP.A.2 TOP: Probability of Compound Events  
KEY: independence

639 ANS: 2

$$\frac{212}{1334} \approx .16 \quad ME = \left( z \sqrt{\frac{p(1-p)}{n}} \right) = \left( 1.96 \sqrt{\frac{(0.16)(0.84)}{1334}} \right) \approx 0.02 \quad \text{or} \quad \frac{1}{\sqrt{1334}} \approx .027$$

PTS: 2 REF: 081716aii NAT: S.IC.B.4 TOP: Analysis of Data

640 ANS: 2

$$\sqrt{x+14} = \sqrt{2x+5} + 1 \quad \sqrt{22+14} - \sqrt{2(22)+5} = 1$$

$$x+14 = 2x+5+2\sqrt{2x+5}+1 \quad 6-7 \neq 1$$

$$-x+8 = 2\sqrt{2x+5}$$

$$x^2 - 16x + 64 = 8x + 20$$

$$x^2 - 24x + 44 = 0$$

$$(x-22)(x-2) = 0$$

$$x = 2, 22$$

PTS: 2 REF: 081704aii NAT: A.REI.A.2 TOP: Solving Radicals  
KEY: advanced

641 ANS: 1

$$(1) \frac{9-0}{2-1} = 9 \quad (2) \frac{17-0}{3.5-1} = 6.8 \quad (3) \frac{0-0}{5-1} = 0 \quad (4) \frac{17--5}{3.5-1} \approx 6.3$$

PTS: 2 REF: 011724aii NAT: F.IF.B.6 TOP: Rate of Change

642 ANS: 1

$$\begin{array}{r}
 3x^2 + 4x - 1 \\
 2x + 3 \overline{) 6x^3 + 17x^2 + 10x + 2} \\
 \underline{6x^3 + 9x^2} \phantom{+ 10x + 2} \\
 8x^2 + 10x \phantom{+ 2} \\
 \underline{8x^2 + 12x} \phantom{+ 2} \\
 -2x + 2 \phantom{+ 2} \\
 \underline{-2x - 3} \\
 5
 \end{array}$$

PTS: 2 REF: fall1503aai NAT: A.APR.D.6 TOP: Rational Expressions  
 KEY: division

643 ANS: 1

$$\begin{aligned}
 x^2 + 2x - 8 &= 0 \\
 (x + 4)(x - 2) &= 0 \\
 x &= -4, 2
 \end{aligned}$$

PTS: 2 REF: 081701aai NAT: A.APR.D.6 TOP: Undefined Rationals

644 ANS:

The mean difference between the students' final grades in group 1 and group 2 is  $-3.64$ . This value indicates that students who met with a tutor had a mean final grade of 3.64 points less than students who used an on-line subscription. One can infer whether this difference is due to the differences in intervention or due to which students were assigned to each group by using a simulation to rerandomize the students' final grades many (500) times. If the observed difference  $-3.64$  is the result of the assignment of students to groups alone, then a difference of  $-3.64$  or less should be observed fairly regularly in the simulation output. However, a difference of  $-3$  or less occurs in only about 2% of the rerandomizations. Therefore, it is quite unlikely that the assignment to groups alone accounts for the difference; rather, it is likely that the difference between the interventions themselves accounts for the difference between the two groups' mean final grades.

PTS: 4 REF: fall1514aai NAT: S.IC.B.5 TOP: Analysis of Data

645 ANS:

$$\begin{array}{r}
 6x - 3y + 2z = -10 \quad x + 3y + 5z = 45 \quad 4x + 10z = 62 \quad 4x + 4(7) = 20 \quad 6(-2) - 3y + 2(7) = -10 \\
 -2x + 3y + 8z = 72 \quad 6x - 3y + 2z = -10 \quad 4x + 4z = 20 \quad 4x = -8 \quad -3y = -12 \\
 4x + 10z = 62 \quad 7x + 7z = 35 \quad 6z = 42 \quad x = -2 \quad y = 4 \\
 4x + 4z = 20 \quad z = 7
 \end{array}$$

PTS: 4 REF: spr1510aai NAT: A.REI.C.6 TOP: Solving Linear Systems  
 KEY: three variables

646 ANS: 1 PTS: 2 REF: 011704aai NAT: F.TF.C.8  
 TOP: Proving Trigonometric Identities KEY: basic

647 ANS: 4

$$\text{period} = \frac{2\pi}{B}$$

$$\frac{1}{60} = \frac{2\pi}{B}$$

$$B = 120\pi$$

PTS: 2

REF: 061624aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

648 ANS: 3

PTS: 2

REF: 081724aai

NAT: F.BF.A.2

TOP: Sequences

649 ANS: 2

$$(2 - yi)(2 - yi) = 4 - 4yi + y^2 i^2 = -y^2 - 4yi + 4$$

PTS: 2

REF: 061603aai

NAT: N.CN.A.2

TOP: Operations with Complex Numbers

650 ANS:

$$A = 5000(1.045)^n \quad 5000 \left(1 + \frac{.046}{4}\right)^{4(6)} - 5000(1.045)^6 \approx 6578.87 - 6511.30 \approx 67.57 \quad 10000 = 5000 \left(1 + \frac{.046}{4}\right)^{4n}$$

$$B = 5000 \left(1 + \frac{.046}{4}\right)^{4n}$$

$$2 = 1.0115^{4n}$$

$$\log 2 = 4n \cdot \log 1.0115$$

$$n = \frac{\log 2}{4 \log 1.0115}$$

$$n \approx 15.2$$

PTS: 6

REF: 081637aai

NAT: A.CED.A.1

TOP: Exponential Growth

651 ANS:

$$x - 2 \overline{) 3x^2 + 7x - 20} \quad 3x + 13 + \frac{6}{x - 2}$$

$$\underline{3x^2 - 6x}$$

$$13x - 20$$

$$\underline{13x - 26}$$

6

PTS: 2

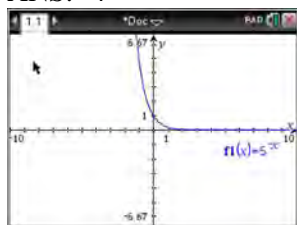
REF: 011732aai

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: division

652 ANS: 4



$$y = 5^{-x} = \left(\frac{1}{5}\right)^x$$

PTS: 2 REF: 061615aia NAT: F.IF.C.7 TOP: Graphing Exponential Functions

653 ANS: 1

(2) is not recursive

PTS: 2 REF: 081608aia NAT: F.BF.A.2 TOP: Sequences

654 ANS: 2

$$\begin{array}{r} 2x^2 - 3x + 7 \\ 2x + 3 \overline{) 4x^3 + 0x^2 + 5x + 10} \\ \underline{4x^3 + 6x^2} \phantom{+ 10} \\ -6x^2 + 5x \phantom{+ 10} \\ \underline{-6x^2 - 9x} \phantom{+ 10} \\ 14x + 10 \\ \underline{14x + 21} \\ -11 \end{array}$$

PTS: 2 REF: 061614aia NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

655 ANS:

$$\frac{f(4) - f(-2)}{4 - (-2)} = \frac{80 - 1.25}{6} = 13.125 \quad g(x) \text{ has a greater rate of change}$$

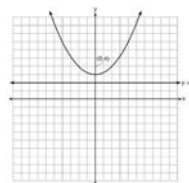
$$\frac{g(4) - g(-2)}{4 - (-2)} = \frac{179 - (-49)}{6} = 38$$

PTS: 4 REF: 061636aia NAT: F.IF.B.6 TOP: Rate of Change

656 ANS: 3 PTS: 2 REF: 061722aia NAT: A.CED.A.1

TOP: Modeling Rationals

657 ANS: 4



A parabola with a focus of  $(0,4)$  and a directrix of  $y = 2$  is sketched as follows: By inspection, it is determined that the vertex of the parabola is  $(0,3)$ . It is also evident that the distance,  $p$ , between the vertex and the focus is 1. It is possible to use the formula  $(x - h)^2 = 4p(y - k)$  to derive the equation of the parabola as follows:  $(x - 0)^2 = 4(1)(y - 3)$

$$x^2 = 4y - 12$$

$$x^2 + 12 = 4y$$

$$\frac{x^2}{4} + 3 = y$$

or A point  $(x,y)$  on the parabola must be the same distance from the focus as it is from the directrix. For any such point  $(x,y)$ , the distance to the focus is  $\sqrt{(x-0)^2 + (y-4)^2}$  and the distance to the directrix is  $y - 2$ . Setting this equal leads to:  $x^2 + y^2 - 8y + 16 = y^2 - 4y + 4$

$$x^2 + 16 = 4y + 4$$

$$\frac{x^2}{4} + 3 = y$$

PTS: 2 REF: spr1502aia NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

658 ANS: 2

$$\begin{aligned} x(30 - 0.01x) - (0.15x^3 + 0.01x^2 + 2x + 120) &= 30x - 0.01x^2 - 0.15x^3 - 0.01x^2 - 2x - 120 \\ &= -0.15x^3 - 0.02x^2 + 28x - 120 \end{aligned}$$

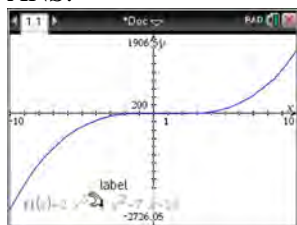
PTS: 2 REF: 061709aia NAT: F.BF.A.1 TOP: Operations with Functions

659 ANS:

$$\left( \frac{1}{\sqrt[3]{y^2}} \right) y^4 = \frac{y^{\frac{12}{3}}}{y^{\frac{2}{3}}} = y^{\frac{10}{3}} \quad n = \frac{10}{3}$$

PTS: 2 REF: 012428aia NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

660 ANS:



$$x - 5 \overline{) 2x^3 - 4x^2 - 7x - 10} \quad \text{Since there is a remainder, } x - 5 \text{ is not a factor.}$$

$$\underline{2x^3 - 10x^2}$$

$$6x^2 - 7x$$

$$\underline{6x^2 - 30x}$$

$$23x - 10$$

$$\underline{23x - 115}$$

$$105$$

PTS: 2 REF: 061627aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

661 ANS: 3 PTS: 2 REF: 081705aia NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

662 ANS: 2



$\bar{x} + 2\sigma$  represents approximately 48% of the data.

PTS: 2 REF: 061609aia NAT: S.ID.A.4 TOP: Normal Distributions

KEY: percent

663 ANS:

$$\frac{x^3 + 9}{x^3 + 8} = \frac{x^3 + 8}{x^3 + 8} + \frac{1}{x^3 + 8}$$

$$\frac{x^3 + 9}{x^3 + 8} = \frac{x^3 + 9}{x^3 + 8}$$

PTS: 2 REF: 061631aia NAT: A.APR.D.7 TOP: Addition and Subtraction of Rationals

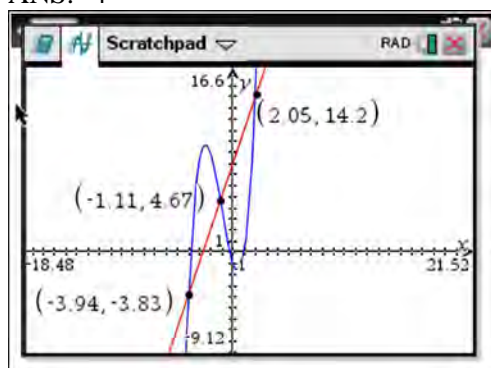
664 ANS:

$$j(-x) = (-x)^4 - 3(-x)^2 - 4 = x^2 - 3x^2 - 4 \quad \text{Since } j(x) = j(-x), \text{ the function is even.}$$

PTS: 2 REF: 081731aia NAT: F.BF.B.3 TOP: Even and Odd Functions



665 ANS: 4



PTS: 2 REF: 061622aai NAT: A.REI.D.11 TOP: Other Systems

666 ANS:

The expression is of the form  $y^2 - 5y - 6$  or  $(y - 6)(y + 1)$ . Let  $y = 4x^2 + 5x$ :

$$(4x^2 + 5x - 6)(4x^2 + 5x + 1)$$

$$(4x - 3)(x + 2)(4x + 1)(x + 1)$$

PTS: 2 REF: fall1512aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY:  $a > 1$ 

667 ANS: 4

$$k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$$

$$k^2(k^2 - 4) + 8k(k^2 - 4) + 12(k^2 - 4)$$

$$(k^2 - 4)(k^2 + 8k + 12)$$

$$(k + 2)(k - 2)(k + 6)(k + 2)$$

PTS: 2 REF: fall1505aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

668 ANS: 2

$$6xi^3(-4xi + 5) = -24x^2i^4 + 30xi^3 = -24x^2(1) + 30x(-1) = -24x^2 - 30xi$$

PTS: 2 REF: 061704aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

669 ANS:

$$100 = 140 \left(\frac{1}{2}\right)^{\frac{5}{h}} \quad \log \frac{100}{140} = \log \left(\frac{1}{2}\right)^{\frac{5}{h}} \quad 40 = 140 \left(\frac{1}{2}\right)^{\frac{t}{10.3002}}$$

$$\log \frac{5}{7} = \frac{5}{h} \log \frac{1}{2} \quad \log \frac{2}{7} = \log \left(\frac{1}{2}\right)^{\frac{t}{10.3002}}$$

$$h = \frac{5 \log \frac{1}{2}}{\log \frac{5}{7}} \approx 10.3002 \quad \log \frac{2}{7} = \frac{t \log \left(\frac{1}{2}\right)}{10.3002}$$

$$t = \frac{10.3002 \log \frac{2}{7}}{\log \frac{1}{2}} \approx 18.6$$

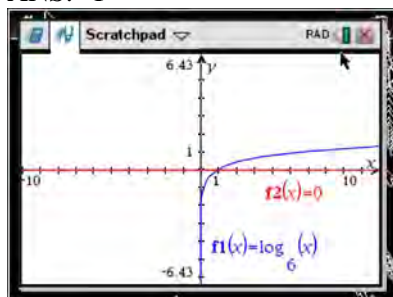
PTS: 6

REF: 061737aai

NAT: F.LE.A.4

TOP: Exponential Decay

670 ANS: 1



PTS: 2

REF: 061618aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

671 ANS:

$r(2) = -6$ . Since there is a remainder when the cubic is divided by  $x - 2$ , this binomial is not a factor.

$$\begin{array}{r|rrrr} 2 & 1 & -4 & 4 & 6 \\ & & 2 & -4 & 0 \\ \hline & 1 & -2 & 0 & -6 \end{array}$$

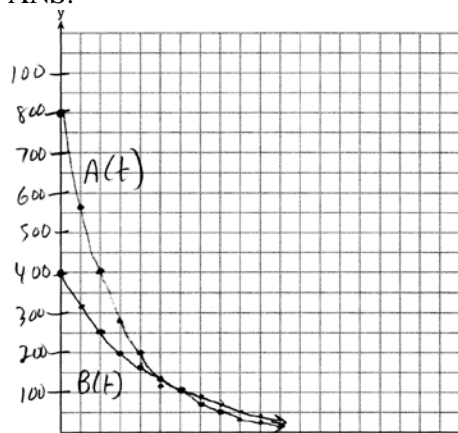
PTS: 2

REF: 061725aai

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

672 ANS:



$$A(t) = 800e^{-0.347t}$$

$$800e^{-0.347t} = 400e^{-0.231t} \quad 0.15 = e^{-0.347t}$$

$$B(t) = 400e^{-0.231t}$$

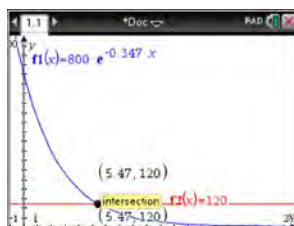
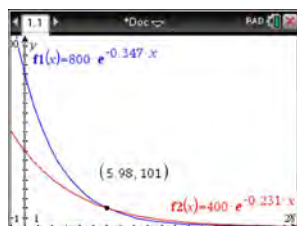
$$\ln 2e^{-0.347t} = \ln e^{-0.231t} \quad \ln 0.15 = \ln e^{-0.347t}$$

$$\ln 2 + \ln e^{-0.347t} = \ln e^{-0.231t} \quad \ln 0.15 = -0.347t \cdot \ln e$$

$$\ln 2 - 0.347t = -0.231t \quad 5.5 \approx t$$

$$\ln 2 = 0.116t$$

$$6 \approx t$$



PTS: 6

REF: 061637aia

NAT: A.REI.D.11

TOP: Other Systems

673 ANS: 2

$$x = -\frac{3}{4}y + 2$$

$$-4x = 3y - 8$$

$$-4x + 8 = 3y$$

$$-\frac{4}{3}x + \frac{8}{3} = y$$

PTS: 2

REF: 061616aia

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

674 ANS: 1

The graph of  $y = \sin x$  is unchanged when rotated  $180^\circ$  about the origin.

PTS: 2

REF: 081614aia

NAT: F.BF.B.3

TOP: Even and Odd Functions

675 ANS: 4

$$x(x+7) \left[ \frac{3x+25}{x+7} - 5 = \frac{3}{x} \right]$$

$$x(3x+25) - 5x(x+7) = 3(x+7)$$

$$3x^2 + 25x - 5x^2 - 35x = 3x + 21$$

$$2x^2 + 13x + 21 = 0$$

$$(2x+7)(x+3) = 0$$

$$x = -\frac{7}{2}, -3$$

PTS: 2 REF: fall1501aii NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

676 ANS: 2

$$\begin{array}{r|rrrr} -4 & 1 & -11 & 16 & 84 \\ & & -4 & 60 & -304 \\ \hline & 1 & -15 & 76 & \end{array}$$

Since there is a remainder when the cubic is divided by  $x+4$ , this binomial is not a factor.

PTS: 2 REF: 081720aii NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

677 ANS: 2 PTS: 2 REF: 061724aii NAT: A.SSE.B.4

TOP: Series KEY: geometric

678 ANS: 1 PTS: 2 REF: 081609aii NAT: F.BF.B.6

TOP: Sigma Notation KEY: represent

679 ANS:

$$a_1 = 12$$

$$a_n = a_{n-1} + 6$$

PTS: 2 REF: 012430aii NAT: F.BF.A.2 TOP: Sequences

680 ANS: 4 PTS: 2 REF: 081708aii NAT: A.APR.B.3

TOP: Solving Polynomial Equations

681 ANS: 4

$$\frac{-3x^2 - 5x + 2}{x^3 + 2x^2} = \frac{(-3x+1)(x+2)}{x^2(x+2)} = \frac{-3x}{x^2} + \frac{1}{x^2} = -3x^{-1} + x^{-2}$$

PTS: 2 REF: 061723aii NAT: A.APR.D.6 TOP: Expressions with Negative Exponents

KEY: variables

682 ANS: 3

$$-33t^2 + 360t = 700 + 5t$$

$$-33t^2 + 355t - 700 = 0$$

$$t = \frac{-355 \pm \sqrt{355^2 - 4(-33)(-700)}}{2(-33)} \approx 3,8$$

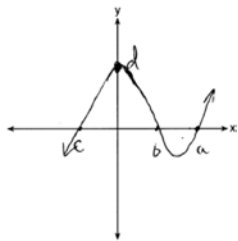
PTS: 2

REF: 081606aai

NAT: A.REI.D.11

TOP: Quadratic-Linear Systems

683 ANS:



PTS: 2

REF: 081732aai

NAT: A.APR.B.3

TOP: Graphing Polynomial Functions

684 ANS: 2

PTS: 2

REF: 011709aai

NAT: S.IC.B.5

TOP: Analysis of Data

685 ANS:

$$2x - 6 = 2\sqrt{x-1} \quad 2 \text{ is extraneous.}$$

$$4x^2 - 24x + 36 = 4(x-1)$$

$$x^2 - 6x + 9 = x - 1$$

$$x^2 - 7x + 10 = 0$$

$$(x-5)(x-2) = 0$$

$$x = 2,5$$

PTS: 4

REF: 012434aai

NAT: A.REI.A.2

TOP: Solving Radicals

KEY: extraneous solutions

686 ANS:

$$\frac{1}{x} - \frac{1}{3} = -\frac{1}{3x}$$

$$\frac{3-x}{3x} = -\frac{1}{3x}$$

$$3-x = -1$$

$$x = 4$$

PTS: 2

REF: 061625aai

NAT: A.REI.A.2

TOP: Solving Rationals

KEY: rational solutions

687 ANS: 4  
 $496 \pm 2(115)$

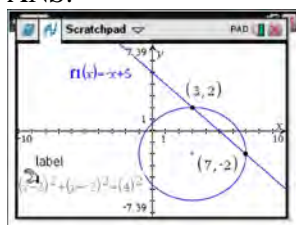
PTS: 2 REF: 011718aai NAT: S.ID.A.4 TOP: Normal Distributions  
 KEY: interval

688 ANS:

$$P(P/K) = \frac{P(P \wedge K)}{P(K)} = \frac{1.9}{2.3} \approx 82.6\% \text{ A key club member has an 82.6\% probability of being enrolled in AP Physics.}$$

PTS: 4 REF: 011735aai NAT: S.CP.B.6 TOP: Conditional Probability

689 ANS:



$$y = -x + 5 \quad y = -7 + 5 = -2$$

$$(x - 3)^2 + (-x + 5 + 2)^2 = 16 \quad y = -3 + 5 = 2$$

$$x^2 - 6x + 9 + x^2 - 14x + 49 = 16$$

$$2x^2 - 20x + 42 = 0$$

$$x^2 - 10x + 21 = 0$$

$$(x - 7)(x - 3) = 0$$

$$x = 7, 3$$

PTS: 4 REF: 061633aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

690 ANS: 1 PTS: 2 REF: 061701aai NAT: A.APR.B.3  
 TOP: Graphing Polynomial Functions

691 ANS: 4

The scenario represents a decreasing geometric sequence with a common ratio of 0.80.

PTS: 2 REF: 061610aai NAT: F.BF.A.1 TOP: Sequences

KEY: recursive

692 ANS: 4

If  $1 - i$  is one solution, the other is  $1 + i$ .  $(x - (1 - i))(x - (1 + i)) = 0$

$$x^2 - x - ix - x + ix + (1 - i^2) = 0$$

$$x^2 - 2x + 2 = 0$$

PTS: 2 REF: 081601aai NAT: A.REI.B.4 TOP: Complex Conjugate Root Theorem

693 ANS: 1 PTS: 2 REF: 081616aai NAT: F.TF.A.1  
 TOP: Unit Circle KEY: bimodalgraph

694 ANS: 3 PTS: 2 REF: 011706aai NAT: S.IC.B.3  
 TOP: Analysis of Data KEY: type

695 ANS: 4

$$y = g(x) = (x-2)^2 \quad (x-2)^2 = 3x-2 \quad y = 3(6)-2 = 16$$

$$x^2 - 4x + 4 = 3x - 2 \quad y = 3(1) - 2 = 1$$

$$x^2 - 7x + 6 = 0$$

$$(x-6)(x-1) = 0$$

$$x = 6, 1$$

PTS: 2

REF: 011705aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

696 ANS: 1

$$x = \frac{-3 \pm \sqrt{3^2 - 4(2)(2)}}{2(2)} = \frac{-3 \pm \sqrt{-7}}{4} = -\frac{3}{4} \pm \frac{i\sqrt{7}}{4}$$

PTS: 2

REF: 061612aai

NAT: A.REI.B.4

TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

697 ANS: 4

The vertex is  $(2, -1)$  and  $p = 2$ .  $y = -\frac{1}{4(2)}(x-2)^2 - 1$

PTS: 2

REF: 081619aai

NAT: G.GPE.A.2

TOP: Graphing Quadratic Functions