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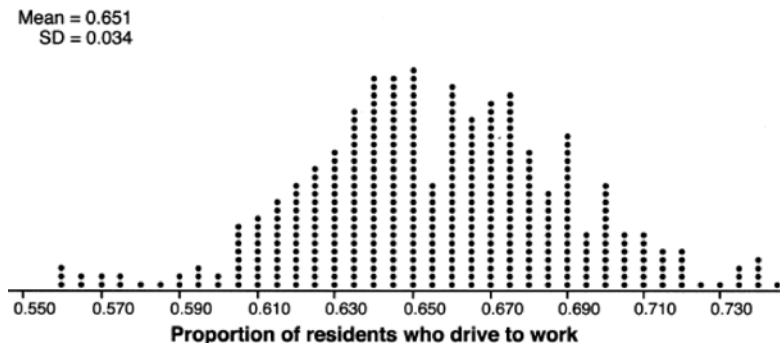
REGENTS AT RANDOM

NY Algebra II Regents Exam Questions
from Spring 2015 to January 2023 Sorted at Random

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Algebra II Regents at Random

- 1 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.

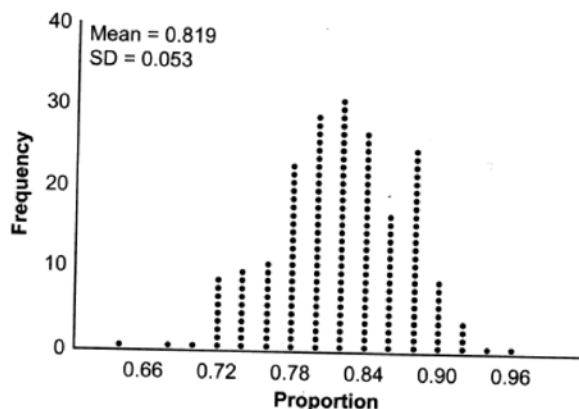


Use the simulation results to construct a plausible interval containing the middle 95% of the data. Round your answer to the *nearest hundredth*. One year after launching the campaign, the Department of Transportation conducts a survey of 200 randomly selected city residents and finds that 122 of them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

- 2 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) $\frac{\ln 1.25}{0.025}$
- 3 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) $x^3 + 2x^2 - 9x + 22 - \frac{30}{x + 2}$
- 4 Describe the transformation applied to the graph of $p(x) = 2^x$ that forms the new function $q(x) = 2^{x-3} + 4$.

- 5 Given $x \neq -2$, the expression $\frac{2x^2 + 5x + 8}{x + 2}$ is equivalent to
- 1) $2x^2 + \frac{9}{x + 2}$
 - 2) $2x + \frac{7}{x + 2}$
 - 3) $2x + 1 + \frac{6}{x + 2}$
 - 4) $2x + 9 - \frac{10}{x + 2}$

- 6 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.

- 7 Given $x \neq -3$, the expression $\frac{2x^3 + 7x^2 - 3x - 25}{x + 3}$ is equivalent to
- 1) $2x^2 + x - 6 - \frac{7}{x + 3}$
 - 2) $2x^2 + 13x - 36 + \frac{83}{x + 3}$
 - 3) $2x^2 + x - 13$
 - 4) $x^2 + 4x - 15 + \frac{20}{x + 3}$

- 8 For n and $p > 0$, is the expression

$$\left(p^2 n^{\frac{1}{2}} \right)^8 \sqrt{p^5 n^4} \text{ equivalent to } p^{18} n^6 \sqrt{p}?$$

Justify your answer.

- 9 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 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.

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

11 Consider the data in the table below.

	Right Handed	Left Handed
Male	87	13
Female	89	11

What is the probability that a randomly selected person is male given the person is left handed?

- 1) $\frac{13}{200}$ 3) $\frac{13}{50}$
 2) $\frac{13}{100}$ 4) $\frac{13}{24}$

12 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) $(2, 5)$

13 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) $\{1\}$

14 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) $\frac{x(x-3)}{(3-x)}$

15 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.

16 Which statement below about the graph of $f(x) = -\log(x+4) + 2$ is true?

- 1) $f(x)$ has a y-intercept at $(0, 2)$.
 2) $-f(x)$ has a y-intercept at $(0, 2)$.
 3) As $x \rightarrow \infty$, $f(x) \rightarrow \infty$.
 4) $x \rightarrow -4$, $f(x) \rightarrow \infty$.

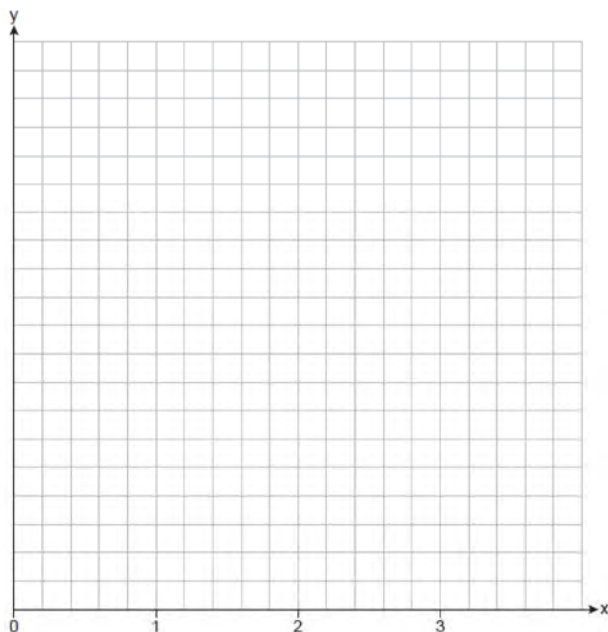
17 Show why $x - 3$ is a factor of

$$m(x) = x^3 - x^2 - 5x - 3. \text{ Justify your answer.}$$

- 18 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) $f(x) \rightarrow -\infty$

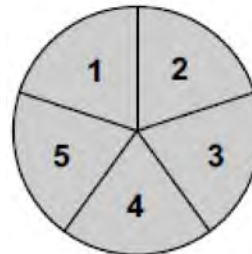
- 19 For which approximate value(s) of x will $\log(x+5) = |x-1| - 3$?
- 1) 5, 1
 - 2) -2.41, 0.41
 - 3) -2.41, 5
 - 4) 5, only

- 20 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 $0 \leq x \leq 3$.

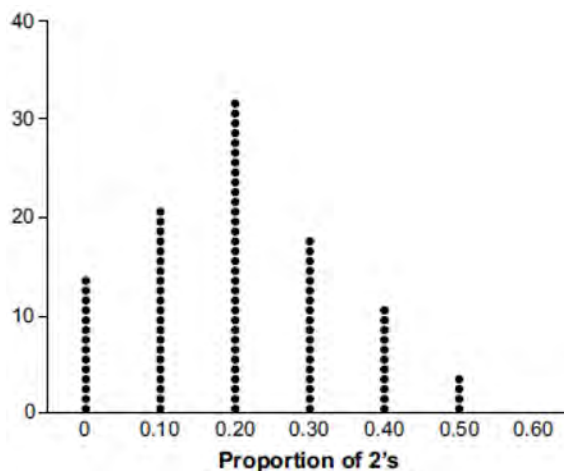


To the *nearest tenth of a cubic inch*, what is the maximum volume of the rectangular solid?

- 21 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.

- 22 Solve algebraically for all values of x :
 $\sqrt{4x+1} = 11-x$

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- 23 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*.

- 24 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0 : initial temperature

T_R : room temperature

r : rate of cooling of the object

t : time in minutes that the object

cools to a temperature, T

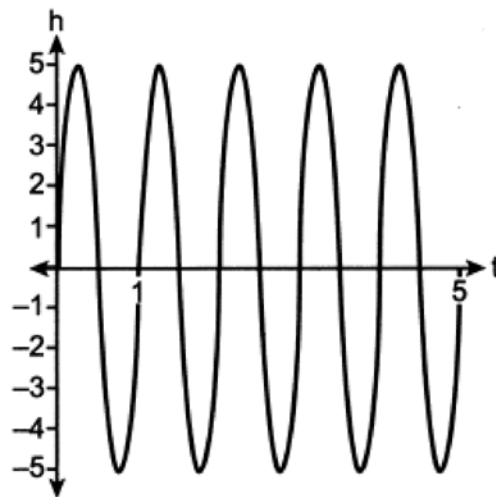
Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F . The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F . Using this information, write an equation for the temperature of the shirt, T , after t minutes. Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes. At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F . After eight minutes, the hoodie measured 270°F . The room temperature is still 75°F . Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*. The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

- 25 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 .

- 26 Algebraically determine the zeros of the function below.

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

- 27 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) 2π
- 3) 60
- 4) $\frac{\pi}{30}$

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28 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

29 The sum of the first 20 terms of the series

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

- 1) -610
- 2) -59
- 3) 1,743,392,200
- 4) 2,324,522,934

30 Given that i is the imaginary unit, the expression

$$(x - 2i)^2$$
 is equivalent to

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

31 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) $x^3 - y^3i$

32 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.

33 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

34 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

35 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) $(x - 6)(x + 1)$

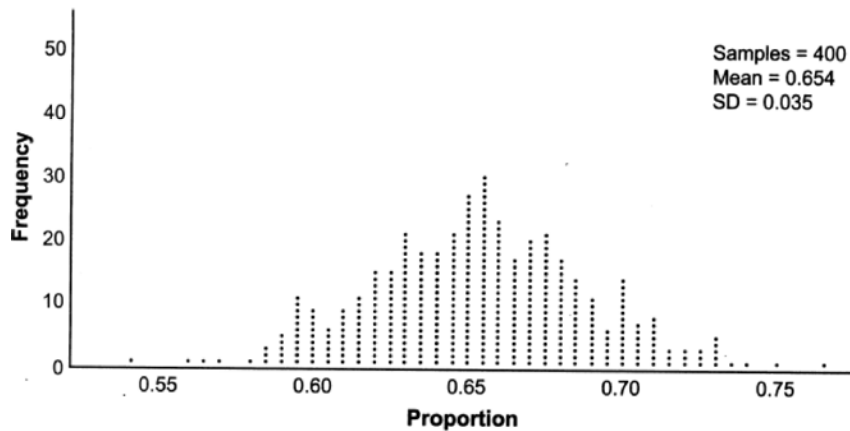
36 What is the total number of points of intersection of the graphs of the equations $y = e^x$ and $xy = 20$?

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

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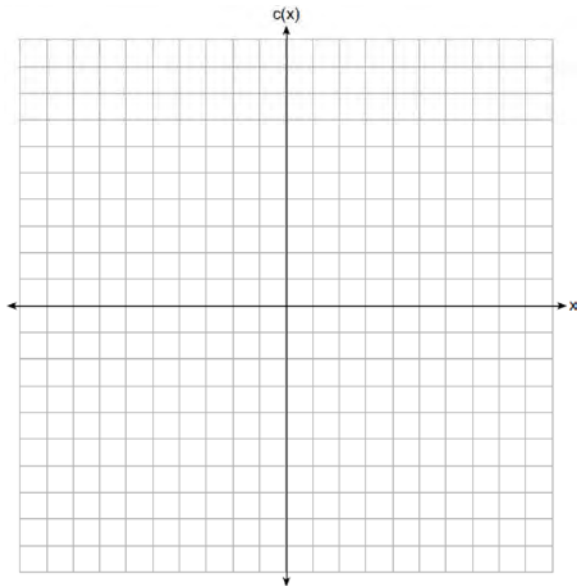
- 37 Betty conducted a survey of her class to see if they like pizza. She gathered 200 responses and 65% of the voters said they did like pizza. Betty then ran a simulation of 400 more surveys, each with 200 responses, assuming that 65% of the voters would like pizza. The output of the simulation is shown below.



Considering the middle 95% of the data, what is the margin of error for the simulation?

- | | |
|-------------------------------|-------------------------------|
| <p>1) 0.01</p> <p>2) 0.02</p> | <p>3) 0.05</p> <p>4) 0.07</p> |
|-------------------------------|-------------------------------|
- 38 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.
- 39 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) $-2 + \ln(2)$
- 40 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
- 41 Factor completely over the set of integers:
 $-2x^4 + x^3 + 18x^2 - 9x$

42 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.

- 43 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

- 44 In watching auditions for lead singer in a band, Liem became curious as to whether there is an association between how animated the leadsinger 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

- 45 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

- 46 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) $1 + \frac{1}{2x+6}$

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47 Expressed in simplest $a + bi$ form,

$(7 - 3i) + (x - 2i)^2 - (4i + 2x^2)$ is

- 1) $(3 - x^2) - (4x + 7)i$
- 2) $(3 + 3x^2) - (4x + 7)i$
- 3) $(3 - x^2) - 7i$
- 4) $(3 + 3x^2) - 7i$

48 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) $\{0, 3\}$

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

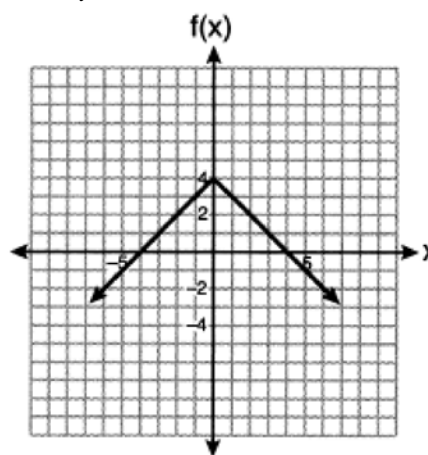
50 If $\cos A = \frac{\sqrt{5}}{3}$ and $\tan A < 0$, what is the value of $\sin A$?

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

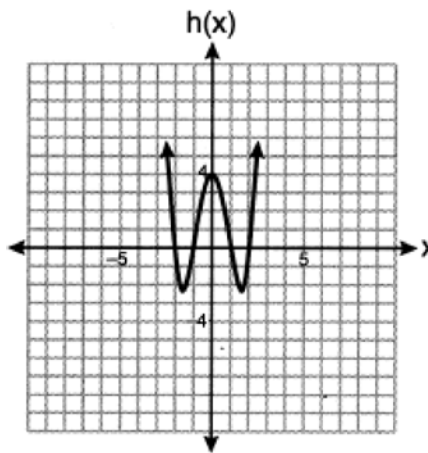
51 The expression $\frac{x^2 + 12}{x^2 + 3}$ can be rewritten as

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

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



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

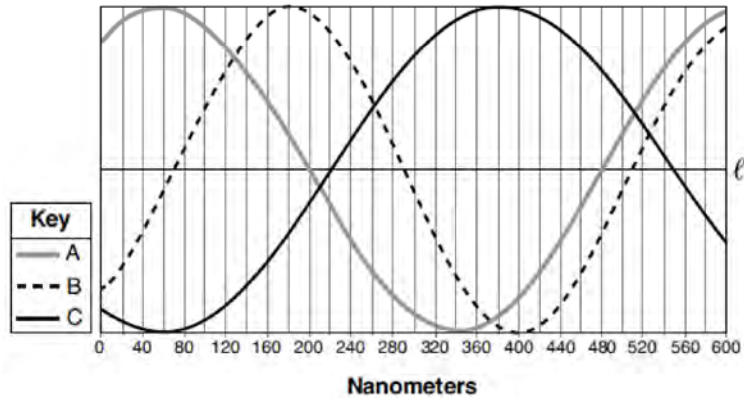


- 3)
- 4) $j(x) = 4 \sin(x) + 1$

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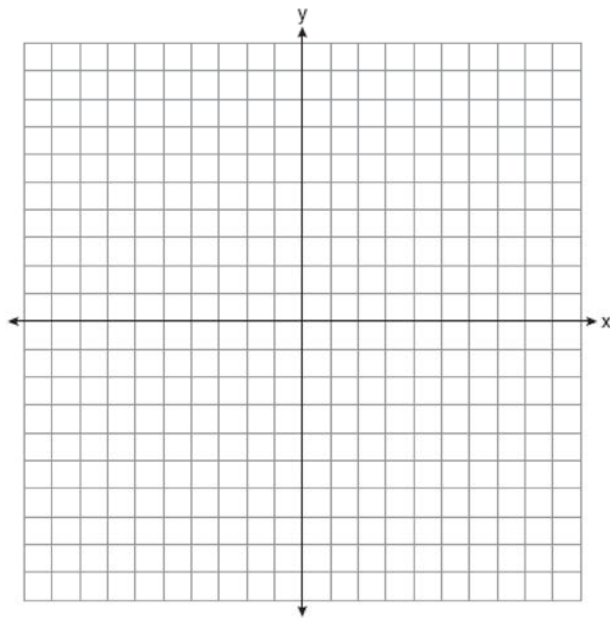
- 53 Visible light can be represented by sinusoidal waves. Three visible light waves are shown in the graph below. The midline of each wave is labeled ℓ .



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

- 54 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.

- 55 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.

- 56 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) $g_1 = 40$

$$g_n = \frac{3}{4} g_{n-1}$$

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

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

x	Altitude (km)	0	1	2	3	4	5
y	Air Pressure (kPa)	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.

59 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

60 Algebraically solve the following system of equations.

$$(x - 2)^2 + (y - 3)^2 = 16$$

$$x + y - 1 = 0$$

61 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*.

62 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 $f(x)$

63 Given $P(A) = \frac{1}{3}$ and $P(B) = \frac{5}{12}$, where A and B are independent events, determine $P(A \cap B)$.

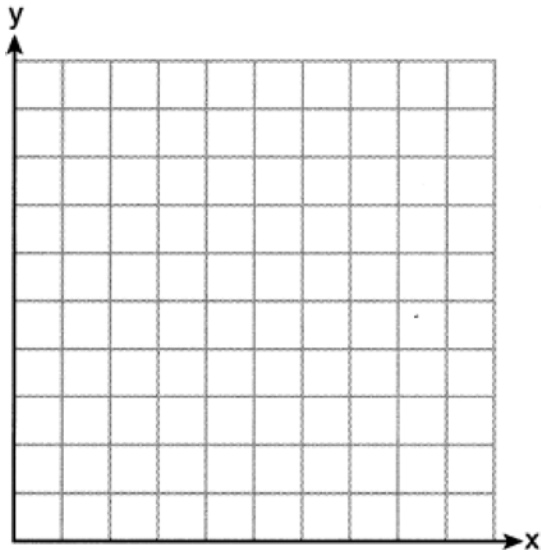
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64 Mia has a student loan that is in deferment, meaning that she does not need to make payments right now. The balance of her loan account during her deferment can be represented by the function $f(x) = 35,000(1.0325)^x$, where x is the number of years 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) $f(x) = 35,000(1.0325)^{\frac{x}{12}}$

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



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

67 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

68 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?

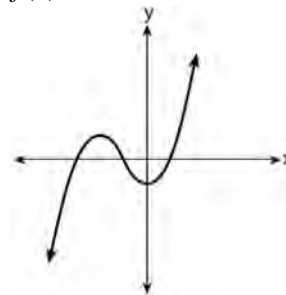
- 1) between 000 and 045, inclusive
- 2) between 000 and 444, inclusive
- 3) between 000 and 449, inclusive
- 4) between 000 and 450, inclusive

69 Consider the end behavior description below.

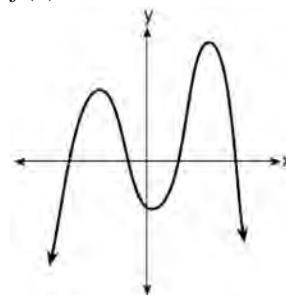
- as $x \rightarrow -\infty, f(x) \rightarrow \infty$
- as $x \rightarrow \infty, f(x) \rightarrow -\infty$

Which function satisfies the given conditions?

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

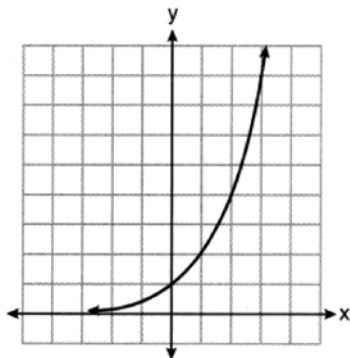


- 2)
- 3) $f(x) = -x^3 + 2x - 6$

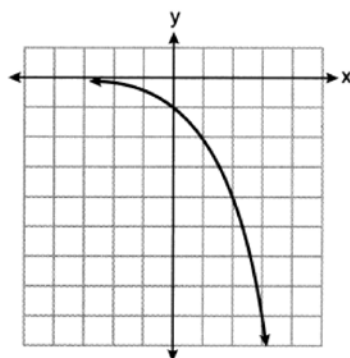


- 4)

- 70 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) $y = h(-x)$
- 71 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*.
- 72 Factor the expression $x^3 - 2x^2 - 9x + 18$ completely.

- 73 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) $f\left(\frac{1}{2}\right) = 0$

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

- 75 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.

- 76 If $(6 - ki)^2 = 27 - 36i$, the value of k is
- 1) -36
 - 2) -3
 - 3) 3
 - 4) 6

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77 Consider the following patterns:

- I. 16, -12, 9, -6.75, ...
- II. 1, 4, 9, 16, ...
- III. 6, 18, 30, 42, ...
- IV. $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \dots$

Which pattern is geometric?

- 1) I
- 2) II
- 3) III
- 4) IV

78 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

79 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

80 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) $a_1 = 64$
 $a_n = 0.75a_{n-1}$

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

82 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

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 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

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

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

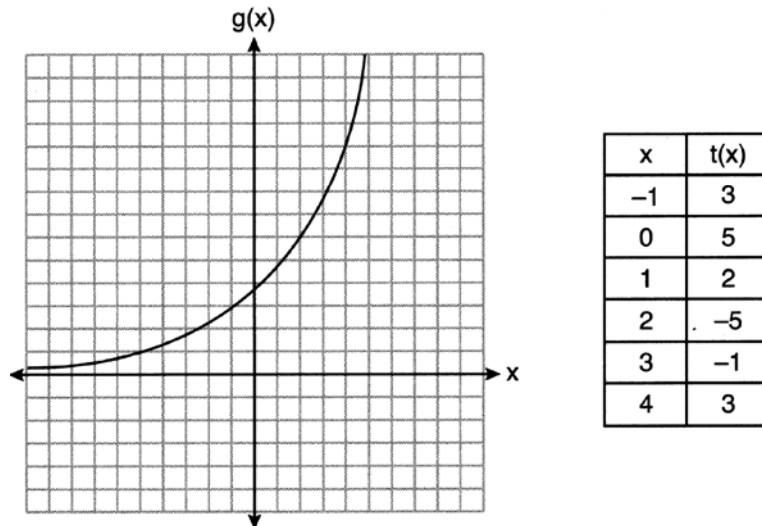
$$y = 11 - 2x$$

86 Consider the data in the table below.

x	1	2	3	4	5	6
y	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*.

87 Consider the graph of g and the table representing t below.



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 .

88 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?

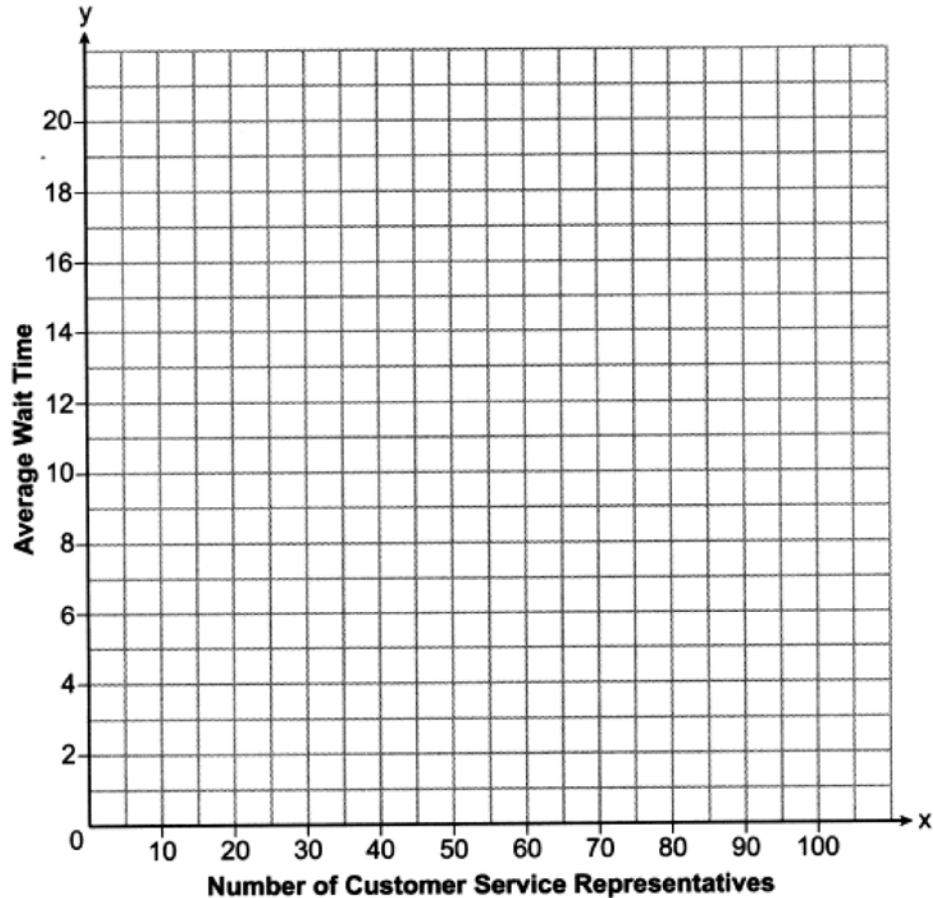
- 1) $f(x) = (x - a)(x^2 + b)$
- 2) $f(x) = (a - x)(x^2 + b)$
- 3) $f(x) = (a - x^2)(x^2 + b)$
- 4) $f(x) = (x - a)(b - x^2)$

89 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) $2ab^3\sqrt[3]{2a^2}$
- 4) $2a^2b^3\sqrt[3]{2b}$

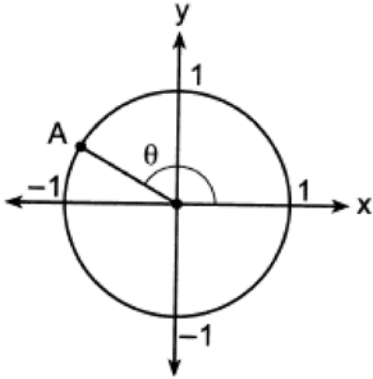
- 90 A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function $A(x) = 15.7(0.98)^x$ and plan B can be modeled by the function $B(x) = 11(0.99)^x$ where x is the number of customer service representatives employed by the company and $A(x)$ 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.

- 91 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.
- 92 Given $p(\theta) = 3 \sin\left(\frac{1}{2}\theta\right)$ on the interval $-\pi < \theta < \pi$, the function p
- 1) decreases, then increases
 - 2) increases, then decreases
 - 3) decreases throughout the interval
 - 4) increases throughout the interval

- 93 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 θ intersects the unit circle.



What is $m\angle\theta$?

- 1) 30°
 2) 120°
 3) 135°
 4) 150°
- 94 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) $\sqrt[3]{x^{10}}$

- 95 As θ 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

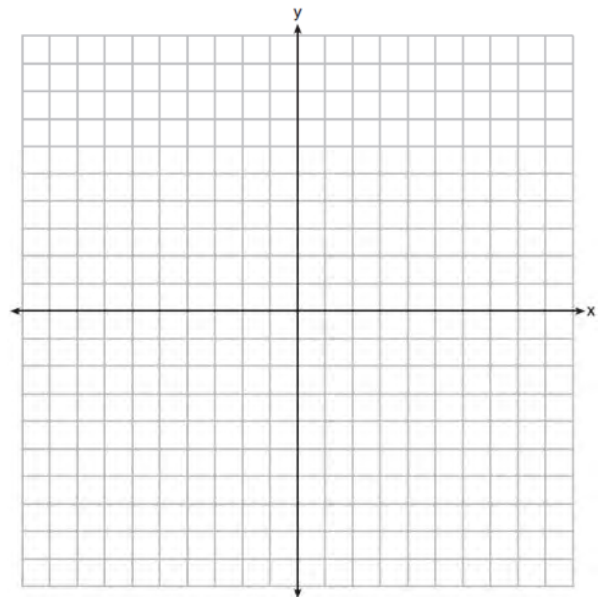
- 96 If a solution of $2(2x - 1) = 5x^2$ is expressed in simplest $a + bi$ form, the value of b is

- 1) $\frac{\sqrt{6}}{5}i$
 2) $\frac{\sqrt{6}}{5}$
 3) $\frac{1}{5}i$
 4) $\frac{1}{5}$

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

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

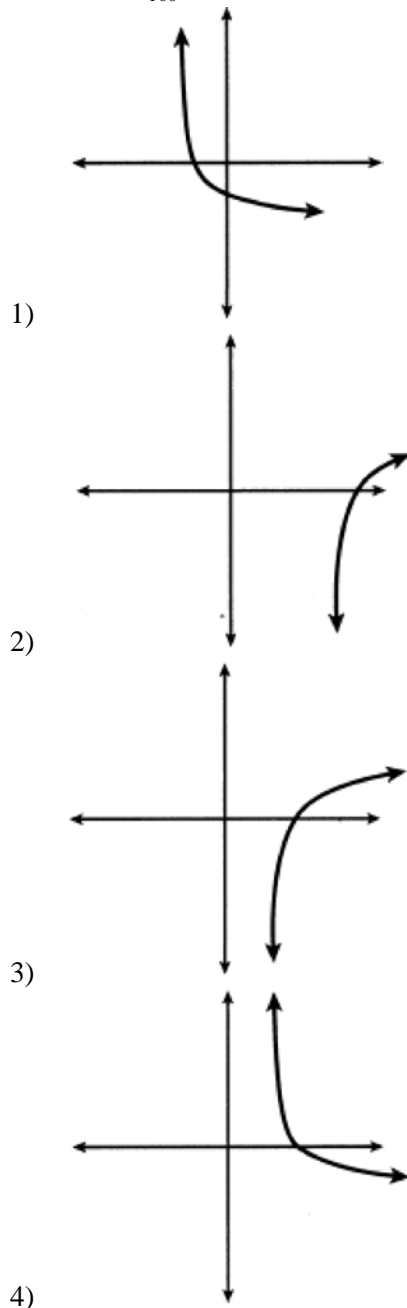
$$g(x) = 2x - 5$$



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

- 98 Solve algebraically for n : $\frac{2}{n^2} + \frac{3}{n} = \frac{4}{n^2}$

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



- 100 Solve the system of equations algebraically.
- $$x^2 + y^2 = 25$$
- $$y + 5 = 2x$$

- 101 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)
- 102 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.
- 103 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

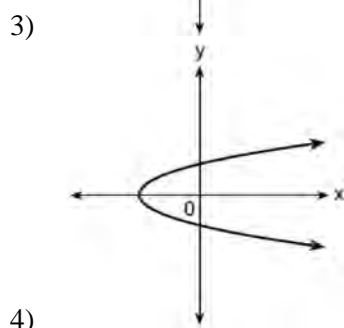
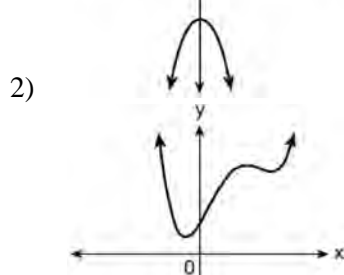
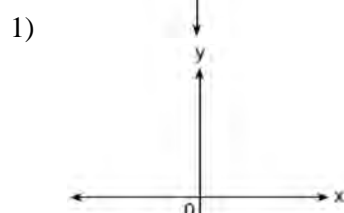
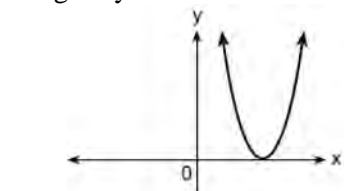
- 104 Write the expression $A(x) \cdot B(x) - 3C(x)$ as a polynomial in standard form.

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

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

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

105 Which graph shows a quadratic function with two imaginary zeros?



106 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) $2x^2 - 12x - 18$

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

$$A(t) = A_0(0.5)^{\frac{t}{0.0803}}$$

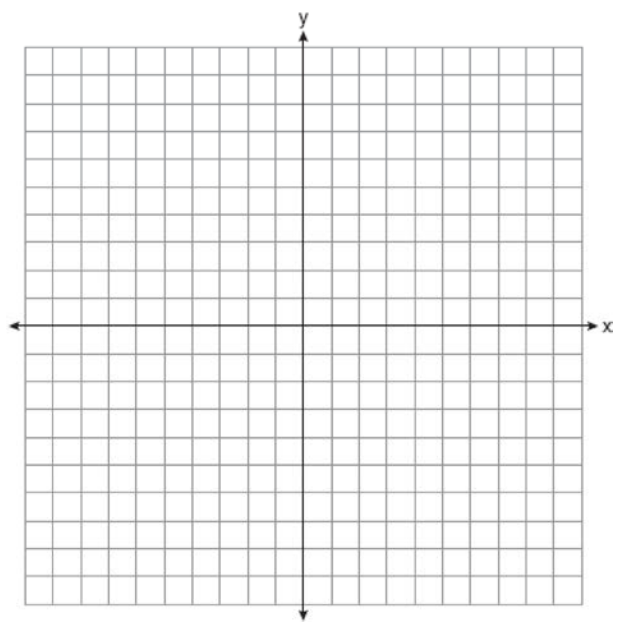
, where A_0 represents the initial amount of the substance. An equivalent form of this equation is

- 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) $A(t) = A_0(1.08361)^t$

108 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) $f^{-1}(x) = 2x + 2$

109 Graph $y = x^3 - 4x^2 + 2x + 7$ on the set of axes below.



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- 110 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.

- 111 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.

- 112 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.

- 113 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

- 114 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

- 115 Given $f(x) = -\frac{2}{5}x + 4$, which statement is true of the inverse function $f^{-1}(x)$?

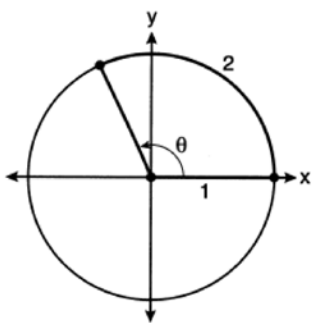
- 1) $f^{-1}(x)$ is a line with slope $\frac{5}{2}$.
- 2) $f^{-1}(x)$ is a line with slope $\frac{2}{5}$.
- 3) $f^{-1}(x)$ passes through the point $(6, -5)$.
- 4) $f^{-1}(x)$ has a y-intercept at $(0, -4)$.

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

117 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?

- 1) $2000(1.003)^{12t}$
- 2) $2000(1.032)^{\frac{t}{12}}$
- 3) $2064^{\frac{t}{12}}$
- 4) $\frac{2000(1.032)^t}{12}$

118 An angle, θ , is rotated counterclockwise on the unit circle, with its terminal side in the second quadrant, as shown in the diagram below.



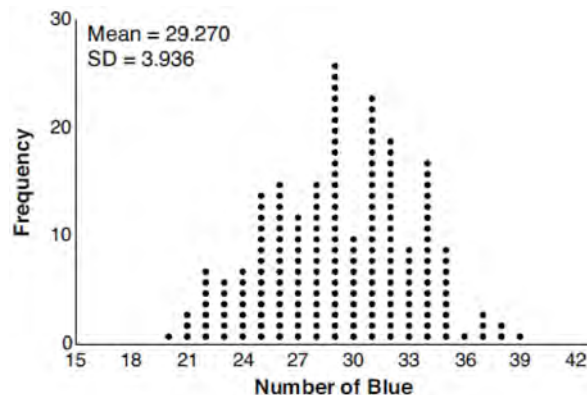
Which value represents the radian measure of angle θ ?

- 1) 1
- 2) 2
- 3) 65.4
- 4) 114.6

119 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) $s(x) = 4^{\frac{x}{2}}$

120 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.

121 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) $P(t) = 500(1.03)^{\frac{t}{12}}$

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- 122 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
- 123 Over the set of integers, completely factor $x^4 - 5x^2 + 4$.
- 124 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 ± 5 and $-a$.
 - 4) $f(x) = x^3 - ax^2 - 9x + 9a$ has zeros of ± 3 and a .
- 125 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.

- 126 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) $\log_{10} 4$

- 127 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) $\frac{x}{80+x} = \frac{90}{100}$

- 128 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) $a_n = 150(0.8)^n + 80$

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

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- 130 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

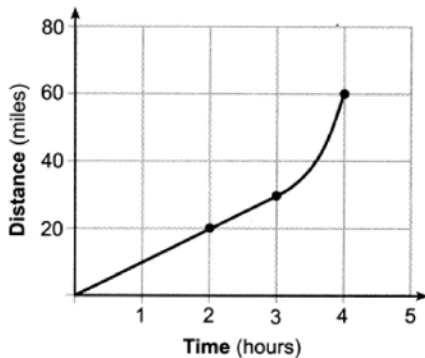
Which expression determines the total amount of money saved by the company over 5 years?

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

- 131 Which equation represents a polynomial identity?

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

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



- 133 What is the solution set of $x = \sqrt{3x + 40}$?

- 1) $\{-5, 8\}$
 2) $\{8\}$
 3) $\{-4, 10\}$
 4) $\{ \}$

- 134 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.

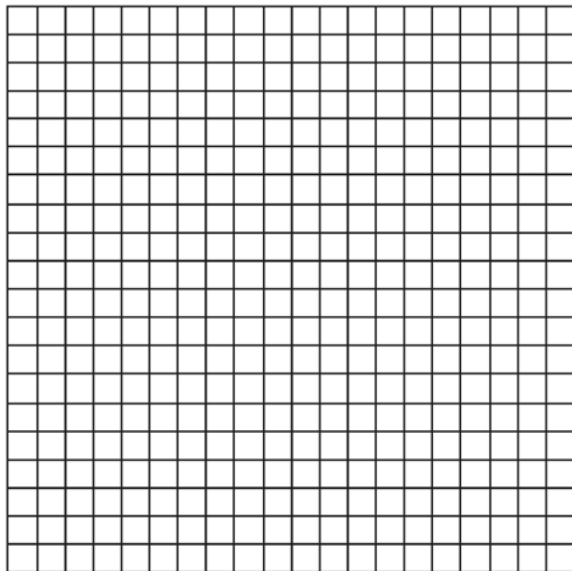
II. The mass of the original sample is 50 g.

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

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- 135 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.)



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

- 137 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.

- 138 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) $x^2 + a^2 + 5x + 5a + 4$

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

- 140 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) $x^2 + 10x - 6 = 0$

- 141 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) $9x^4y^2$

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- 142 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.

	Wear Glasses	Don't Wear Glasses
Blue Eyes	0.14	0.26
Brown Eyes	0.11	0.24
Green Eyes	0.10	0.15

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

- 143 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) $3(x^4)$

- 144 The monthly high temperature (°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.

- 145 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) $x^2 - 2x + 4 - \frac{10}{x - 2}$

- 146 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.

- 147 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

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148 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) $\frac{1}{5} \pm \frac{\sqrt{66}}{5}$

149 Completely factor the following expression:

$$x^2 + 3xy + 3x^3 + y$$

- 150 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

- 151 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

152 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.

- 153 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) $-19 + 27i$

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

155 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) $\pm i$

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- 156 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) $8x - 4i$

- 157 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) $f(t) = 10,000(1.00075)^{12t} + 10,000e^{0.008t}$

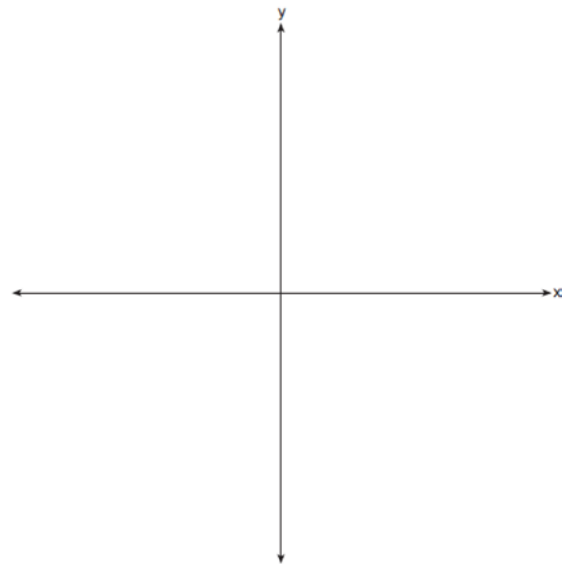
- 158 The mean intelligence quotient (IQ) score is 100, with a standard deviation of 15, and the scores are normally distributed. Given this information, the approximate percentage of the population with an IQ greater than 130 is closest to
- 1) 2%
 - 2) 31%
 - 3) 48%
 - 4) 95%

- 159 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

- 160 The value(s) of x that satisfy $\sqrt{x^2 - 4x - 5} = 2x - 10$ are
- 1) $\{5\}$
 - 2) $\{7\}$
 - 3) $\{5, 7\}$
 - 4) $\{3, 5, 7\}$

- 161 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) $g(x) = \log_3 x - 5$

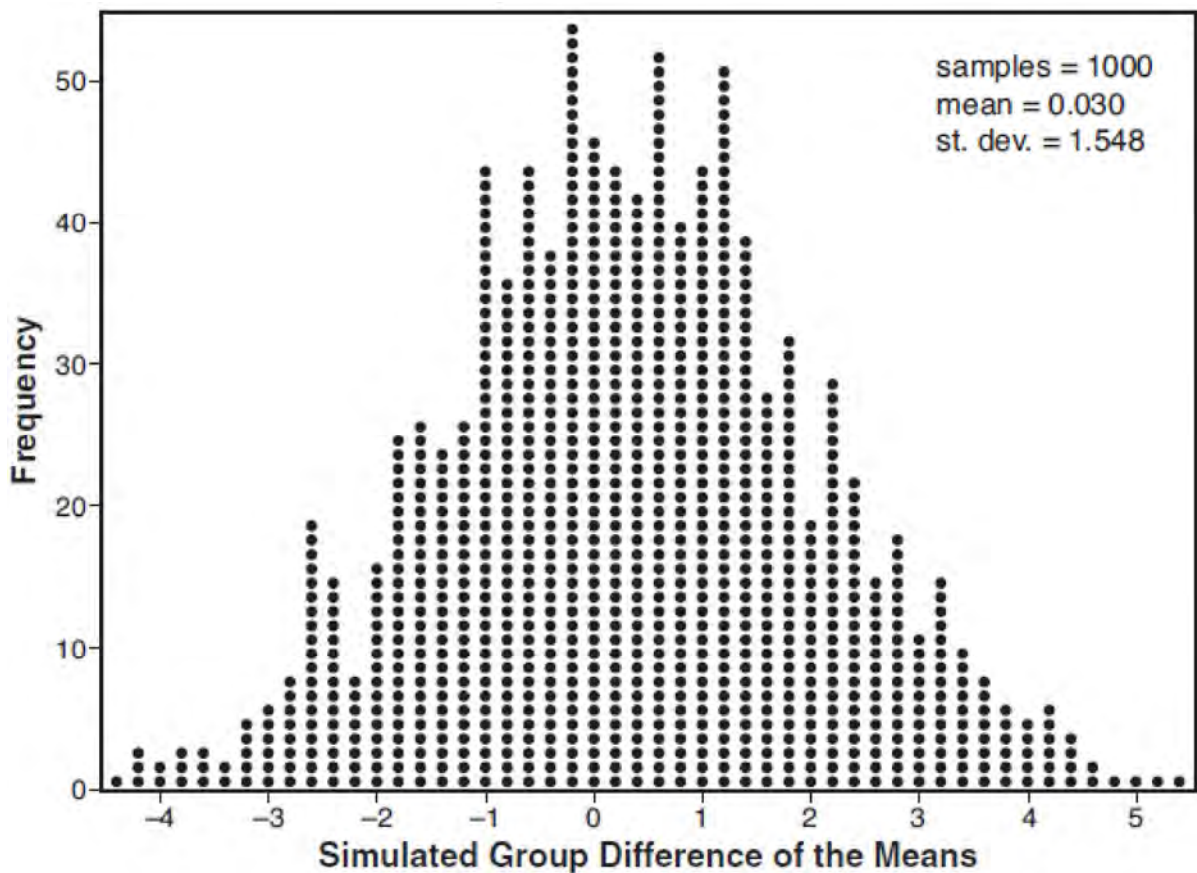
- 162 Sketch the graphs of $r(x) = \frac{1}{x}$ and $a(x) = |x| - 3$ on the set of axes below. Determine, to the nearest tenth, the positive solution of $r(x) = a(x)$.



163 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.

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- 164 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.

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

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

- 166 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 $(b, 0)$.

- 167 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, $x = 0$.

- 168 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

- 169 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}

- 170 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.

- 171 Which function is even?

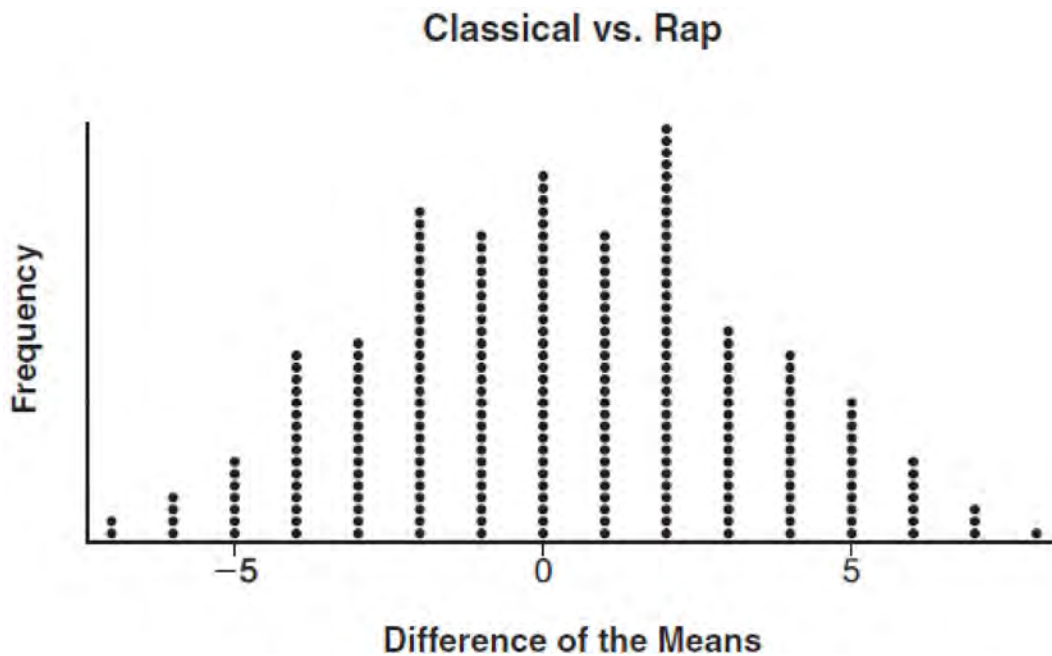
- 1) $f(x) = \sin x$
- 2) $f(x) = x^2 - 4$
- 3) $f(x) = |x - 2| + 5$
- 4) $f(x) = x^4 + 3x^3 + 4$

172 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.

173 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

174 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

- 175 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

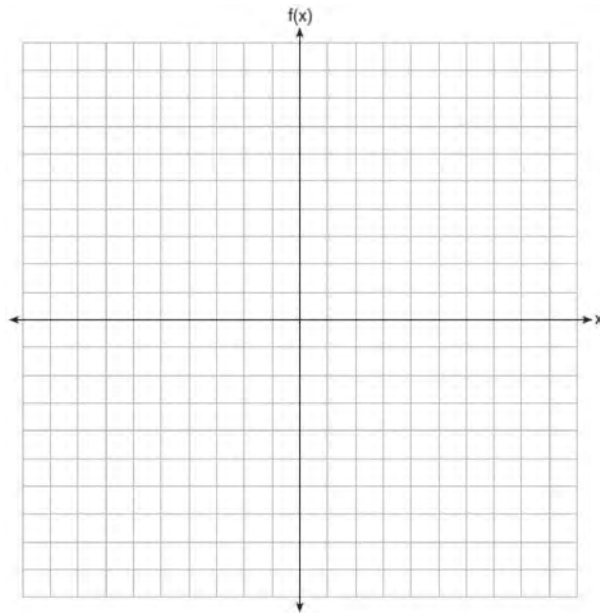
Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer. In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s , to the *nearest mph*. Any B values that round to 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.

- 176 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
- 177 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

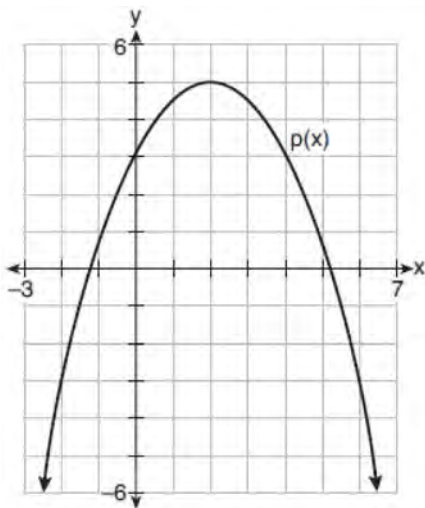
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- 178 The completely factored form of $n^4 - 9n^2 + 4n^3 - 36n - 12n^2 + 108$ is
- 1) $(n^2 - 9)(n + 6)(n - 2)$
 - 2) $(n + 3)(n - 3)(n + 6)(n - 2)$
 - 3) $(n - 3)(n - 3)(n + 6)(n - 2)$
 - 4) $(n + 3)(n - 3)(n - 6)(n + 2)$
- 179 What is the solution set of the equation $\frac{10}{x^2 - 2x} + \frac{4}{x} = \frac{5}{x - 2}$?
- 1) $\{0, 2\}$
 - 2) $\{0\}$
 - 3) $\{2\}$
 - 4) $\{ \}$
- 180 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) $f(x + 1) + 3$
- 181 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) $\frac{16x + y}{124}$
- 182 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%
- 183 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) $[1, 30]$
- 184 On the grid below, graph the function $f(x) = x^3 - 6x^2 + 9x + 6$ on the domain $-1 \leq x \leq 4$.



- 185 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

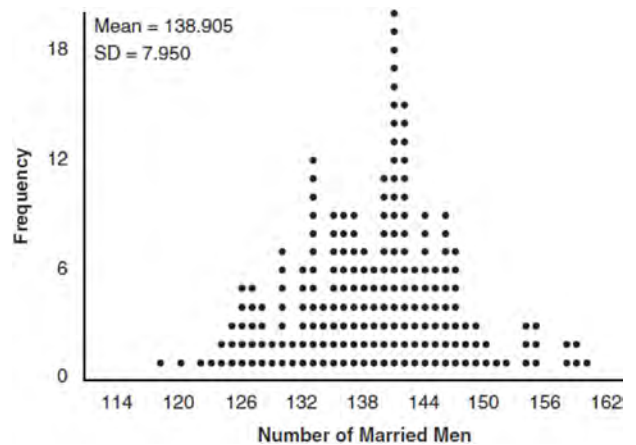
- 1) 0.25
 - 2) 1.25
 - 3) 3.25
 - 4) 10.25
- 186 The terminal side of θ , an angle in standard position, intersects the unit circle at $P\left(-\frac{1}{3}, -\frac{\sqrt{8}}{3}\right)$.

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

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

- 187 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.

- 188 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.

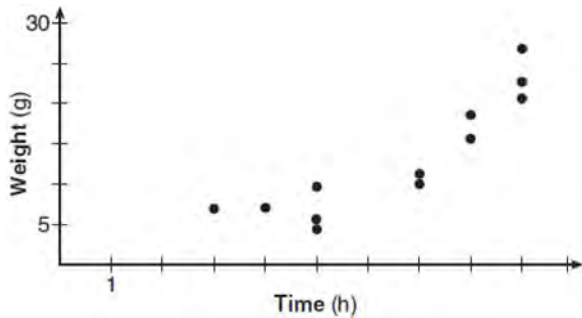


- a) Based on the simulation, create an interval in which the middle 95% of the number of married men may fall. Round your answer to the *nearest integer*.
 - b) A study claims "50 percent of men 21 and older in the United States are married." Do your results from part a contradict this claim? Explain.
- 189 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.

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- 190 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) $w = 8(.75)^t$
- 191 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) $1 + \frac{1}{x+2}$

- 192 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

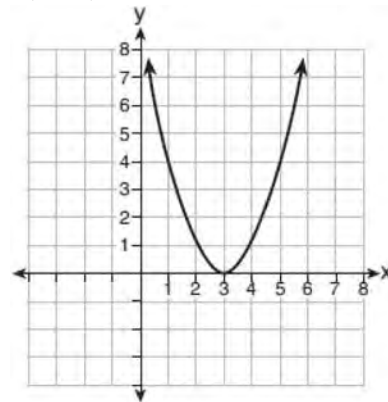
- 193 Which function's graph has a period of 8 and reaches a maximum height of 1 if at least one full period is graphed?

- 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) $y = -4 \cos(8x) + 5$

- 194 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) $2x^2 + 32 = 0$

- 195 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.

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- 196 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

- 197 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) $\frac{\ln\left(\frac{c}{a}\right)}{\ln b}$

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

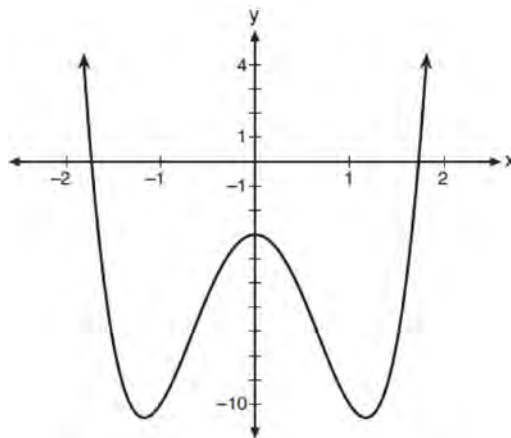
Which equation is *not* equivalent?

- 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) $y = 2.5 - 2.5(2.7^{-2})(2.7^{0.05x})$

- 199 Given $\cos \theta = \frac{7}{25}$, where θ 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) $\frac{24}{7}$

- 200 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.

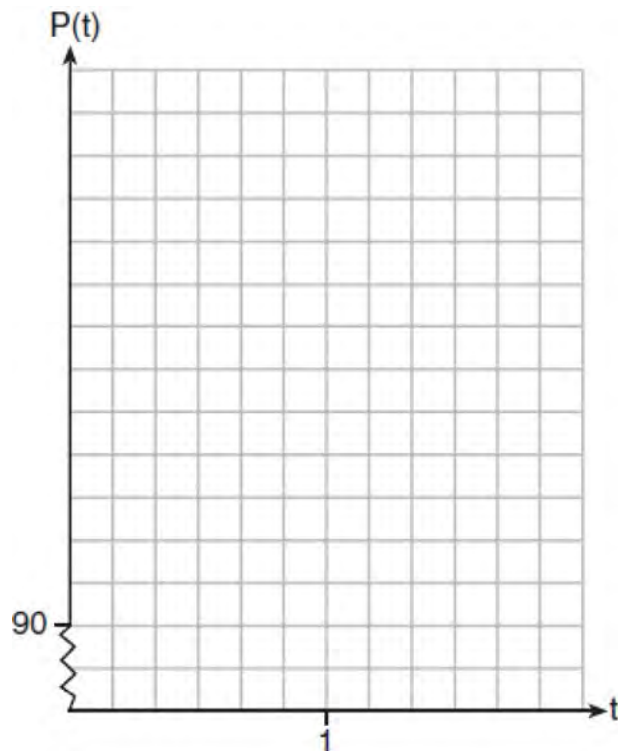
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- 201 The resting blood pressure of an adult patient can be modeled by the function P below, where $P(t)$ is the pressure in millimeters of mercury after time t in seconds.

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

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.

- 202 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.

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

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

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

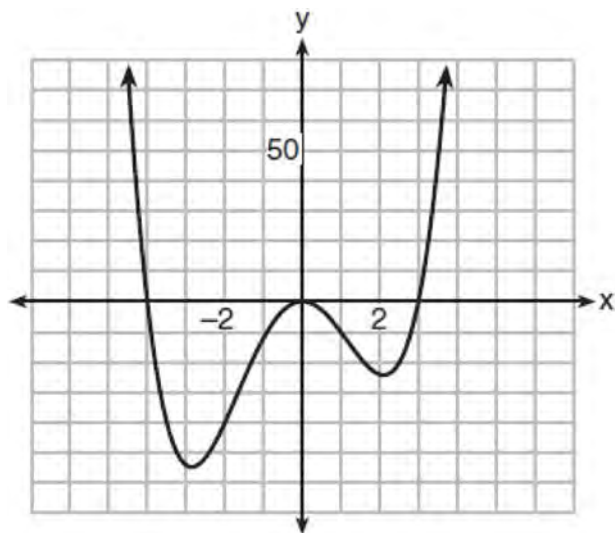
$$P(A|B) = 0.8$$

What is $P(B)$?

- 1) 0.1
 - 2) 0.25
 - 3) 0.375
 - 4) 0.667
- 204 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
- 205 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

- 206 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) $(x + 6)(x + 1)$

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



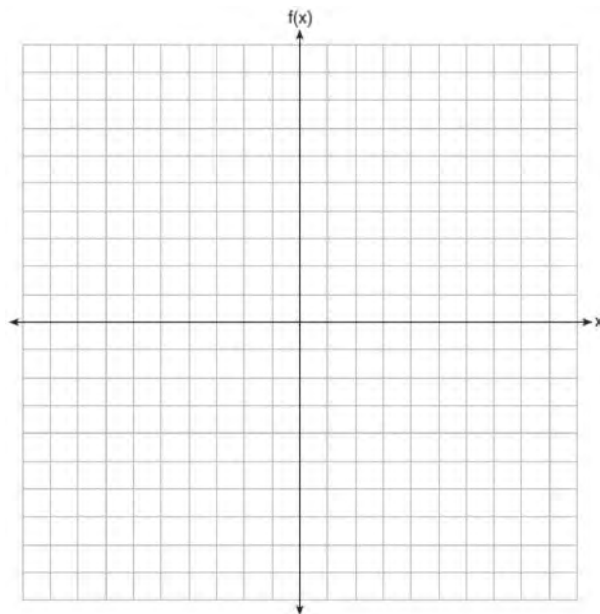
Write an equation for $f(x)$. The function g is formed by translating function f left 2 units. Write an equation for $g(x)$.

- 208 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.

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



- 210 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,

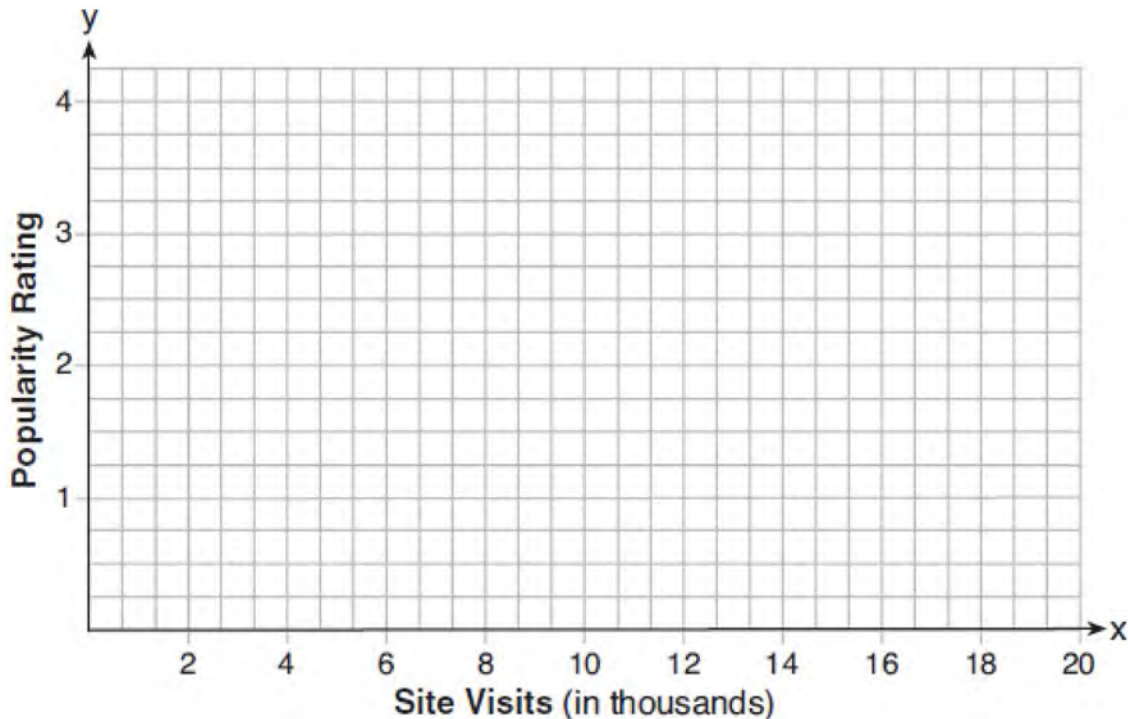
where A is the amount of pain reliever in milligrams remaining in the body after t hours.

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.

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

- 212 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?

- 213 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

- 214 Consider the system of equations below:

$$\begin{aligned} x + y - z &= 6 \\ 2x - 3y + 2z &= -19 \\ -x + 4y - z &= 17 \end{aligned}$$

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

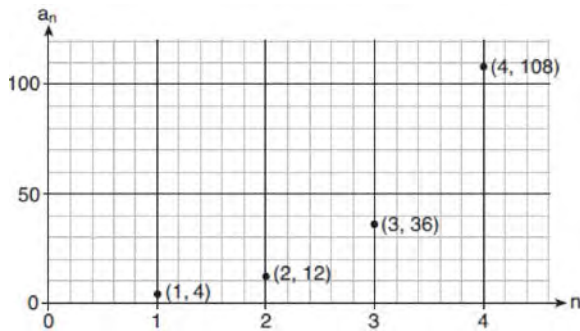
- 1) -1
- 2) 2
- 3) 3
- 4) -4

- 215 Juan and Felipe 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
Short Practice Time	8	10
Long Practice Time	15	12

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

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



- 217 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

- 218 Evan graphed a cubic function, $f(x) = ax^3 + bx^2 + cx + d$, and determined the roots of $f(x)$ to be ± 1 and 2. What is the value of b , if $a = 1$?
- 1) 1
 - 2) 2
 - 3) -1
 - 4) -2

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

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

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

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

- 220 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?

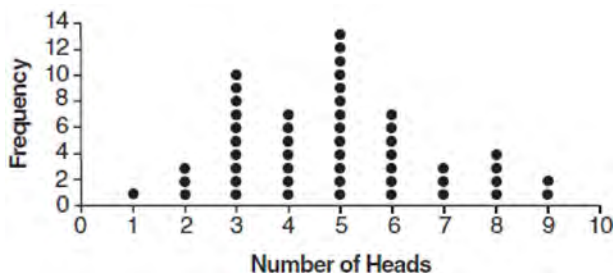
- 1) \$11,622,614.67
- 2) \$17,433,922.00
- 3) \$116,226,146.80
- 4) \$1,743,392,200.00

- 221 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

- 222 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)

- 223 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.
- 224 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)

- 225 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*.

- 226 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*.

- 227 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) $-3x^2 - 6xi - 18$

- 228 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.

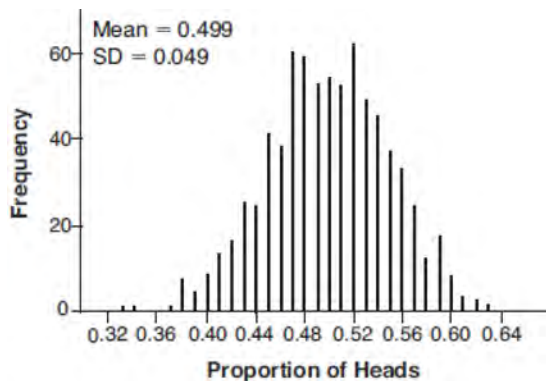
- 229 What is the quotient when $10x^3 - 3x^2 - 7x + 3$ is divided by $2x - 1$?

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

230 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) $C = 550(1.00643)^{t+12}$

231 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.

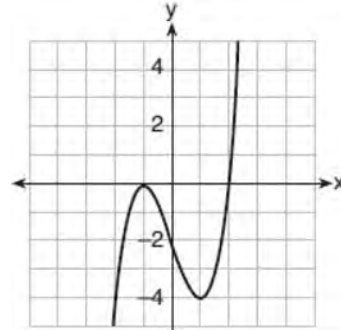


Do the results of the simulation provide strong evidence that Robin's coin is unfair? Explain your answer.

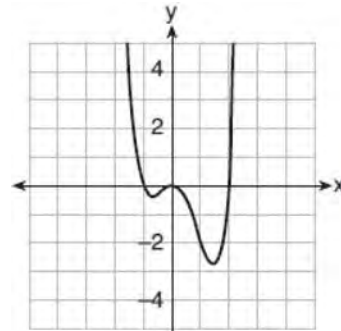
232 If $(a^3 + 27) = (a + 3)(a^2 + ma + 9)$, then m equals

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

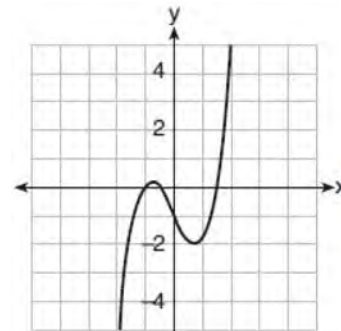
233 Which graph represents a polynomial function that contains $x^2 + 2x + 1$ as a factor?



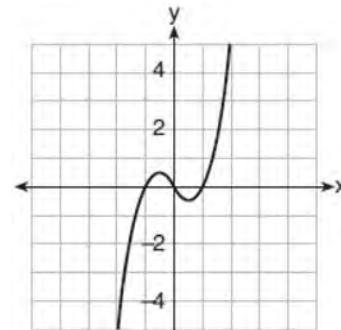
1)



2)



3)



4)

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

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

$$\begin{aligned} &(2 + 4i)(3 - i) \\ &= 6 - 2i + 12i - 4i^2 \\ &= 6 + 10i - 4i^2 \\ &= 6 + 10i - 4(1) \\ &= 6 + 10i - 4 \\ &= 2 + 10i \end{aligned}$$

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

236 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.

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

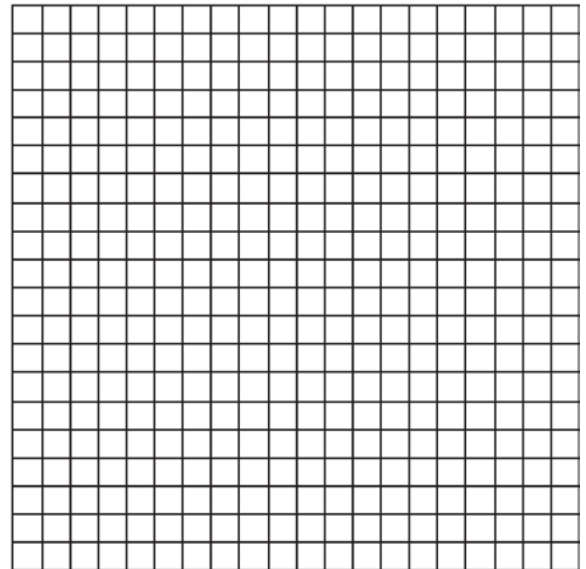
Coffee at a temperature of 195°F is poured into a container. The room temperature is kept at a constant 68°F and $k = 0.05$. Coffee is safe to drink when its temperature is, at most, 120°F . To the *nearest minute*, how long will it take until the coffee is safe to drink?

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

237 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t .

238 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.

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

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240 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

241 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) $a_1 = 2$

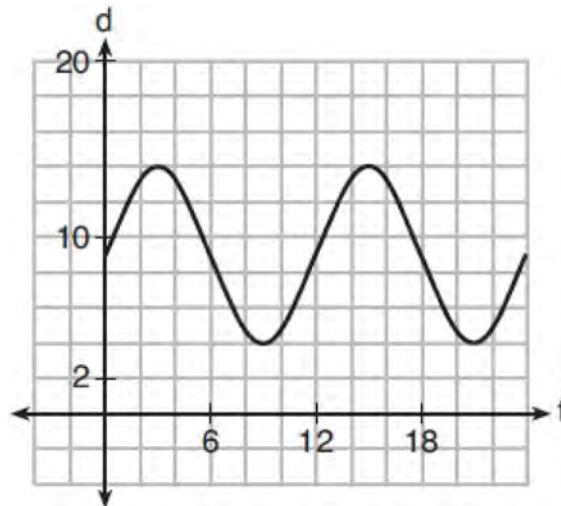
$a_n = a_{n-1} + 0.5$

4) $a_n = 2.5 + 0.5n$

242 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

243 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) $d = 5 \sin\left(\frac{\pi}{6} t\right) + 9$

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

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

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

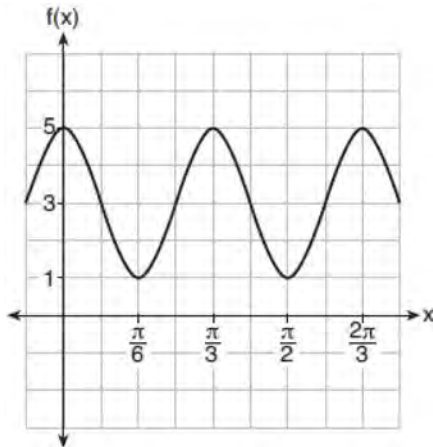
3) $f^{-1}(x) = \log_a x$

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

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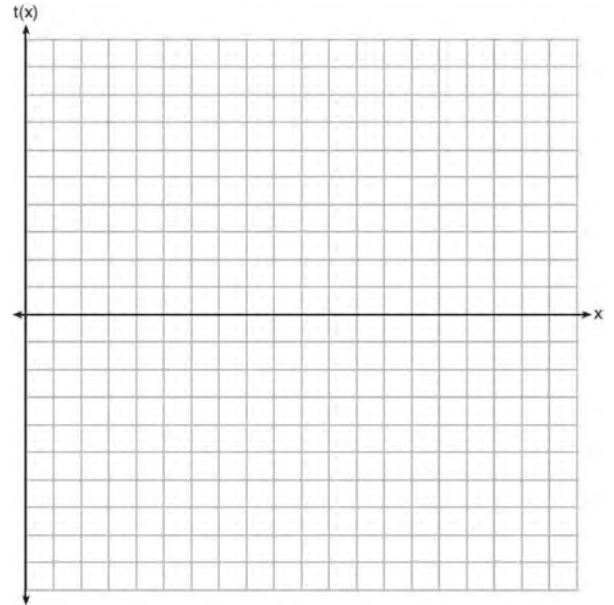
- 245 The function $f(x) = a \cos bx + c$ is plotted on the graph shown below.



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) $a = 4, b = \frac{\pi}{3}, c = 3$
- 246 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%
- 247 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

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



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

- 250 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

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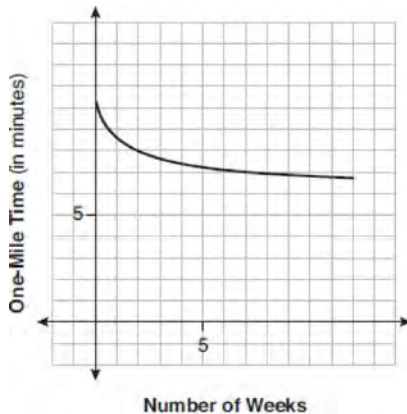
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251 Which statement(s) are true for all real numbers?

- 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

252 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.

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

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

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

254 Solve algebraically for all values of x :

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

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

256 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

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

258 The expression $6 - (3x - 2i)^2$ is equivalent to

- 1) $-9x^2 + 12xi + 10$
- 2) $9x^2 - 12xi + 2$
- 3) $-9x^2 + 10$
- 4) $-9x^2 + 12xi - 4i + 6$

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

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- 260 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) $\frac{1 - 2.5^{n-1}}{1 - 2.5}$
- 261 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) $f^{-1}(x) = \pm\sqrt[3]{x+2}$
- 262 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° . You lower the temperature of your air conditioning by 2° 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.
- 263 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) $g(x) = -\frac{1}{2}x - 16$
- 264 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.

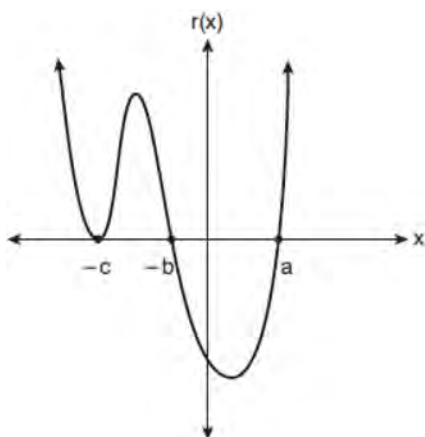
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265 If $\cos \theta = -\frac{3}{4}$ and θ is in Quadrant III, then $\sin \theta$ is equivalent to

- 1) $-\frac{\sqrt{7}}{4}$
- 2) $\frac{\sqrt{7}}{4}$
- 3) $-\frac{5}{4}$
- 4) $\frac{5}{4}$

266 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) $r(x) = (x - a)(x + b)(x + c)^2$

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

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

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

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

268 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.

269 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.

270 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.

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

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

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

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

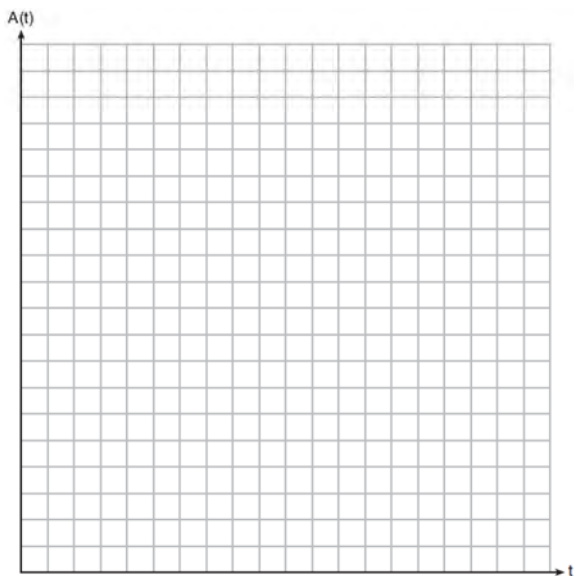
$$4) \left(x^{\frac{2}{3}}\right)^2 = \sqrt[3]{x^4}$$

272 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.

273 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.



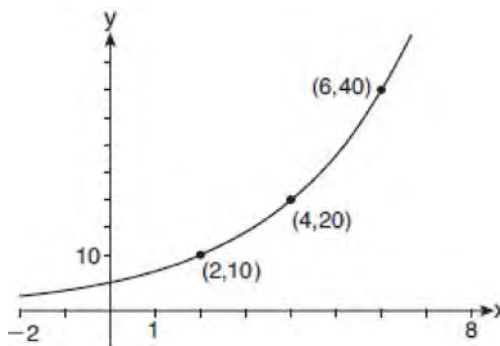
Tony's goal is to save \$1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal. Explain how your graph of $A(t)$ confirms your answer.

274 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) $2x^3 - 4x^2 - x$

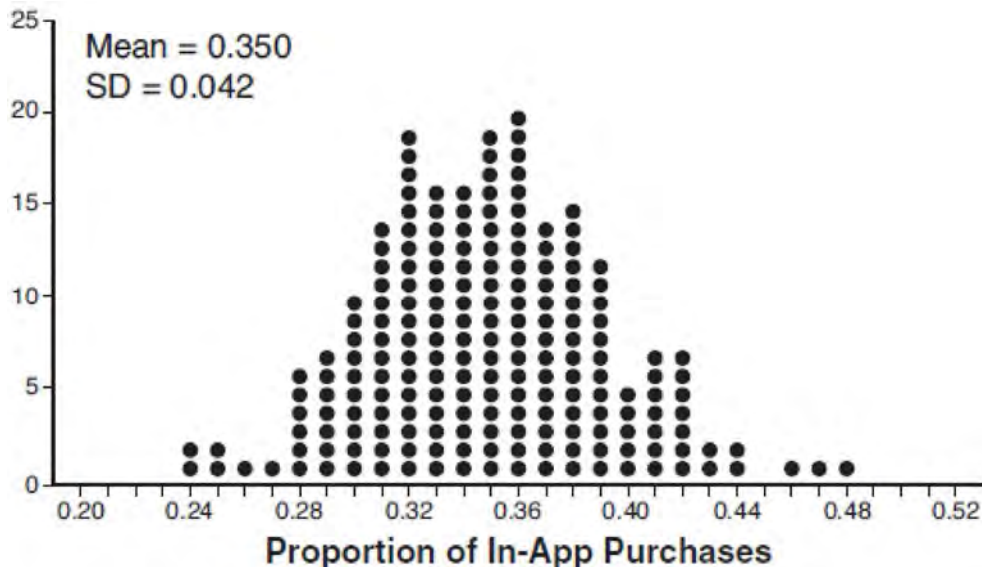
275 The graph of $y = f(x)$ is shown below.



Which expression defines $f(x)$?

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

- 276 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.

- 277 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) $a_0 = 75,000$
 $a_n = 0.92(a_{n-1})$
- 278 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
- 279 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

280 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) $m_1 = 2000$

3) $m_1 = 2000$

$m_n = m_{n-1} - 320$

$m_n = (0.84)m_{n-1}$

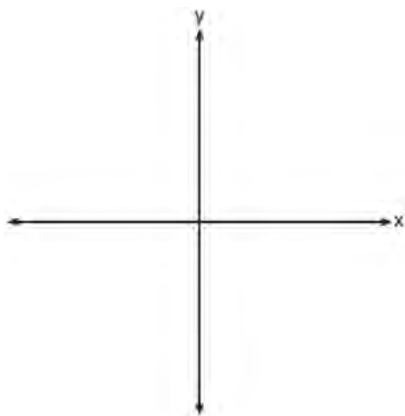
2) $m_n = 2000(0.84)^{n-1}$

4) $m_n = 2000(0.84)^{n+1}$

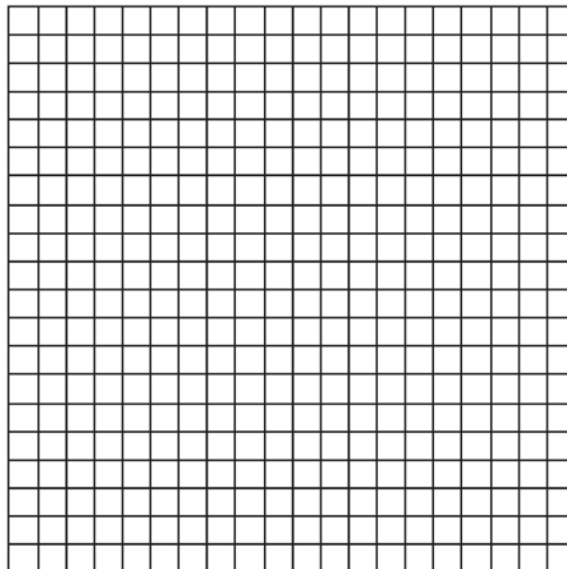
281 If \$5000 is put into a savings account that pays 3.5% interest compounded monthly, how much money, to the nearest ten cents, would be in that account after 6 years, assuming no money was added or withdrawn?

- 1) \$5177.80
- 2) \$5941.30
- 3) \$6146.30
- 4) \$6166.50

282 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.

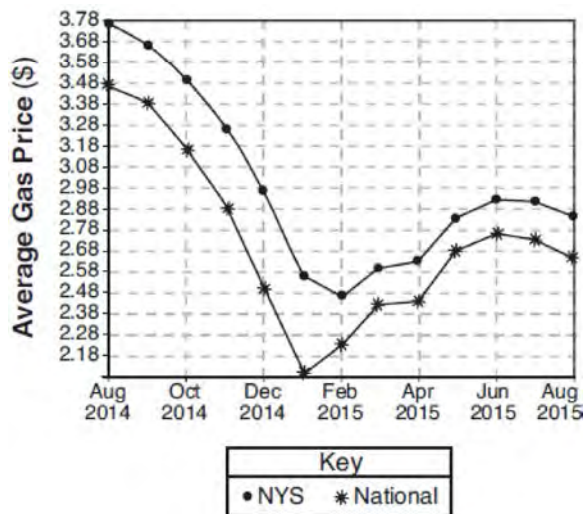


283 Write an equation for a sine function with an amplitude of 2 and a period of $\frac{\pi}{2}$. On the grid below, sketch the graph of the equation in the interval 0 to 2π .



284 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.

- 285 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) $G(x) - C$
- 286 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
- 287 Given $c(m) = m^3 - 2m^2 + 4m - 8$, the solution of $c(m) = 0$ is
- 1) ± 2
 - 2) 2, only
 - 3) $2i, 2$
 - 4) $\pm 2i, 2$

- 288 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) $(3, 0)$

- 289 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 $j(x)$.

- 290 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) $(x + 2)^2 = -8(y - 7)$

- 291 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) $\frac{(x + 7)(x^2 + 4x + 3)}{(x + 3)}$

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

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

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

294 Write $-\frac{1}{2}i^3(\sqrt{-9} - 4) - 3i^2$ in simplest $a + bi$ form.

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

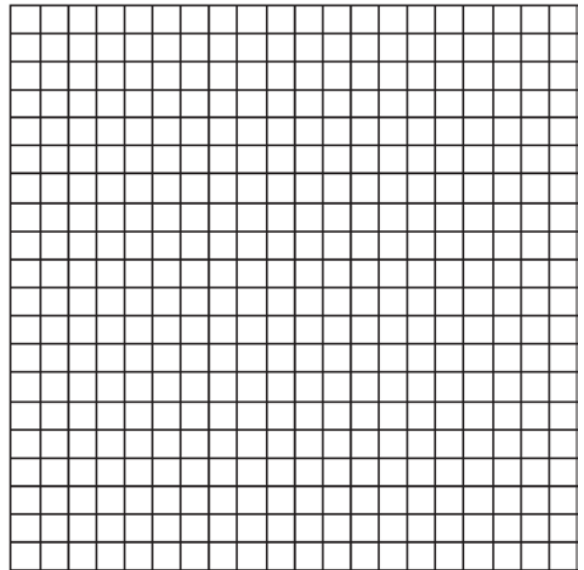
296 Explain what a rational exponent, such as $\frac{5}{2}$ means.

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

297 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

298 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.



299 How many solutions exist for

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

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

300 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) $y = -6$

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301 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

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

303 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.

304 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*.

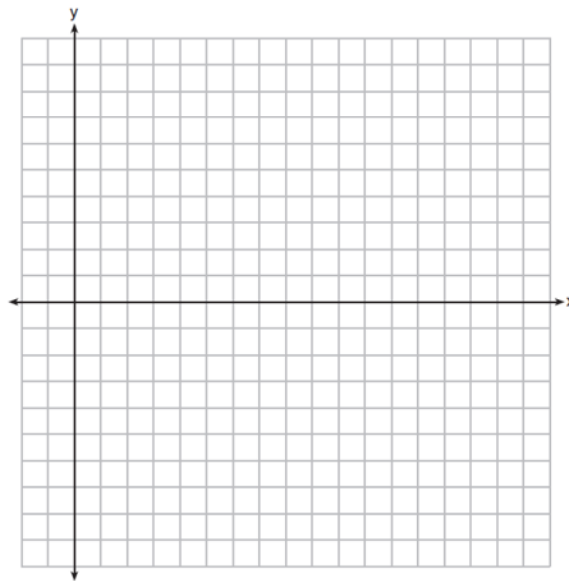
305 Researchers in a local area found that the population of rabbits with an initial population of 20 grew continuously at the rate of 5% per month. The fox population had an initial value of 30 and grew continuously at the rate of 3% per month. Find, to the *nearest tenth of a month*, how long it takes for these populations to be equal.

306 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.

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- 307 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

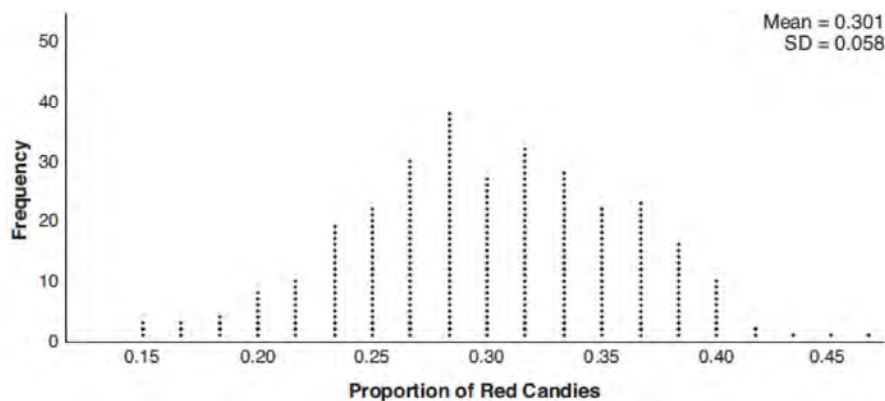
A student response is selected at random from the results. State the *exact* probability the student response is from a freshman, given the student prefers to watch reality shows on television.

- 308 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.

A	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{6}{9}$	$\frac{8}{9}$	1
D	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.

- 309 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.

- 310 Determine the quotient and remainder when $(6a^3 + 11a^2 - 4a - 9)$ is divided by $(3a - 2)$.
 Express your answer in the form $q(a) + \frac{r(a)}{d(a)}$.

- 311 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) $-\frac{1}{3} \pm \frac{\sqrt{11}}{3}$

- 312 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) $(x^3y^2 + 3)(x^3y^2 - 3)(x^2 + 4)(x^2 - 4)$

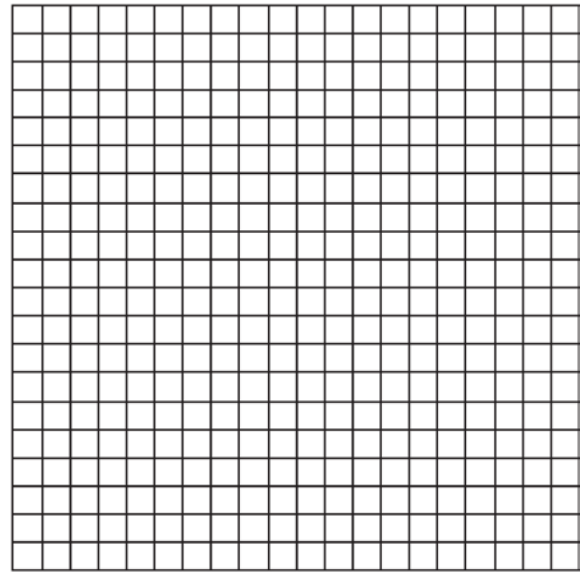
- 313 A savings account, S , has an initial value of \$50. The account grows at a 2% interest rate compounded n times per year, t , according to the function below.

$$S(t) = 50 \left(1 + \frac{.02}{n} \right)^{nt}$$

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 $S(t) = 50(1 - 0.02)^t$.

- 314 Determine an equation for the parabola with focus $(4, -1)$ and directrix $y = -5$. (Use of the grid below is optional.)



- 315 Over the set of integers, factor the expression $x^4 - 4x^2 - 12$.

- 316 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

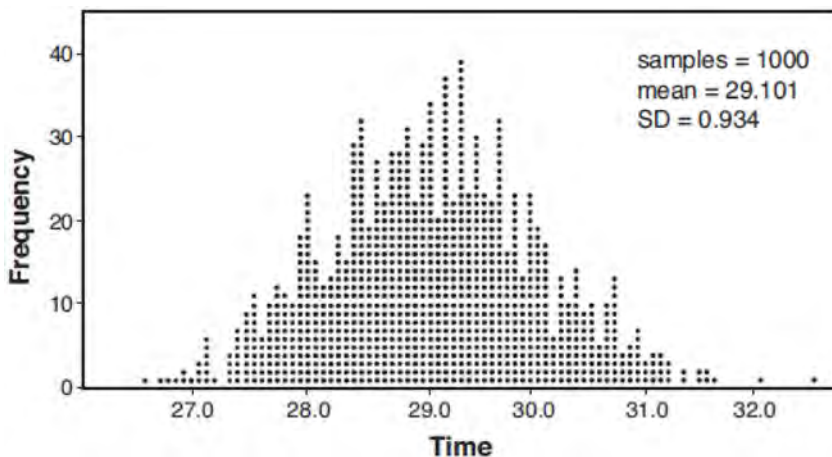
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- 317 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

\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*.

- 318 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) $\frac{3}{2} \pm \frac{\sqrt{33}}{2} i$

- 319 Solve the following system of equations algebraically. $x^2 + y^2 = 400$
 $y = x - 28$

- 320 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 $y \neq 0$.

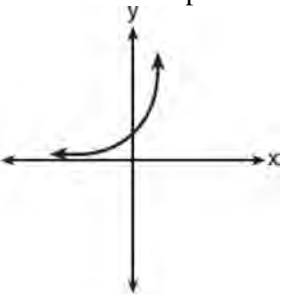
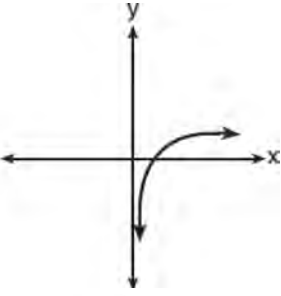
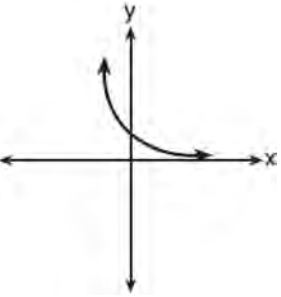
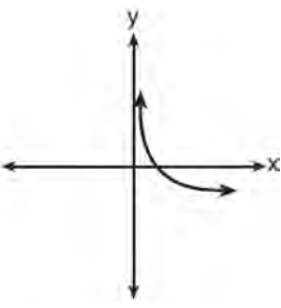
- 321 If $f(x) = x^2 + 9$ and $g(x) = x + 3$, which operation would not result in a polynomial expression?
- 1) $f(x) + g(x)$
 - 2) $f(x) - g(x)$
 - 3) $f(x) \bullet g(x)$
 - 4) $f(x) \div g(x)$

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322 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.

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

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

324 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

325 The height above ground for a person riding a Ferris wheel after t seconds is modeled by

$$h(t) = 150 \sin\left(\frac{\pi}{45}t + 67.5\right) + 160 \text{ feet.}$$

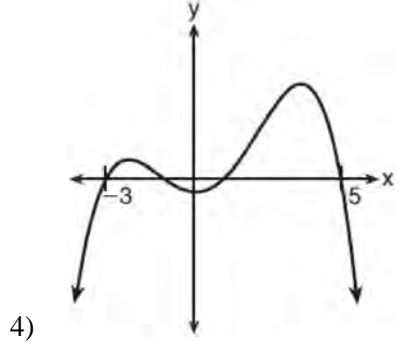
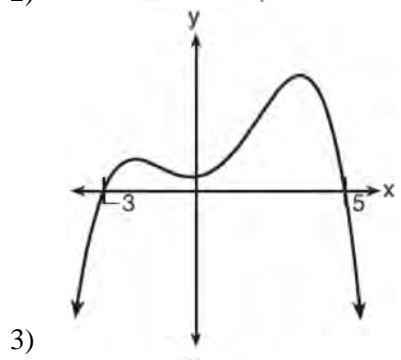
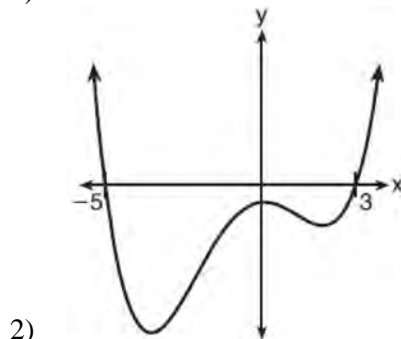
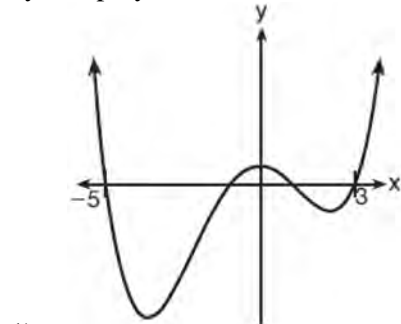
How many seconds does it take to go from the bottom of the wheel to the top of the wheel?

- 1) 10
2) 45
3) 90
4) 150

326 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) $29,400 \left(1.068^{\frac{1}{365}}\right)^{365t}$

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



328 Explain why $81^{\frac{3}{4}}$ equals 27.

329 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

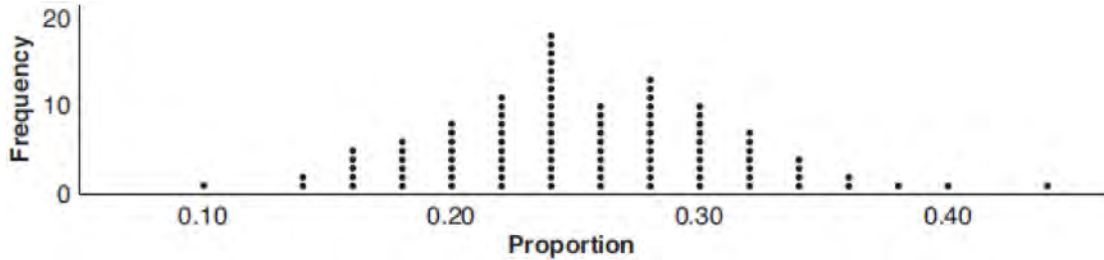
4)

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

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330 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)

331 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

332 For which values of x , rounded to the nearest hundredth, will $\left| x^2 - 9 \right| - 3 = \log_3 x$?

- 1) 2.29 and 3.63
- 2) 2.37 and 3.54
- 3) 2.84 and 3.17
- 4) 2.92 and 3.06

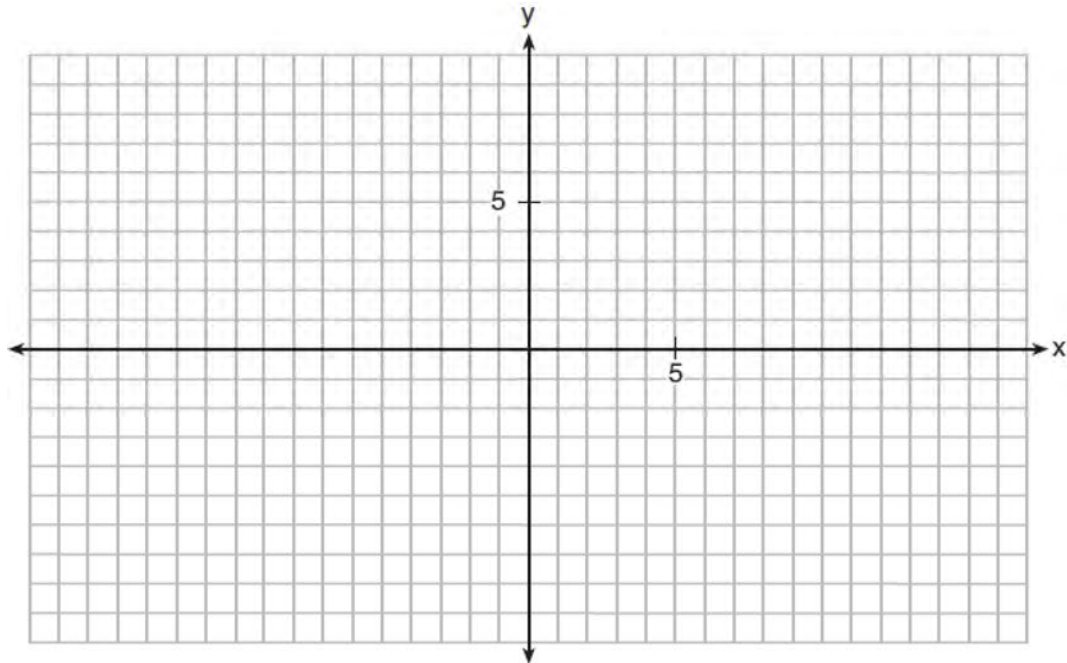
333 The expression $(x+a)(x+b)$ can not be written as

- 1) $a(x+b) + x(x+b)$
- 2) $x^2 + abx + ab$
- 3) $x^2 + (a+b)x + ab$
- 4) $x(x+a) + b(x+a)$

334 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.

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



336 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

337 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.

338 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) $y = 166.67(1.0032737)^t$

339 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*.

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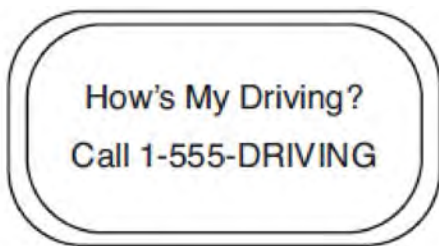
340 Which equation represents the equation of the parabola with focus $(-3,3)$ and directrix $y = 7$?

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

341 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) $400(1.001121184)^{52t}$

342 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.

343 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

344 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

345 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) $3x + 1 + \frac{1}{3x + 1}$

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- 346 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) $\{(0, 6), (5, 21)\}$
- 347 Suppose two sets of test scores have the same mean, but different standard deviations, σ_1 and σ_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.

- 348 For positive values of x , which expression is

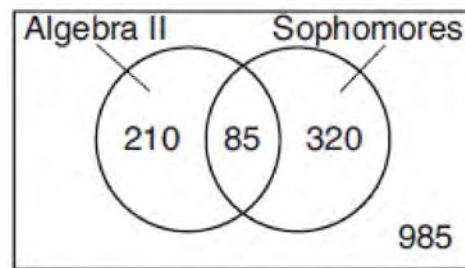
equivalent to $\sqrt{16x^2} \cdot x^{\frac{2}{3}} + \sqrt[3]{8x^5}$

- 1) $6\sqrt{x^3}$
 - 2) $6\sqrt[3]{x^5}$
 - 3) $4\sqrt[3]{x^2} + 2\sqrt[3]{x^5}$
 - 4) $4\sqrt{x^3} + 2\sqrt[5]{x^3}$
- 349 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) $P(A) = 0.15, P(B) = 0.05$

- 350 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) $\frac{-c + d}{d + 2c}$
- 351 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) $\frac{85}{1600}$
- 352 Write a recursive formula for the sequence 6, 9, 13.5, 20.25, ...

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- 353 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 3) 0.271
 2) 0.136 4) 0.543
- 354 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 3) 68
 2) 20 4) 125
- 355 Natalia's teacher has given her the following information about angle θ .
- $\pi < \theta < 2\pi$
 - $\cos \theta = \frac{\sqrt{3}}{4}$
- Explain how Natalia can determine if the value of $\tan \theta$ is positive or negative.
- 356 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) $3^{\frac{3}{2}}x^2y^{\frac{7}{6}}$

357 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.

358 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) $\frac{x^2-9}{x(x-3)}$

359 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.

360 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

361 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) $a_1 = 25,000, a_n = a_{n+1} + 1000$

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

363 Given the following polynomials

$$\begin{aligned}x &= (a + b + c)^2 \\y &= a^2 + b^2 + c^2 \\z &= ab + bc + ac\end{aligned}$$

Which identity is true?

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

364 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.

365 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 $P(1) = 0$.

366 What is the solution set for x in the equation below?

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

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

367 Algebraically solve for x : $\frac{-3}{x+3} + \frac{1}{2} = \frac{x}{6} - \frac{1}{2}$

368 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) $\sqrt{a^3}$

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

370 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 $[9000, 12,000]$.

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371 If the terminal side of angle θ , 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) $-\frac{4}{5}$

372 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.

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

$$x + 3y + 5z = 45$$

$$6x - 3y + 2z = -10$$

$$-2x + 3y + 8z = 72$$

374 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

375 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

376 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) $V = 120 \sin(120\pi t)$

377 Determine if $x - 5$ is a factor of $2x^3 - 4x^2 - 7x - 10$. Explain your answer.

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- 378 If $\sin^2(32^\circ) + \cos^2(M) = 1$, then M equals
- 1) 32°
 - 2) 58°
 - 3) 68°
 - 4) 72°
- 379 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
- 380 Which statement is *incorrect* for the graph of the function $y = -3 \cos \left[\frac{\pi}{3} (x - 4) \right] + 7$?
- 1) The period is 6.
 - 2) The amplitude is 3.
 - 3) The range is $[4, 10]$.
 - 4) The midline is $y = -4$.
- 381 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*.
- 382 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) $m(m^2 + 3)(m^2 - 2)$
- 383 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 $R(x) = x \bullet S(x)$. 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) $-0.15x^3 + 32x + 120$
- 384 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) $(1.00427)^{\frac{m}{12}}$
- 385 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.
- 386 Algebraically determine the values of x that satisfy the system of equations below.
- $$y = -2x + 1$$
- $$y = -2x^2 + 3x + 1$$

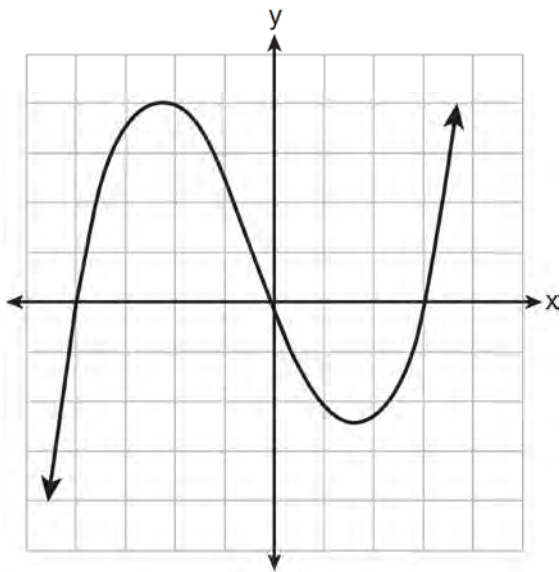
- 387 Jim is looking to buy a vacation home for \$172,600 near his favorite southern beach. The formula to compute a mortgage payment, M , is

$$M = P \cdot \frac{r(1+r)^N}{(1+r)^N - 1}$$

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.

- 388 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

- 389 The formula below can be used to model which scenario?

$$a_1 = 3000$$

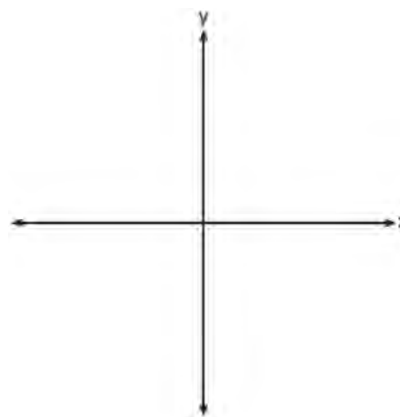
$$a_n = 0.80a_{n-1}$$

- 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.

- 390 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.

- 391 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.



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392 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?

- 1) (0,200)
- 2) (100,300)
- 3) (200,400)
- 4) (300,400)

393 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.

394 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

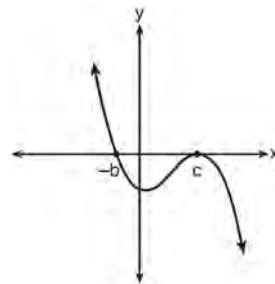
form $A = A_0 \left(\frac{1}{2}\right)^{\frac{t}{h}}$ that models this situation,

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*.

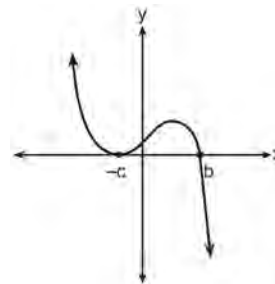
395 Which factorization is *incorrect*?

- 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) $t^3 + 5t^2 + 6t + t^2 + 5t + 6 = (t + 1)(t + 2)(t + 3)$

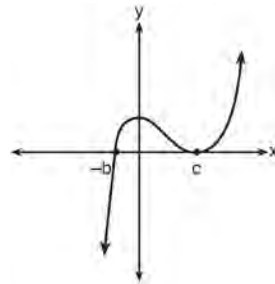
396 If a , b , and c are all positive real numbers, which graph could represent the sketch of the graph of $p(x) = -a(x + b)(x^2 - 2cx + c^2)$?



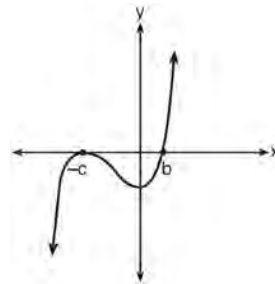
1)



2)



3)



4)

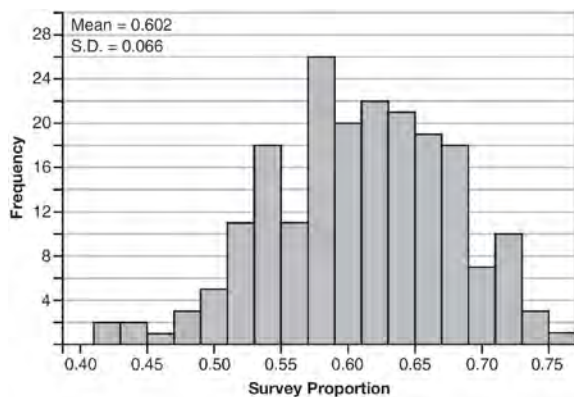
397 Algebraically prove that the difference of the squares of any two consecutive integers is an odd integer.

398 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.

399 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.

400 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 ± 115
- 2) 430 ± 230
- 3) 496 ± 115
- 4) 496 ± 230

401 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.

402 The zeros for $f(x) = x^4 - 4x^3 - 9x^2 + 36x$ are

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

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- 403 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.

- 404 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

$$g(x) = 4x^3 - 5x^2 + 3$$

- 405 Given $z(x) = 6x^3 + bx^2 - 52x + 15$, $z(2) = 35$, and $z(-5) = 0$, algebraically determine all the zeros of $z(x)$.

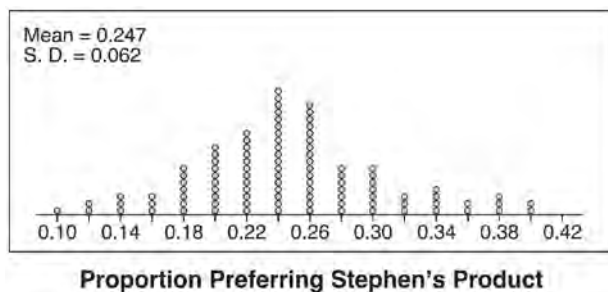
406 Solve for x : $\frac{1}{x} - \frac{1}{3} = -\frac{1}{3x}$

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- 407 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

- 408 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.

- 409 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) $300(1.30)^{\frac{365}{14}}$

- 410 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

- 411 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) $6 \pm 2\sqrt{19}$

- 412 Rewrite the expression

$(4x^2 + 5x)^2 - 5(4x^2 + 5x) - 6$ as a product of four linear factors.

413 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) $3x^2 + 13x + \frac{49}{2} + \frac{151}{2x + 3}$

414 Which statement about statistical analysis is *false*?

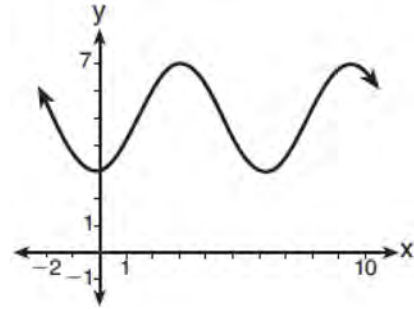
- 1) Experiments can suggest patterns and relationships in data.
- 2) Experiments can determine cause and effect relationships.
- 3) Observational studies can determine cause and effect relationships.
- 4) Observational studies can suggest patterns and relationships in data.

415 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.

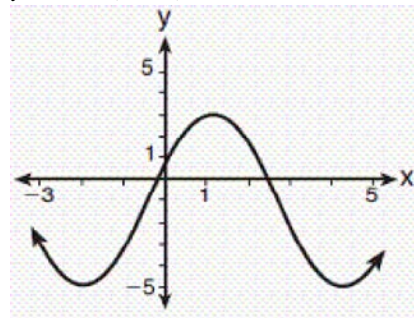
416 The solution to the equation $18x^2 - 24x + 87 = 0$ is

- 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) $\frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$

417 Which sinusoid has the greatest amplitude?



- 1)
- 2) $y = 3 \sin(\theta - 3) + 5$



- 3)
- 4) $y = -5 \sin(\theta - 1) - 3$

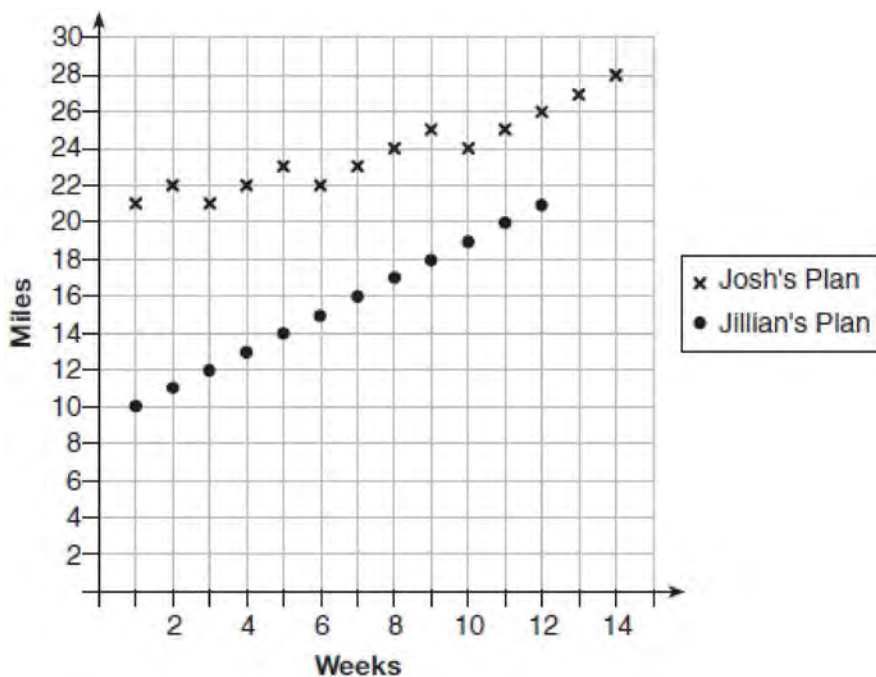
418 Iridium-192 is an isotope of iridium and has a half-life of 73.83 days. If a laboratory experiment begins with 100 grams of Iridium-192, the number of grams, A , of Iridium-192 present after t days

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?

- 1) $A = 100 \left(\frac{73.83}{2} \right)^t$
- 2) $A = 100 \left(\frac{1}{147.66} \right)^t$
- 3) $A = 100(0.990656)^t$
- 4) $A = 100(0.116381)^t$

- 419 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.

- 420 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.

- 421 Use the properties of rational exponents to determine the value of y for the equation:

$$\frac{\sqrt[3]{x^8}}{(x^4)^{\frac{1}{3}}} = x^y, x > 1$$

- 422 Solve the system of equations shown below algebraically.

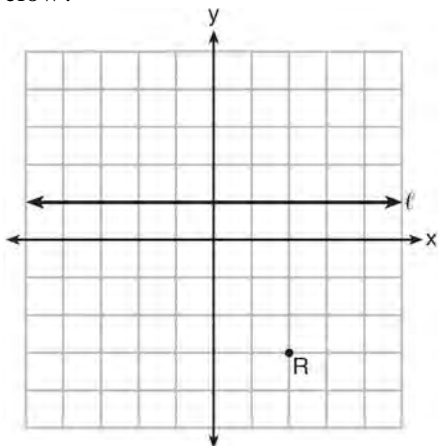
$$(x-3)^2 + (y+2)^2 = 16$$

$$2x + 2y = 10$$

423 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) $x^2 - 2x + 2 = 0$

424 Which equation represents the set of points equidistant from line ℓ 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) $y = -\frac{1}{8}(x-2)^2 - 1$

425 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) $-3x^{-1} + x^{-2}$

426 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) $P = 714(0.9750)^y$

427 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?

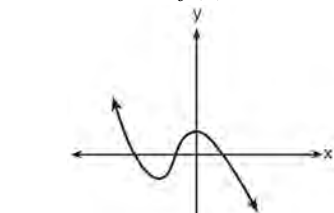
- 1) $\sum_{n=1}^6 8(1.10)^{n-1}$
- 2) $\sum_{n=1}^6 8(1.10)^n$
- 3) $\frac{8 - 8(1.10)^6}{0.90}$
- 4) $\frac{8 - 8(0.10)^n}{1.10}$

428 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?

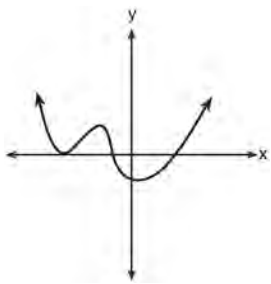
- 1) $(-0.9, 1.8)$
- 2) $(-0.9, 1.9)$
- 3) $(1.4, 3.3)$
- 4) $(1.4, 3.4)$

429 Which graph has the following characteristics?

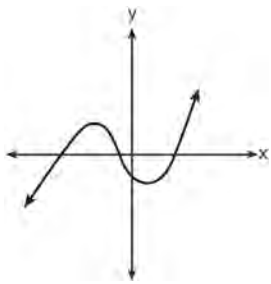
- three real zeros
- as $x \rightarrow -\infty$, $f(x) \rightarrow -\infty$
- as $x \rightarrow \infty$, $f(x) \rightarrow \infty$



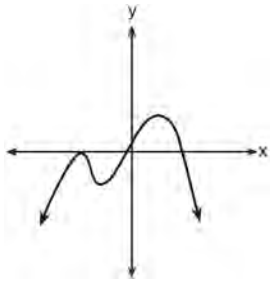
1)



2)



3)

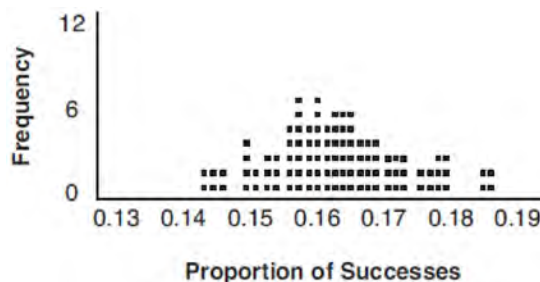


4)

430 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) $-\sqrt[5]{m}$
- 4) $\frac{1}{\sqrt[5]{m}}$

431 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 $\approx .16$

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432 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.

433 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?

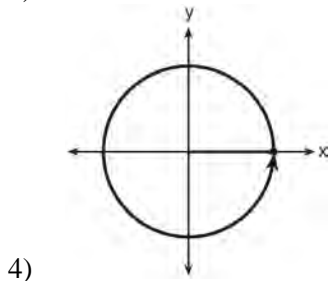
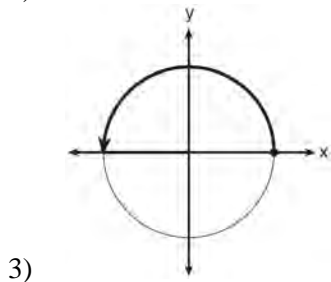
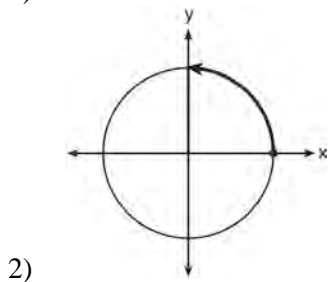
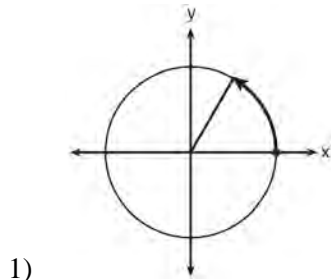
- 1) $\frac{157}{229}$ 3) $\frac{157}{384}$
 2) $\frac{157}{312}$ 4) $\frac{157}{456}$

434 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.

435 Which diagram shows an angle rotation of 1 radian on the unit circle?



436 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

437 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.

438 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) $a_n = 2 \cdot 3^{n+1}$

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

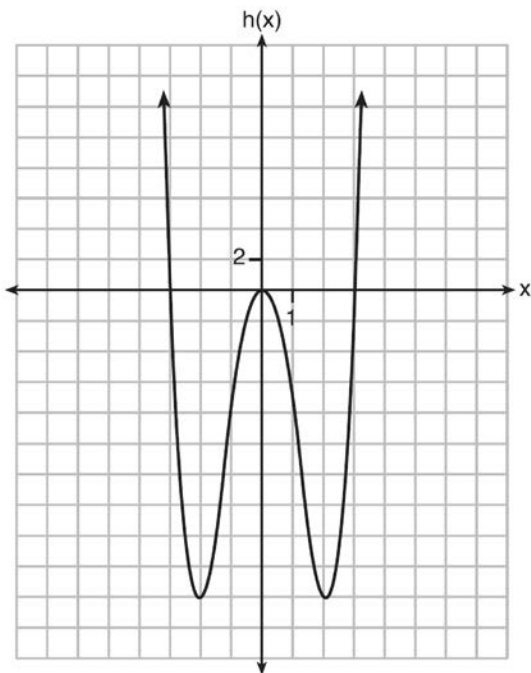
440 Solve the following system of equations algebraically for all values of x , y , and z :

$$\begin{aligned} x + y + z &= 1 \\ 2x + 4y + 6z &= 2 \\ -x + 3y - 5z &= 11 \end{aligned}$$

441 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.

442 The expression $\frac{4x^3 + 5x + 10}{2x + 3}$ is equivalent to

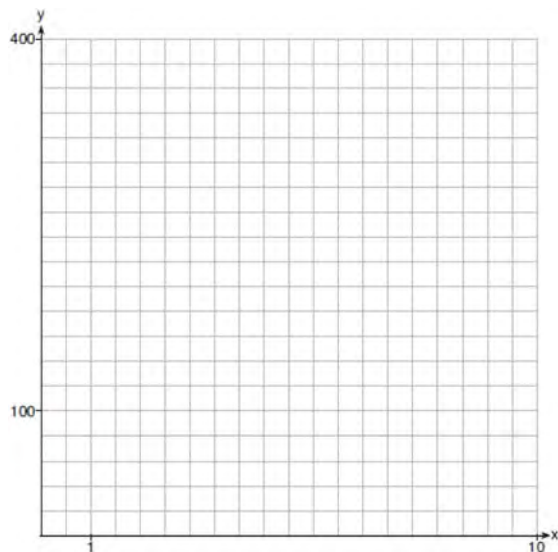
- 1) $2x^2 + 3x - 7 + \frac{31}{2x + 3}$
- 2) $2x^2 - 3x + 7 - \frac{11}{2x + 3}$
- 3) $2x^2 + 2.5x + 5 + \frac{15}{2x + 3}$
- 4) $2x^2 - 2.5x - 5 - \frac{20}{2x + 3}$

443 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) $\frac{m(c)}{g(c)} = \frac{-1}{1 - c}$

444 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.

445 Graph $y = 400(.85)^{2x} - 6$ on the set of axes below.



446 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) $9k^2 - 12ki + 4$

447 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

448 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 $1.0 \times 10^{-12} \text{ W/m}^2$ (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 $6.3 \times 10^{-3} \text{ W/m}^2$ be classified?

- 1) moderate
- 2) loud
- 3) very loud
- 4) deafening

449 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.

450 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.

451 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?

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452 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:

- I. The current population is 110 million.
- II. The population increases continuously by approximately 3.9% per year.

This model supports

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

453 Explain how $\left(3^{\frac{1}{5}}\right)^2$ can be written as the equivalent radical expression $\sqrt[5]{9}$.

454 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?

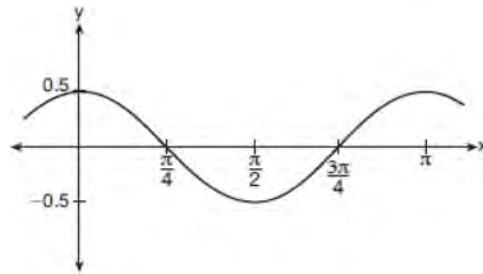
- A. The equation of $p(x) = (x - 2)(x + 10)(x + 14)$.
- B. The equation of $p(x) = -(x + 2)(x - 10)(x - 14)$.
- C. The maximum volume occurs when $x = 10$.
- D. The maximum volume of the box is approximately 56.

- 1) A and C
- 2) A and D
- 3) B and C
- 4) B and D

455 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) $x = 3^y$

456 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) $y = 2 \cos \frac{1}{2} x$

457 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

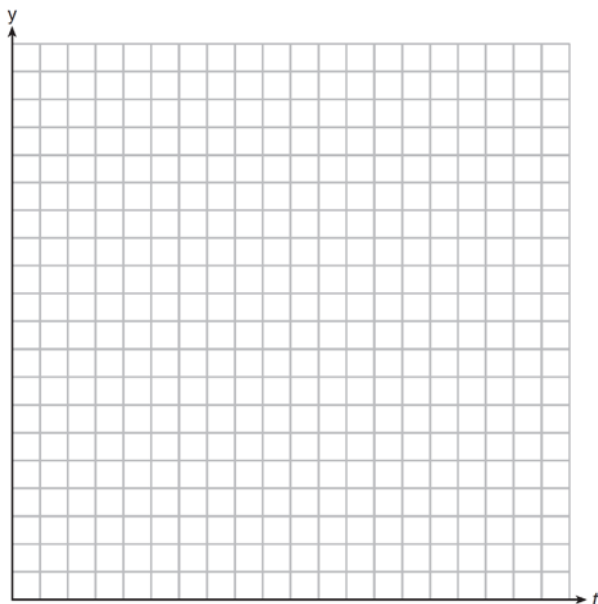
458 The expression $\frac{x^3 + 2x^2 + x + 6}{x + 2}$ is equivalent to

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

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- 459 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.



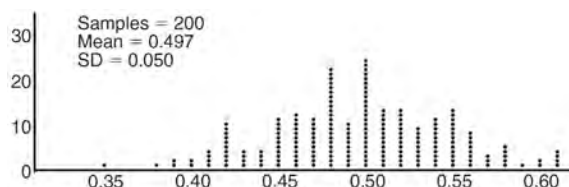
To the *nearest hour*, t , when does the amount of the given drug remaining in patient B begin to exceed the amount of the given drug remaining in patient A? The doctor will allow patient A to take another 800 milligram dose of the drug once only 15% of the original dose is left in the body. Determine, to the *nearest tenth of an hour*, how long patient A will have to wait to take another 800 milligram dose of the drug.

- 460 Algebraically prove that $\frac{x^3 + 9}{x^3 + 8} = 1 + \frac{1}{x^3 + 8}$, where $x \neq -2$.

- 461 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 $-1 - 4i$

- 462 Given the equal terms $\sqrt[3]{x^5}$ and $y^{\frac{5}{6}}$, determine and state y , in terms of x .

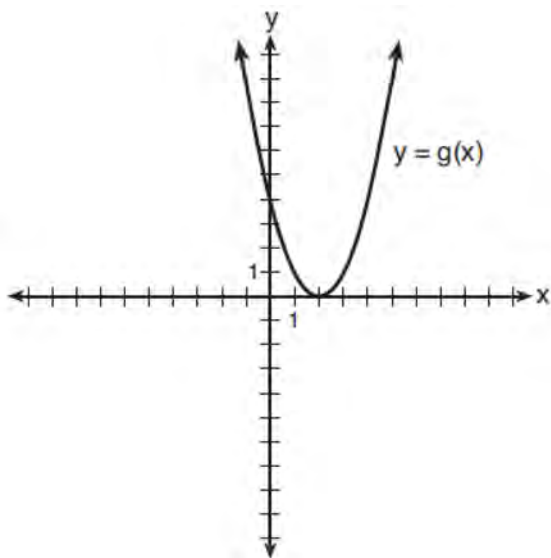
- 463 Anne has a coin. She does not know if it is a fair coin. She flipped the coin 100 times and obtained 73 heads and 27 tails. She ran a computer simulation of 200 samples of 100 fair coin flips. The output of the proportion of heads is shown below.



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.

- 464 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) $\{(1, 1), (6, 16)\}$
- 465 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. $\frac{x^{\frac{1}{6}}}{x^{\frac{1}{3}}}$ 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
- 466 Solve algebraically for all values of x :
 $\sqrt{x-5} + x = 7$

- 467 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) $(11.29, 32.87)$

- 468 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 $q(x) + \frac{r(x)}{g(x)}$.

- 469 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) $C(n) = \frac{329.99 + 326.34n}{n}$

- 470 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.

- 471 Over the set of integers, factor the expression $4x^3 - x^2 + 16x - 4$ completely.

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472 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) $g_n = 18(2)^{n-1}$

473 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) $\left(\sqrt[d]{3b}\right)^2$

474 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?

1) $\frac{255 + 93T}{3T} = 90$

2) $\frac{255 + 90T}{3T} = 93$

3) $\frac{255 + 93T}{T+3} = 90$

4) $\frac{255 + 90T}{T+3} = 93$

475 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 θ is in Quadrant II.

476 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.

477 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

478 Write $(5 + 2yi)(4 - 3i) - (5 - 2yi)(4 - 3i)$ in $a + bi$ form, where y is a real number.

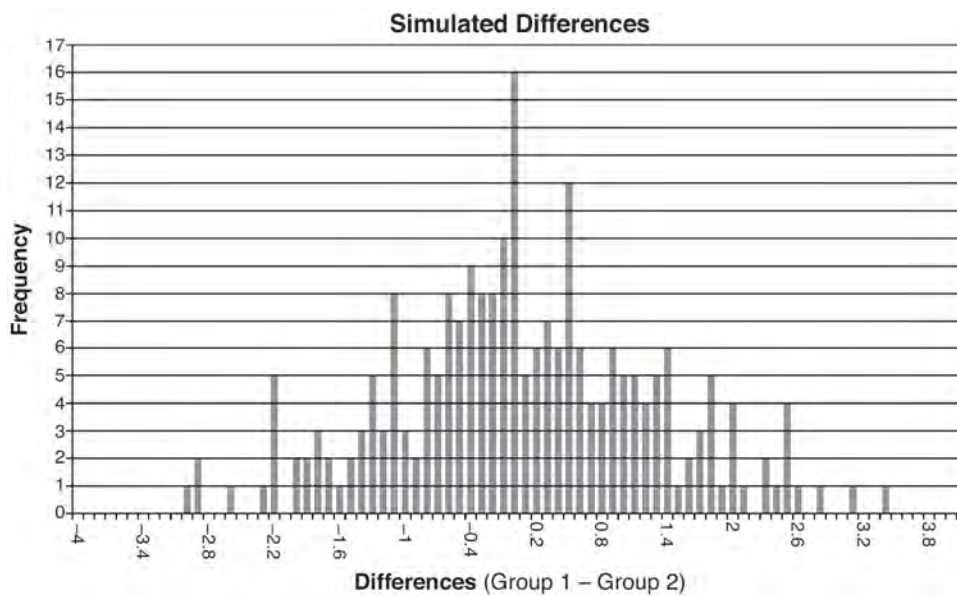
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479 Ayva designed an experiment to determine the effect of a new energy drink on a group of 20 volunteer students. Ten students were randomly selected to form group 1 while the remaining 10 made up group 2. Each student in group 1 drank one energy 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.

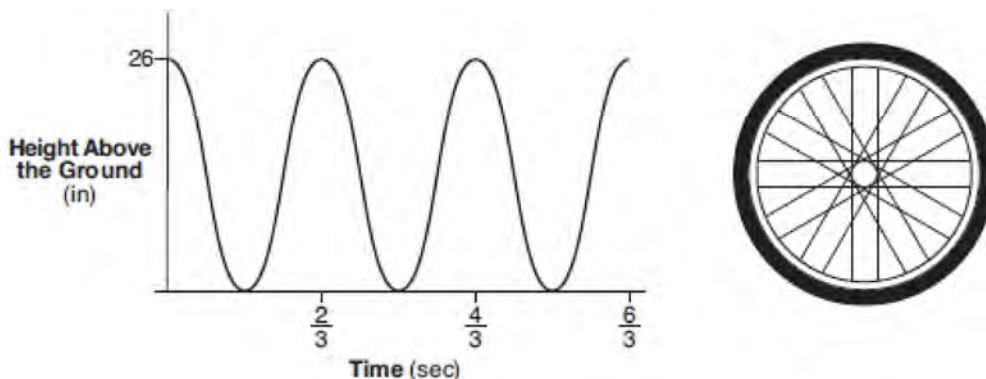
Group 1 (seconds)	Group 2 (seconds)
17.4	23.3
18.1	18.8
18.2	22.1
19.6	12.7
18.6	16.9
16.2	24.4
16.1	21.2
15.3	21.2
17.8	16.3
19.7	14.5
Mean = 17.7	Mean = 19.1

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.

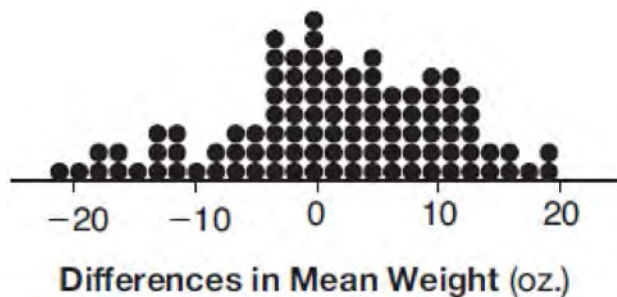
- 480 The graph below represents the height above the ground, h , in inches, of a point on a triathlete's bike wheel during a training ride in terms of time, t , in seconds.



Identify the period of the graph and describe what the period represents in this context.

- 481 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?
- 482 Simplify $xi(i - 7i)^2$, where i is the imaginary unit.
- 483 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) $\left\{-\frac{7}{2}, -3\right\}$
- 484 The solution set for the equation $\sqrt{56 - x} = x$ is
- 1) $\{-8, 7\}$
 - 2) $\{-7, 8\}$
 - 3) $\{7\}$
 - 4) $\{\}$
- 485 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.
- 486 Describe how a controlled experiment can be created to examine the effect of ingredient X in a toothpaste.

- 487 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?

- | | |
|---|---|
| <p>1) There was no effect observed between the two groups.</p> <p>2) There was an effect observed that could be due to the random assignment of plants to the groups.</p> | <p>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.</p> <p>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.</p> |
|---|---|
-
- 488 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) $2x^2 - x + 4 + \frac{1}{2x - 1}$
-
- 489 Write $\sqrt[3]{x} \cdot \sqrt{x}$ as a single term with a rational exponent.
-
- 490 Which equation represents an odd function?
- 1) $y = \sin x$
 - 2) $y = \cos x$
 - 3) $y = (x + 1)^3$
 - 4) $y = e^{5x}$
-
- 491 Explain how $(-8)^{\frac{4}{3}}$ can be evaluated using properties of rational exponents to result in an integer answer.

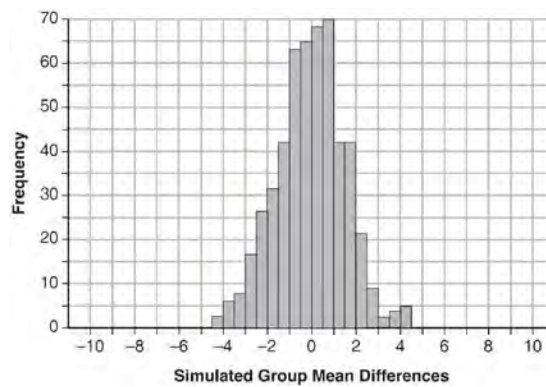
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492 Seventy-two students are randomly divided into two equally-sized study groups. Each member of the first group (group 1) is to meet with a tutor after school twice each week for one hour. The second group (group 2), is given an online subscription 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.

493 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) $B(t) = 750(1.16)^{\frac{t}{12}}$

494 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

495 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.

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496 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

497 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) $y = \frac{x^2}{4} + 3$

498 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) $y^2 + 4$

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

500 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

501 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.

502 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.

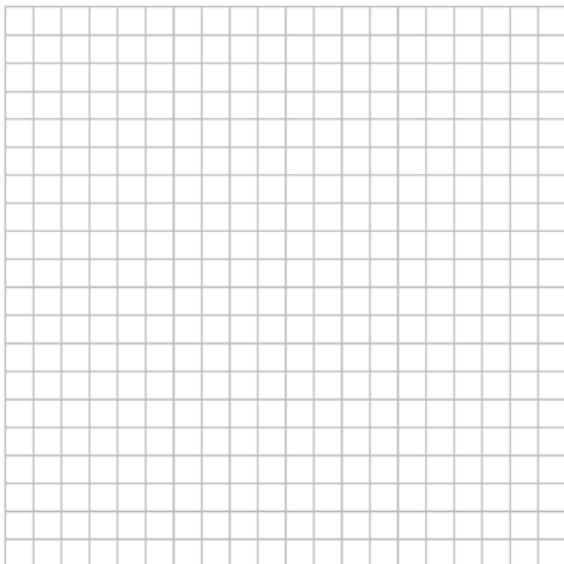
$$\frac{1}{J} + \frac{1}{W} = \frac{1}{F}$$

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) $\frac{1}{F} - \frac{1}{W}$

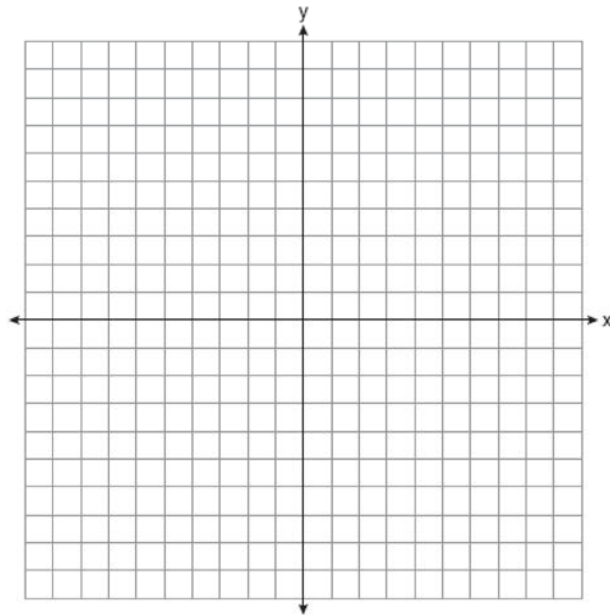
503 For the function $f(x) = (x - 3)^3 + 1$, find $f^{-1}(x)$.

- 504 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.

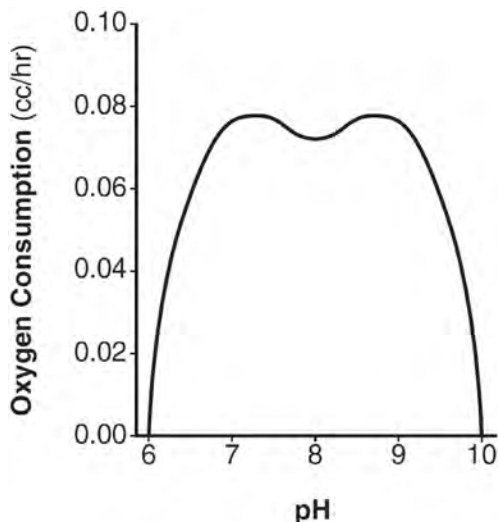
- 505 On the axes below, graph *one* cycle of a cosine function with amplitude 3, period $\frac{\pi}{2}$, midline $y = -1$, and passing through the point $(0, 2)$.



- 506 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

- 507 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) $4(x - 3)^2 + 4(y + 9)^2 = 436$

- 508 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.

- 509 Consider the system shown below.

$$2x - y = 4$$

$$(x + 3)^2 + y^2 = 8$$

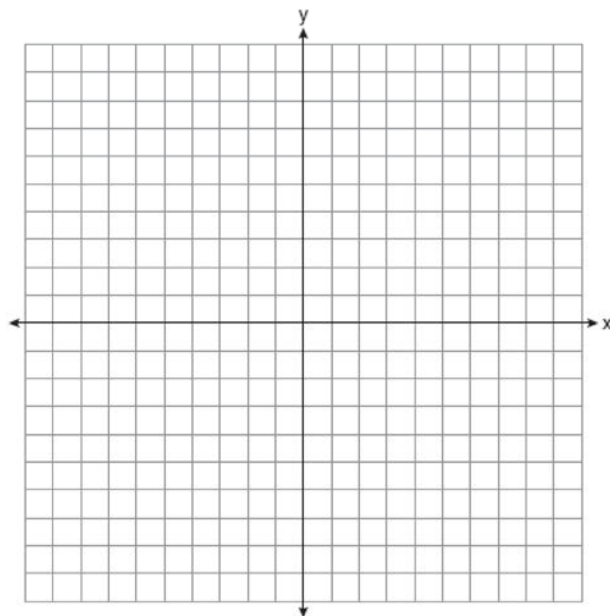
The two solutions of the system can be described as

- 1) both imaginary
 - 2) both irrational
 - 3) both rational
 - 4) one rational and one irrational
- 510 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.

- 511 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) $f(n) = -0.75 + 8(n - 1)$

- 512 Find algebraically the zeros for $p(x) = x^3 + x^2 - 4x - 4$. On the set of axes below, graph $y = p(x)$.



- 513 Which binomial is *not* a factor of the expression

$$x^3 - 11x^2 + 16x + 84?$$

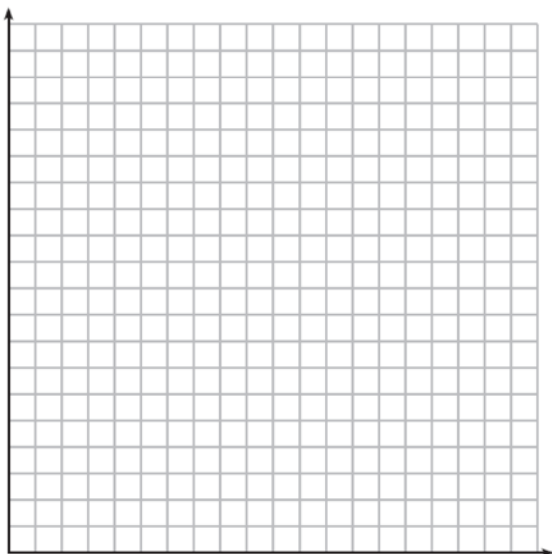
- 1) $x + 2$
- 2) $x + 4$
- 3) $x - 6$
- 4) $x - 7$

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- 514 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.



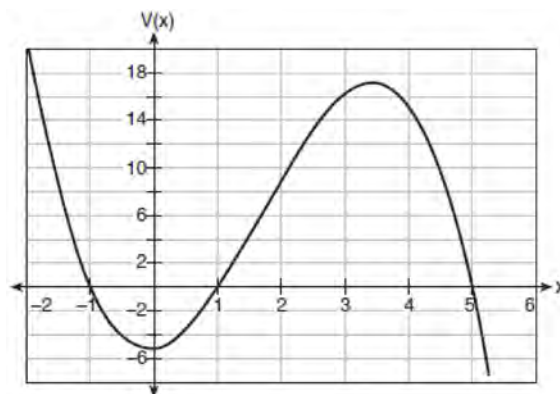
State when $V(t) = Z(t)$, to the *nearest hundredth*, and interpret its meaning in the context of the problem. Zach takes out an insurance policy that requires him to pay a \$3000 deductible in case of a collision. Zach will cancel the collision policy when the value of his car equals his deductible. To the *nearest year*, how long will it take Zach to cancel this policy? Justify your answer.

- 515 Express $(1 - i)^3$ in $a + bi$ form.

- 516 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?

- 1) $g(4) = 0$
- 2) $g(-4) = 0$
- 3) $x - 4$ is a factor of $g(x)$.
- 4) No conclusion can be made regarding $g(x)$.

- 517 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.



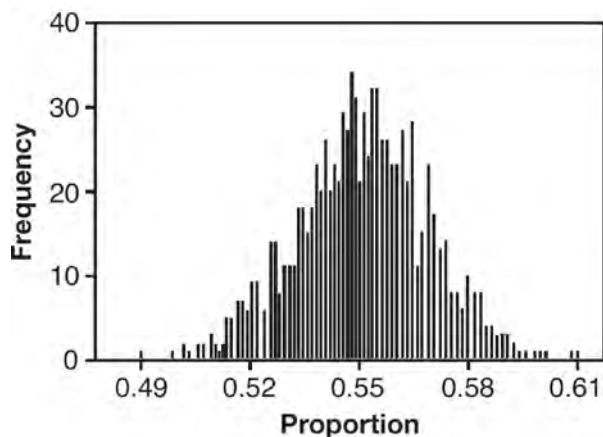
Over which interval is the volume of the box changing at the fastest average rate?

- 1) $[1, 2]$
- 2) $[1, 3.5]$
- 3) $[1, 5]$
- 4) $[0, 3.5]$

- 518 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

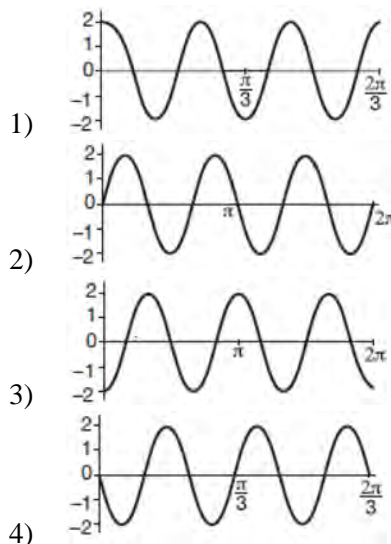
- 519 A candidate for political office commissioned a poll. His staff received responses from 900 likely voters and 55% of them said they would vote for the candidate. The staff then conducted a simulation of 1000 more polls of 900 voters, assuming that 55% of voters would vote for their candidate. The 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

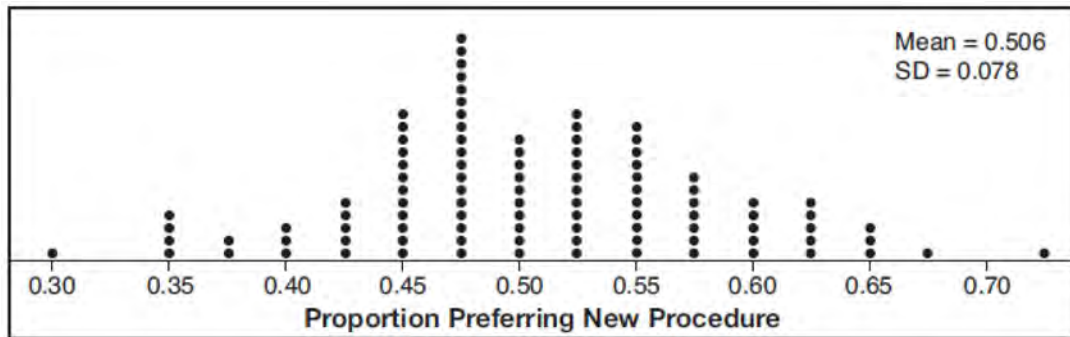
- 1) 0.01
 - 2) 0.03
 - 3) 0.06
 - 4) 0.12
- 520 Mrs. Jones had hundreds of jelly beans in a bag that contained equal numbers of six different flavors. Her student randomly selected four jelly beans and they were all black licorice. Her student complained and said "What are the odds I got all of that 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.

- 521 Which graph represents a cosine function with no horizontal shift, an amplitude of 2, and a period of $\frac{2\pi}{3}$?



- 522 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
- 523 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.

- 524 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.



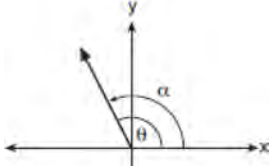
Assume the set of data is approximately normal and the dealership wants to be 95% confident of its results. Determine an interval containing the plausible sample values for which the dealership will launch the new procedure. Round your answer to the *nearest hundredth*. Forty customers are selected randomly 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.

- 525 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
- 526 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.
- 527 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) $300e^{-0.42}$
- 528 The solution set for the equation $\sqrt{x+14} - \sqrt{2x+5} = 1$ is
- 1) $\{-6\}$
 - 2) $\{2\}$
 - 3) $\{18\}$
 - 4) $\{2, 22\}$

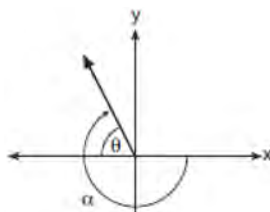
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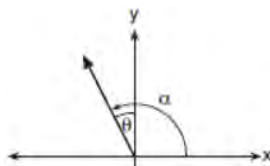
- 529 Which diagram represents an angle, α , measuring $\frac{13\pi}{20}$ radians drawn in standard position, and its reference angle, θ ?



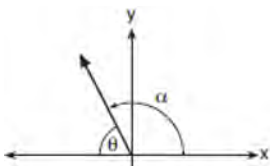
1)



2)



3)



4)

- 530 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

- 531 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) $\frac{1}{2}$

- 532 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?

- 1) The average monthly temperature variation is more in Bar Harbor than in Phoenix.
- 2) The midline average monthly temperature for Bar Harbor is lower than the midline temperature for Phoenix.
- 3) The maximum average monthly temperature for Bar Harbor is 79° F, to the nearest degree.
- 4) The minimum average monthly temperature for Phoenix is 20° F, to the nearest degree.

- 533 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.

Algebra II Regents Exam Questions at Random

www.jmap.org

534 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) $S = \frac{100 - 100(1.03)^{12}}{1 - 1.03}$

535 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) $j_1 = 250,000$
 $j_n = j_{n-1} + 937$

536 If $p(x) = ab^x$ and $r(x) = cd^x$, then $p(x) \bullet r(x)$ equals

- 1) $ac(b+d)^x$
- 2) $ac(b+d)^{2x}$
- 3) $ac(bd)^x$
- 4) $ac(bd)^{x^2}$

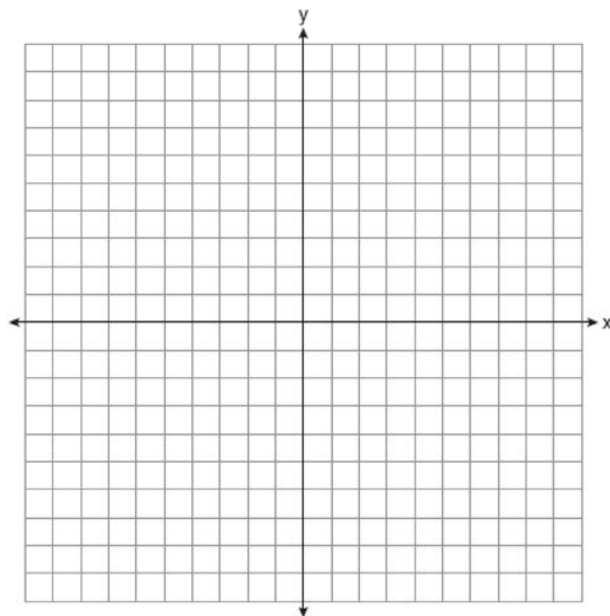
537 What is the completely factored form of $k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$?

- 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) $(k+2)(k-2)(k+6)(k+2)$

538 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) $a_0 = 1000$
 $a_n = a_{n-1}(1.018) + 750n$

539 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.

Algebra II Regents Exam Questions at Random

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- 540 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.

Speed (mph)	10	20	30	40	50	60	70
Distance (ft)	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.

- 541 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?
- $t = 3$
 - $t = 5$
 - $t = 8$
 - $t = 11$
- 542 What are the zeros of $P(m) = (m^2 - 4)(m^2 + 1)$?
- 2 and -2 , only
 - 2, -2 , and -4
 - -4 , i , and $-i$
 - 2, -2 , i , and $-i$
- 543 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
- 150
 - 70
 - 10
 - 0
- 544 Which statement regarding the graphs of the functions below is *untrue*?
- $$f(x) = 3 \sin 2x, \text{ from } -\pi < x < \pi$$
- $$g(x) = (x - 0.5)(x + 4)(x - 2)$$
- $$h(x) = \log_2 x$$
- $$j(x) = -|4x - 2| + 3$$
- $f(x)$ and $j(x)$ have a maximum y -value of 3.
 - $f(x)$, $h(x)$, and $j(x)$ have one y -intercept.
 - $g(x)$ and $j(x)$ have the same end behavior as $x \rightarrow -\infty$.
 - $g(x)$, $h(x)$, and $j(x)$ have rational zeros.
- 545 Solve the equation $\sqrt{2x - 7} + x = 5$ algebraically, and justify the solution set.
- 546 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.
- 547 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
 - -5
 - all real numbers
 - no real solution

Algebra II Regents Exam Questions at Random

www.jmap.org

- 548 After sitting out of the refrigerator for a while, a turkey at room temperature (68°F) is placed into an oven at 8 a.m., when the oven temperature is 325°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

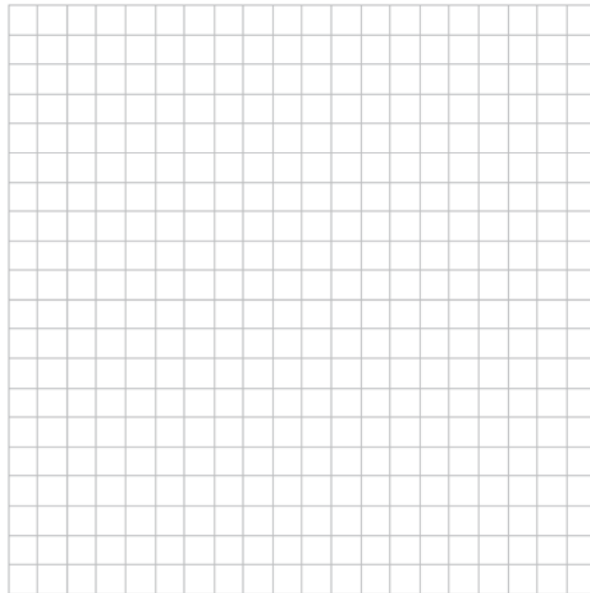
k = decay constant

The turkey reaches the temperature of approximately 100°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.

- 549 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.

- 550 Algebraically determine whether the function $j(x) = x^4 - 3x^2 - 4$ is odd, even, or neither.

- 551 On the grid below, sketch a cubic polynomial whose zeros are 1, 3, and -2.



- 552 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) $y = \frac{1}{8}(x - 1)^2$

- 553 The completely factored form of $2d^4 + 6d^3 - 18d^2 - 54d$ is

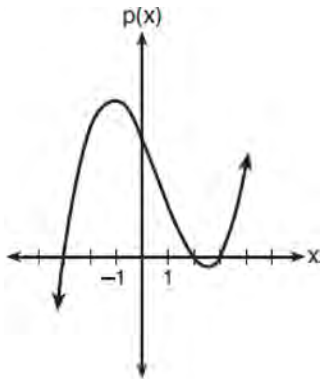
1) $2d(d^2 - 9)(d + 3)$

2) $2d(d^2 + 9)(d + 3)$

3) $2d(d + 3)^2(d - 3)$

4) $2d(d - 3)^2(d + 3)$

554 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) $p(x) = x^3 + 2x^2 - 9x - 18$

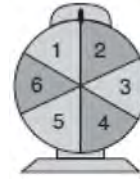
555 The function $f(x) = 2^{-0.25x} \cdot \sin\left(\frac{\pi}{2}x\right)$ represents a damped sound wave function. What is the average rate of change for this function on the interval $[-7, 7]$, to the nearest hundredth?

- 1) -3.66
- 2) -0.30
- 3) -0.26
- 4) 3.36

556 Which equation represents a parabola with the focus at $(0, -1)$ and the directrix of $y = 1$?

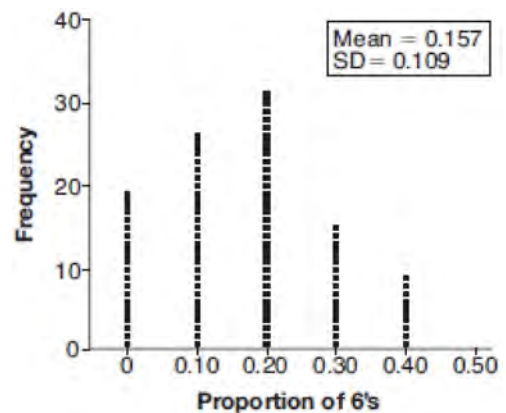
- 1) $x^2 = -8y$
- 2) $x^2 = -4y$
- 3) $x^2 = 8y$
- 4) $x^2 = 4y$

557 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.

Algebra II Regents Exam Questions at Random

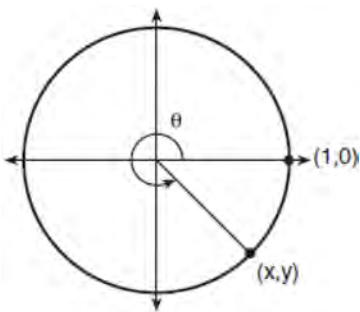
www.jmap.org

558 Solve for all values of p : $\frac{3p}{p-5} - \frac{2}{p+3} = \frac{p}{p+3}$

559 The expression $6xi^3(-4xi + 5)$ is equivalent to

- 1) $2x - 5i$
- 2) $-24x^2 - 30xi$
- 3) $-24x^2 + 30x - i$
- 4) $26x - 24x^2i - 5i$

560 Using the unit circle below, explain why $\csc \theta = \frac{1}{y}$.



561 A circle centered at the origin has a radius of 10 units. The terminal side of an angle, θ , 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) $\frac{4}{5}$

562 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

563 Which function represents exponential decay?

- 1) $y = 2^{0.3t}$
- 2) $y = 1.2^{3t}$
- 3) $y = \left(\frac{1}{2}\right)^{-t}$
- 4) $y = 5^{-t}$

564 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*.

565 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.

Algebra II Regents Exam Questions at Random

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- 566 Algebraically determine the values of h and k to correctly complete the identity stated below.
 $2x^3 - 10x^2 + 11x - 7 = (x - 4)(2x^2 + hx + 3) + k$

- 567 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.

- 568 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) $(x^2 - 4)^2 - 5(x^2 - 4) - 6 = (x^2 - 7)(x^2 - 6)$

- 569 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) $\frac{\sqrt{35}}{5}$

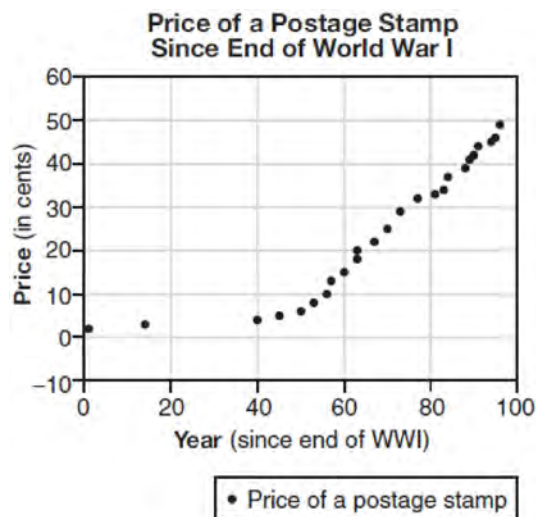
- 570 The heights of women in the United States are normally distributed with a mean of 64 inches and a standard deviation of 2.75 inches. The percent of women whose heights are between 64 and 69.5 inches, to the nearest whole percent, is

- 1) 6
- 2) 48
- 3) 68
- 4) 95

- 571 Solve algebraically for all values of x :

$$\sqrt{x - 4} + x = 6$$

- 572 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) $y = 24 \sin(14x) + 25$

- 573 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.

Algebra II Regents Exam Questions at Random

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- 574 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.

- 575 The solution to the equation $4x^2 + 98 = 0$ is

- 1) ± 7
- 2) $\pm 7i$
- 3) $\pm \frac{7\sqrt{2}}{2}$
- 4) $\pm \frac{7i\sqrt{2}}{2}$

- 576 What does $\left(\frac{-54x^9}{y^4} \right)^{\frac{2}{3}}$ equal?

- 1) $\frac{9ix^6\sqrt[3]{4}}{y\sqrt[3]{y^2}}$
- 2) $\frac{9ix^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$
- 3) $\frac{9x^6\sqrt[3]{4}}{y\sqrt[3]{y}}$
- 4) $\frac{9x^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$

- 577 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

- 578 Verify the following Pythagorean identity for all values of x and y :

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

- 579 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) $P_0 = 19,378,000$
 - 3) $P_t = 19,378,000(1.015)^{t-1}$
 - 4) $P_0 = 19,378,000$
- $$P_t = 19,378,000 + 1.015P_{t-1}$$
- $$P_t = 1.015P_{t-1}$$

Algebra II Regents Exam Questions at Random

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580 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.

m	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
- 2) month 19 to month 69
- 3) month 36 to month 72
- 4) month 60 to month 73

581 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) $x = \ln 4 - 3$

582 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?

583 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

584 Write an explicit formula for a_n , the n th term of the recursively defined sequence below.

$$a_1 = x + 1$$

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

For what values of x would $a_n = 0$ when $n > 1$?

Algebra II Regents Exam Questions at Random

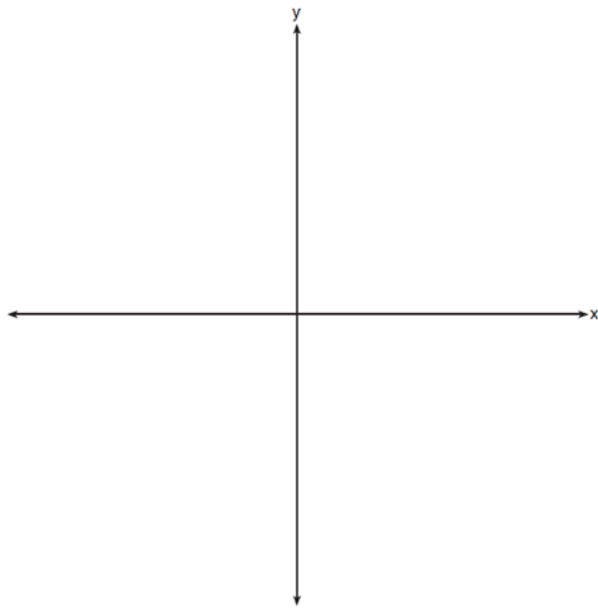
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585 Which binomial is a factor of $x^4 - 4x^2 - 4x + 8$?

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

586 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 2π .



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.

Algebra II Regents at Random Answer Section

1 ANS:

$.651 \pm 2 \cdot .034 = .58 - .72$. No, since .61 (122/200) falls within the 95% interval.

PTS: 4

REF: 062235aai

NAT: S.IC.A.2

TOP: Analysis of Data

2 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

3 ANS: 1

$$x+2 \overline{) \begin{array}{r} x^3 - 2x^2 - x + 6 \\ x^4 + 0x^3 - 5x^2 + 4x + 14 \end{array}}$$

$$\underline{x^4 + 2x^3}$$

$$-2x^3 - 5x^2$$

$$\underline{-2x^3 - 4x^2}$$

$$-x^2 + 4x$$

$$\underline{-x^2 - 2x}$$

$$6x + 14$$

$$\underline{6x + 12}$$

$$2$$

PTS: 2

REF: 012305aai

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: division

4 ANS:

Translation 3 units right and 4 units up

PTS: 2

REF: 012027aai

NAT: F.IF.C.7

TOP: Graphing Exponential Functions

5 ANS: 3

$$\begin{array}{r}
 2x+1 \\
 x+2 \overline{) 2x^2 + 5x + 8} \\
 \underline{2x^2 + 4x} \\
 x + 8 \\
 \underline{x + 2} \\
 6
 \end{array}$$

PTS: 2 REF: 012007aii NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

6 ANS:

$.819 \pm 2 \cdot .053 = .713 - .925$. Since .70 does not fall within the 95% interval.

PTS: 4 REF: 082236aii NAT: S.IC.A.2 TOP: Analysis of Data

7 ANS: 1

$$\begin{array}{r}
 2x^2 + x - 6 \\
 x+3 \overline{) 2x^3 + 7x^2 - 3x - 25} \\
 \underline{2x^3 + 6x^2} \\
 x^2 - 3x \\
 \underline{x^2 + 3x} \\
 -6x - 25 \\
 \underline{-6x - 18} \\
 -7
 \end{array}$$

PTS: 2 REF: 062203aii NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

8 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: 012025aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

9 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: 062234aii NAT: A.REI.A.2 TOP: Solving Radicals
 KEY: context

10 ANS:

$$\cos A = \frac{\cos A}{\sin A}$$

$$-3 = \frac{3}{\sin A}$$

$$\sin A = \frac{3}{-3\sqrt{10}} = -\frac{1}{\sqrt{10}}$$

PTS: 2 REF: 082229aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

11 ANS: 4

$$\frac{13}{13+11} = \frac{13}{24}$$

PTS: 2 REF: 012011aai NAT: S.CP.A.4 TOP: Conditional Probability

12 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: 062213aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

13 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

14 ANS: 1

$$\frac{x(x^2-9)}{-(x^2-9)} = -x$$

PTS: 2 REF: 012023aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

15 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.LE.A.2 TOP: Sequences
KEY: recursive

16 ANS: 4 PTS: 2 REF: 062215aai NAT: F.IF.C.7
TOP: Graphing Logarithmic Functions

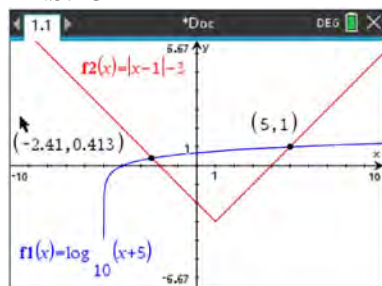
17 ANS:

$m(3) = 3^3 - 3^2 - 5(3) - 3 = 27 - 9 - 15 - 3 = 0$ 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: 012026aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

18 ANS: 3 PTS: 2 REF: 082214aai NAT: F.IF.C.7
TOP: Graphing Exponential Functions

19 ANS: 3



PTS: 2 REF: 012317aai NAT: A.REI.D.11 TOP: Other Systems

20 ANS:



PTS: 4 REF: 082234aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

21 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

22 ANS:

$\sqrt{4x+1} = 11-x$ 20 is extraneous.

$$4x+1 = 121 - 22x + x^2$$

$$0 = x^2 - 26x + 120$$

$$0 = (x-6)(x-20)$$

$$x = 6, 20$$

PTS: 2 REF: 082227aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

23 ANS:

$$F(t) = 169.136(.971)^t$$

PTS: 2 REF: 062232aai NAT: S.ID.B.6 TOP: Regression

KEY: exponential

24 ANS:

$$T = (400 - 75)e^{-0.0735t} + 75, 325e^{-0.0735(5)} + 75 \approx 300, 270 = (450 - 75)e^{-8r} + 75, 325e^{-0.0735t} + 75 = 375e^{-0.0817t} + 75$$

$$r \approx 0.0817 \qquad t \approx 17$$

PTS: 6 REF: 012337aai NAT: A.CED.A.1 TOP: Exponential Decay

25 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

26 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

27 ANS: 2

$$1 = \frac{2\pi}{k}$$

$$k = 2\pi$$

PTS: 2

REF: 012313aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

28 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

29 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

30 ANS: 4

$$(x - 2i)(x - 2i) = x^2 - 4xi + 4i^2 = x^2 - 4xi - 4$$

PTS: 2

REF: 082202aai

NAT: N.CN.A.2

TOP: Operations with Complex Numbers

31 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

32 ANS:

$$\begin{array}{r}
 3x^2 + 8x + 34 \\
 x-4 \overline{) 3x^3 - 4x^2 + 2x - 1} \\
 \underline{3x^3 - 12x^2} \\
 8x^2 + 2x \\
 \underline{8x^2 - 32x} \\
 34x - 1 \\
 \underline{34x - 136} \\
 135
 \end{array}$$

$x = 4$ is not a root of $f(x)$ because $\frac{f(x)}{g(x)}$ has a remainder.

PTS: 4 REF: 082235aai NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

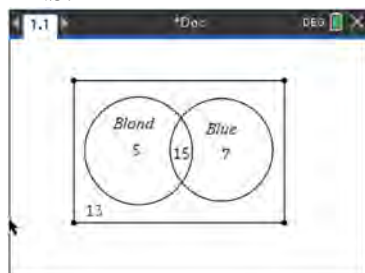
33 ANS: 2

$$a_2 = 8 + \log_{2+1} 1 = 8 + 0 = 8$$

$$a_3 = 8 + \log_{3+1} 2 = 8 + \frac{1}{2} = 8.5$$

PTS: 2 REF: 062221aai NAT: F.IF.A.3 TOP: Sequences

34 ANS: 2



$$40 - (20 + 22 - 15) = 13$$

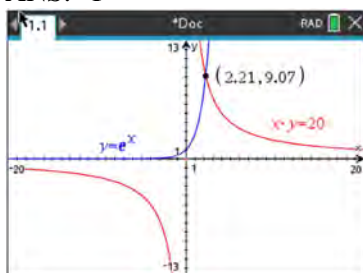
PTS: 2 REF: 062204aai NAT: S.CP.A.1 TOP: Venn Diagrams

35 ANS: 1

$$\begin{aligned}
 u = x + 2 \quad u^2 - 5u + 6 \\
 (u - 3)(u - 2) \\
 (x + 2 - 3)(x + 2 - 2) \\
 (x - 1)x
 \end{aligned}$$

PTS: 2 REF: 012301aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
 KEY: higher power

36 ANS: 1



PTS: 2 REF: 082210aia NAT: A.REI.D.11 TOP: Other Systems

37 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: 012319aia NAT: S.IC.B.4 TOP: Analysis of Data

38 ANS: 4 PTS: 2 REF: 012303aia NAT: F.LE.B.5

TOP: Modeling Exponential Functions

39 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: 062207aia NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

40 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: 062209aia NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

41 ANS:

$$-x(2x^3 - x^2 - 18x + 9)$$

$$-x(x^2(2x-1) - 9(2x-1))$$

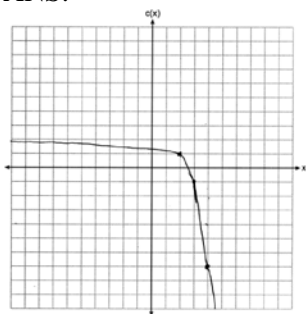
$$-x(x^2 - 9)(2x - 1)$$

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

PTS: 2 REF: 062228aia NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

42 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

43 ANS: 3 PTS: 2 REF: 082201aai NAT: S.IC.B.3

TOP: Analysis of Data KEY: type

44 ANS: 2 PTS: 2 REF: 082204aai NAT: S.IC.B.3

TOP: Analysis of Data KEY: type

45 ANS: 1 PTS: 2 REF: 062214aai NAT: S.ID.A.4

TOP: Normal Distributions KEY: predict

46 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

47 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

48 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

49 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

50 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

51 ANS: 2

$$\frac{1}{x^2 + 3} \div \frac{x^2 + 0x + 12}{x^2 + 0x + 3}$$

$$\frac{1}{9}$$

PTS: 2 REF: 062218aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

52 ANS: 2 PTS: 2 REF: 062222aai NAT: F.IF.C.9

TOP: Comparing Functions

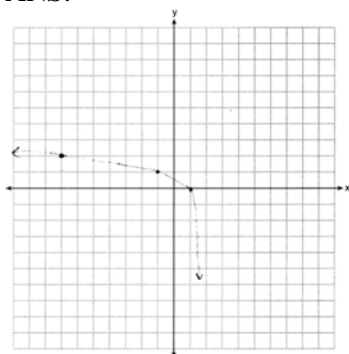
53 ANS:

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

54 ANS:

Domain: $x < 2$, Asymptote $x = 2$

PTS: 4

REF: 012034aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

55 ANS:

$$B(t) = 100(2)^{\frac{t}{30}}$$

PTS: 2

REF: 012031aai

NAT: F.BF.A.1

TOP: Modeling Exponential Functions

56 ANS: 4

(1) and (3) are not recursive

PTS: 2

REF: 012013aai

NAT: F.LE.A.2

TOP: Sequences

KEY: recursive

57 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

58 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

59 ANS:

No, because $P(F / CR) \neq P(F)$

$$\frac{36}{42 + 36} \neq \frac{17 + 37 + 36 + 15}{39 + 17 + 42 + 12 + 17 + 37 + 36 + 15}$$

$$\frac{36}{78} \neq \frac{105}{215}$$

$$\frac{6}{13} \neq \frac{21}{43}$$

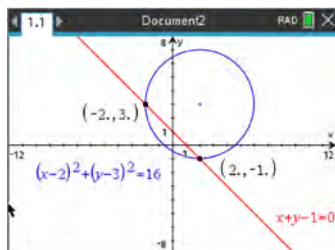
PTS: 2

REF: 082231aii

NAT: S.CP.A.4

TOP: Conditional Probability

60 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: 012035aii

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

61 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: 012029aii

NAT: A.SSE.B.4

TOP: Series

KEY: geometric

62 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: 012307aii

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

63 ANS:

$$\frac{1}{3} \times \frac{5}{12} = \frac{5}{36}$$

PTS: 2

REF: 012327aii

NAT: S.CP.A.2

TOP: Probability of Compound Events

KEY: probability

64 ANS: 1

$$1.0325^{\frac{1}{12}} \approx 1.0027$$

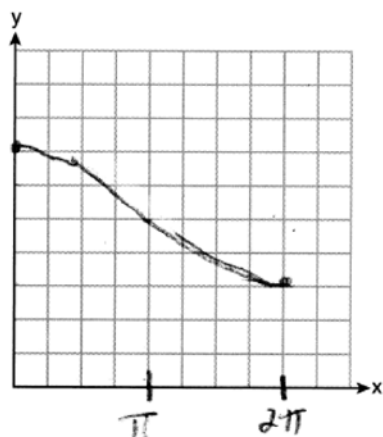
PTS: 2

REF: 012323aii

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

65 ANS:



PTS: 2

REF: 062231aii

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

66 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

67 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: 012302aia NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

68 ANS: 3

$$\text{between 000 and 449, inclusive} \rightarrow \frac{450}{1000} = 45\%$$

PTS: 2 REF: 012024aia NAT: S.IC.B.3 TOP: Analysis of Data

KEY: type

69 ANS: 3

PTS: 2

REF: 012005aia

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

70 ANS: 3

PTS: 2

REF: 062205aia

NAT: F.BF.B.3

TOP: Transformations with Functions

71 ANS:



43

PTS: 2 REF: 012328aia NAT: S.ID.A.4 TOP: Normal Distributions

KEY: percent

72 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

73 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: 082206aai

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

74 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: 062217aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: linear

75 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

76 ANS: 3

$$(6 - ki)^2 = 27 - 36i$$

$$36 - 12ki + k^2 i^2 = 27 - 36i$$

$$9 - k^2 - 12ki = -36i$$

$$\text{Set real part equal to real part: } 9 - k^2 = 0 \quad \text{Set imaginary part equal to imaginary part: } -12ki = -36i$$

$$k = \pm 3$$

$$\frac{-12ki}{-12i} = \frac{-36i}{-12i}$$

$$k = 3$$

PTS: 2

REF: 012308aai

NAT: N.CN.A.2

TOP: Operations with Complex Numbers

77 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

78 ANS: 2

PTS: 2

REF: 062206aai

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

79 ANS: 4 PTS: 2 REF: 062216aai NAT: S.IC.B.3
TOP: Analysis of Data KEY: type

80 ANS: 4
1) is a correct formula, but not recursive

PTS: 2 REF: 082216aai NAT: F.LE.A.2 TOP: Sequences
KEY: recursive

81 ANS:

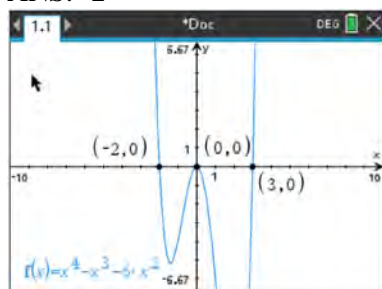
$$a^{x+1} = a^{\frac{2}{3}}$$

$$x + 1 = \frac{2}{3}$$

$$x = -\frac{1}{3}$$

PTS: 2 REF: 012326aai NAT: A.CED.A.1 TOP: Exponential Equations
KEY: common base shown

82 ANS: 2



PTS: 2 REF: 012316aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

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: 3 PTS: 2 REF: 012015aai NAT: S.IC.B.3
TOP: Analysis of Data KEY: type

85 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

86 ANS:

$$y = 2.459(1.616)^x$$

PTS: 2 REF: 012329aii NAT: S.ID.B.6 TOP: Regression
KEY: exponential

87 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.C.9 TOP: Comparing Functions

88 ANS: 2

1) $x \rightarrow \infty, f(x) \rightarrow \infty$; 3) quartic polynomial; 4) three real roots

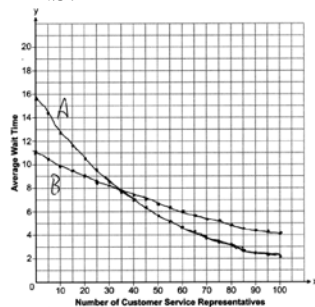
PTS: 2 REF: 012318aii NAT: A.APR.B.3 TOP: Graphing Polynomial Functions

89 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: 082213aii NAT: N.RN.A.2 TOP: Operations with Radicals
KEY: with variables, index > 2

90 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: 082237aii NAT: A.REI.D.11 TOP: Other Systems

91 ANS:

$$S_5 = \frac{6 - 6(.8)^5}{1 - .8} \approx 20.17$$

PTS: 2 REF: 062226aii NAT: A.SSE.B.4 TOP: Series
KEY: geometric

92 ANS: 4 PTS: 2 REF: 082220aii NAT: F.IF.B.4
TOP: Graphing Trigonometric Functions

93 ANS: 4 PTS: 2 REF: 082205aii NAT: F.TF.A.2
TOP: Unit Circle

94 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

95 ANS: 4 PTS: 2 REF: 012016aai NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

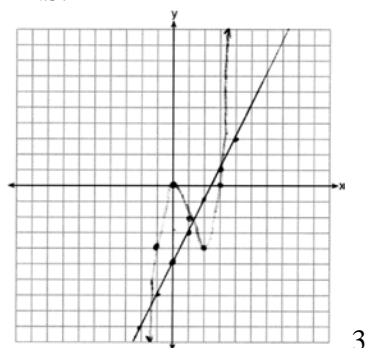
96 ANS: 2

$$5x^2 - 4x + 2 = 0 \quad \frac{4 \pm \sqrt{(-4)^2 - 4(5)(2)}}{2(5)} = \frac{4 \pm \sqrt{-24}}{10} = \frac{4 \pm 2i\sqrt{6}}{10} = \frac{2 \pm i\sqrt{6}}{5}$$

PTS: 2 REF: 012020aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

97 ANS:



3

PTS: 4 REF: 062233aai NAT: A.REI.D.11 TOP: Other Systems

98 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

99 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

100 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: 062236aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

101 ANS: 2

$$2x + 4y - 2z = 2 \quad -x - 3y + 2z = 0 \quad x + y = 2 \quad 3 + 2y - z = 1 \quad 2y - z = -2$$

$$\underline{-x - 3y + 2z = 0} \quad \underline{4x - 8y + 2z = 20} \quad \underline{x - y = 4} \quad 6 - 4y + z = 10 \quad \underline{2(-1) - z = -2}$$

$$x + y = 2 \quad 5x - 5y = 20 \quad 2x = 6 \quad 2y - z = -2 \quad z = 0$$

$$x - y = 4 \quad x = 3 \quad \underline{-4y + z = 4}$$

$$-2y = 2$$

$$y = -1$$

PTS: 2 REF: 062208aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

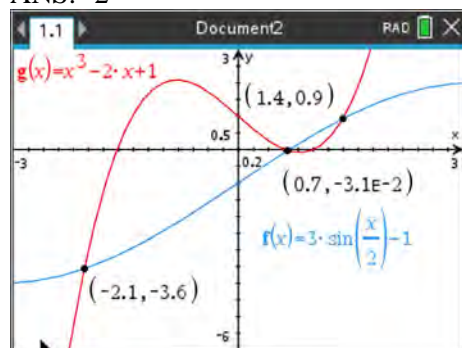
102 ANS:

$$a_n = 100(.8)^{n-1} \quad S_{20} = \frac{100 - 100(.8)^{20}}{1 - .8} \approx 494 \quad \text{No, because } 494 > 40 \times 12.$$

PTS: 4 REF: 012033aai NAT: A.SSE.B.4 TOP: Series

KEY: geometric

103 ANS: 2



PTS: 2 REF: 012021aai NAT: A.REI.D.11 TOP: Other Systems

104 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

105 ANS: 2

1) 1 real, mult. 2; 3) not a quadratic; 4) not a function.

PTS: 2 REF: 012324aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

106 ANS: 3

$$x^2 - 6x + 9 - (x^2 + 6x + 9) = -12x$$

PTS: 2 REF: 062210aai NAT: F.BF.A.1 TOP: Operations with Functions

107 ANS: 1

$$0.5^{\frac{1}{0.0803}} \approx 0.000178$$

PTS: 2 REF: 082224aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

108 ANS: 3

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

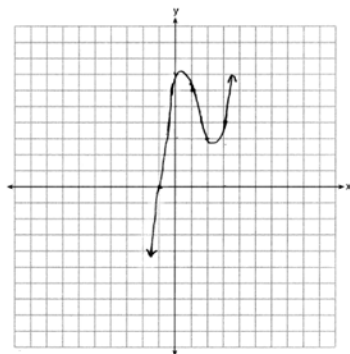
$$2x = y + 4$$

$$y = 2x - 4$$

PTS: 2 REF: 012315aai NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: linear

109 ANS:



PTS: 2 REF: 012032aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

110 ANS: 3

PTS: 2 REF: 012003aai NAT: A.APR.C.4

TOP: Polynomial Identities

111 ANS:

$$\text{antibiotic } n(0) = \frac{0+1}{0+5} + \frac{18}{0^2 + 8(0) + 15} = \frac{3}{15} + \frac{18}{15} = \frac{21}{15}$$

$$\frac{t+1}{t+5} + \frac{18}{t^2 + 8t + 15} = \frac{9}{t+3}$$

$$a(0) = \frac{9}{0+3} = 3$$

$$\frac{(t+1)(t+3)}{(t+5)(t+3)} + \frac{18}{(t+3)(t+5)} = \frac{9(t+5)}{(t+3)(t+5)}$$

$$t^2 + 4t + 3 + 18 = 9t + 45$$

$$t^2 - 5t - 24 = 0$$

$$(t-8)(t+3) = 0$$

$$t = 8$$

PTS: 6 REF: 012037aai NAT: A.REI.A.2 TOP: Solving Rationals
KEY: rational solutions

112 ANS:

$$0.133696 \times 9256 \approx 1237$$

PTS: 2 REF: 082230aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: predict

113 ANS: 1

$$\frac{N(6) - N(0)}{6 - 0} \approx -8.93$$

PTS: 2 REF: 012012aai NAT: F.IF.B.6 TOP: Rate of Change

114 ANS: 4 PTS: 2 REF: 012008aai NAT: S.CP.A.3
TOP: Conditional Probability

115 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: 082223aai NAT: F.BF.B.4 TOP: Inverse of Functions
KEY: linear

116 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

117 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
118 ANS: 2 PTS: 2 REF: 062219aai NAT: F.TF.A.1
TOP: Unit Circle

119 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: 012304aai NAT: F.IF.C.7 TOP: Graphing Exponential Functions
120 ANS: 4 PTS: 2 REF: 012014aai NAT: S.IC.B.5
TOP: Analysis of Data

121 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
122 ANS: 2 PTS: 2 REF: 082203aai NAT: F.IF.C.7
TOP: Graphing Trigonometric Functions KEY: amplitude

123 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

124 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

125 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: 082233aai NAT: F.LE.A.4 TOP: Exponential Growth

126 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

127 ANS: 2 PTS: 2 REF: 082222aai NAT: A.CED.A.1

TOP: Modeling Rationals

128 ANS: 2 PTS: 2 REF: 012321aai NAT: F.BF.A.2

TOP: Sequences

129 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

130 ANS: 1 PTS: 2 REF: 082221aai NAT: F.BF.B.6

TOP: Sigma Notation KEY: represent

131 ANS: 2 PTS: 2 REF: 012311aai NAT: A.APR.C.4

TOP: Polynomial Identities

132 ANS:

$$\frac{60-20}{4-2} = \frac{40}{2} = 20$$

PTS: 2

REF: 082225aai

NAT: F.IF.B.6

TOP: Rate of Change

133 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

134 ANS: 2

The mass of the carbon-14 is decreasing by half every 5715 years.

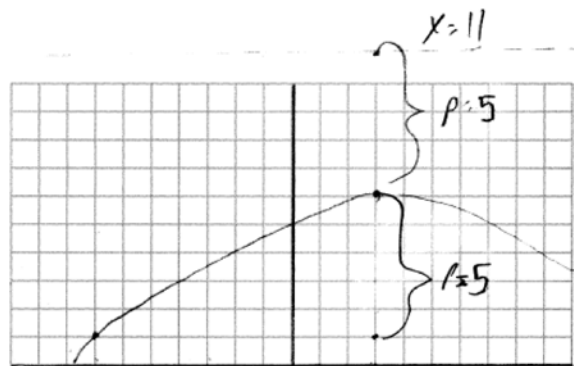
PTS: 2

REF: 062211aai

NAT: F.LE.B.5

TOP: Modeling Exponential Functions

135 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

136 ANS: 4

The distance between the focus and directrix is $1 - (-3) = 4$. p is half this distance, or 2. The vertex of the parabolais (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

137 ANS: 4

PTS: 2

REF: 012314aai

NAT: S.IC.B.3

TOP: Analysis of Data

138 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

139 ANS: 3 PTS: 2 REF: 012002aai NAT: F.BF.A.1
TOP: Operations with Functions

140 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

141 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

142 ANS:

Yes. $P(B) = P(B|G)$

$$0.14 + 0.26 = \frac{.14}{.35}$$

$$.4 = .4$$

PTS: 2 REF: 062229aai NAT: S.CP.A.4 TOP: Conditional Probability

143 ANS: 1 PTS: 2 REF: 062201aai NAT: N.RN.A.2
TOP: Radicals and Rational Exponents

144 ANS:

$\frac{B(10) - B(6)}{10 - 6} \approx -3.88$. The average monthly high temperature decreases about 4° each month from June and October.

PTS: 4 REF: 012336aai NAT: F.IF.B.6 TOP: Rate of Change

145 ANS: 2

$$\begin{array}{r}
 x^2 + 2x + 4 \\
 x - 2 \overline{) x^3 - 0x^2 + 0x - 2} \\
 \underline{x^3 - 2x^2} \\
 2x^2 + 0x \\
 \underline{2x^2 - 4x} \\
 4x - 2 \\
 \underline{4x - 8} \\
 6
 \end{array}$$

PTS: 2 REF: 082217aai NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

146 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

147 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

Algebra II Regents at Random Answer Section

148 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

149 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

150 ANS: 4

$$S_7 = \frac{85000 - 85000(1.06)^7}{1 - 1.06} \approx 713476.20$$

PTS: 2 REF: 061905aai NAT: A.SSE.B.4 TOP: Series
KEY: geometric

151 ANS: 4

$$400 \cdot .954 \approx 380$$

PTS: 2 REF: 061918aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: predict

152 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

153 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

154 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

155 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

156 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

157 ANS: 4

$$1 + \frac{.009}{12} = 1.00075$$

PTS: 2 REF: 011918aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

158 ANS: 1



PTS: 2 REF: 081919aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: percent

159 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: 011903aai NAT: A.APR.B.3 TOP: Solving Polynomial Equations

160 ANS: 3

$$x^2 - 4x - 5 = 4x^2 - 40x + 100$$

$$3x^2 - 36x + 105 = 0$$

$$x^2 - 12x + 35 = 0$$

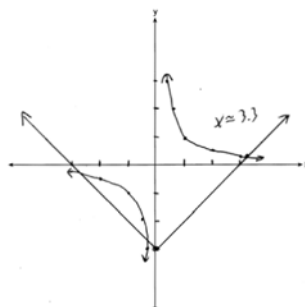
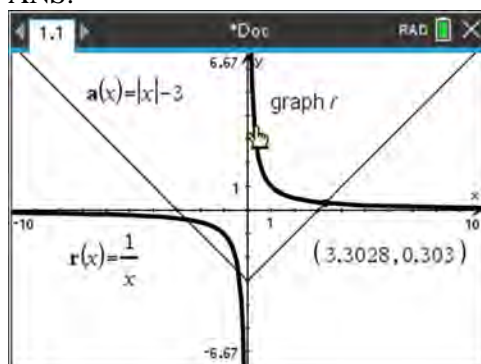
$$(x-7)(x-5) = 0$$

$$x = 5, 7$$

PTS: 2 REF: 081807aai NAT: A.REI.A.2 TOP: Solving Radicals
KEY: extraneous solutions

161 ANS: 1 PTS: 2 REF: 011902aai NAT: F.IF.C.7
TOP: Graphing Logarithmic Functions

162 ANS:



PTS: 2 REF: 081932aai NAT: A.REI.D.11 TOP: Other Systems

163 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

164 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

165 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

166 ANS: 4

There is no x -intercept.

PTS: 2

REF: 011823aai

NAT: F.IF.C.7

TOP: Graphing Exponential Functions

167 ANS: 2

PTS: 2

REF: 061802aai

NAT: F.IF.C.7

TOP: Graphing Exponential Functions

168 ANS: 4

PTS: 2

REF: 081824aai

NAT: S.CP.A.3

TOP: Conditional Probability

169 ANS: 3

$$\frac{x^{\frac{2}{3}} \bullet x^{\frac{5}{2}}}{x^{\frac{1}{6}}} = \frac{x^{\frac{4}{6}} \bullet x^{\frac{15}{6}}}{x^{\frac{1}{6}}} = x^{\frac{18}{6}} = x^3$$

PTS: 2

REF: 081812aai

NAT: N.RN.A.2

TOP: Operations with Radicals

KEY: with variables, index > 2

170 ANS:

$a_1 = 3$ $a_2 = 7$ $a_3 = 15$ $a_4 = 31$; No, because there is no common ratio: $\frac{7}{3} \neq \frac{15}{7}$

PTS: 2

REF: 061830aai

NAT: F.IF.A.3

TOP: Sequences

KEY: recursive

171 ANS: 2

$$f(x) = f(-x)$$

$$x^2 - 4 = (-x)^2 - 4$$

$$x^2 - 4 = x^2 - 4$$

PTS: 2 REF: 061806aai NAT: F.BF.B.3 TOP: Even and Odd Functions

172 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

173 ANS: 2 PTS: 2 REF: 011910aai NAT: S.IC.B.3
TOP: Analysis of Data KEY: bias174 ANS: 2 PTS: 2 REF: 081802aai NAT: S.IC.B.3
TOP: Analysis of Data KEY: type

175 ANS:

$$B = 1.69\sqrt{30 + 4.45} - 3.49 \approx 6, \text{ which is a steady breeze.} \quad 15 = 1.69\sqrt{s + 4.45} - 3.49$$

$$18.49 = 1.69\sqrt{s + 4.45}$$

$$\frac{18.49}{1.69} = \sqrt{s + 4.45}$$

$$\left(\frac{18.49}{1.69}\right)^2 = s + 4.45$$

$$s = \left(\frac{18.49}{1.69}\right)^2 - 4.45$$

$$s \approx 115$$

$$9.5 = 1.69\sqrt{s + 4.45} - 3.49 \quad 10.49 = 1.69\sqrt{s + 4.45} - 3.49 \quad 55-64$$

$$12.99 = 1.69\sqrt{s + 4.45} \quad 13.98 = 1.69\sqrt{s + 4.45}$$

$$\frac{12.99}{1.69} = \sqrt{s + 4.45} \quad \frac{13.98}{1.69} = \sqrt{s + 4.45}$$

$$\left(\frac{12.99}{1.69}\right)^2 = s + 4.45 \quad \left(\frac{13.98}{1.69}\right)^2 = s + 4.45$$

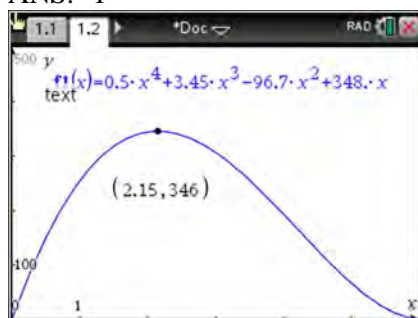
$$s = \left(\frac{12.99}{1.69}\right)^2 - 4.45 \quad s = \left(\frac{13.98}{1.69}\right)^2 - 4.45$$

$$s \approx 55$$

$$s \approx 64$$

PTS: 6 REF: 081937aai NAT: A.REI.A.2 TOP: Solving Radicals
KEY: context

176 ANS: 1



PTS: 2 REF: 011908aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

177 ANS: 4

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

PTS: 2 REF: 011921aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

178 ANS: 2

$$\begin{aligned} n^2(n^2 - 9) + 4n(n^2 - 9) - 12(n^2 - 9) \\ (n^2 + 4n - 12)(n^2 - 9) \\ (n + 6)(n - 2)(n + 3)(n - 3) \end{aligned}$$

PTS: 2 REF: 061911aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

179 ANS: 4

$$x(x-2) \left(\frac{10}{x^2-2x} + \frac{4}{x} = \frac{5}{x-2} \right) \text{ 2 is extraneous.}$$

$$10 + 4(x-2) = 5x$$

$$10 + 4x - 8 = 5x$$

$$2 = x$$

PTS: 2 REF: 081915aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

180 ANS: 2

PTS: 2

REF: 081911aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

181 ANS: 3

PTS: 2

REF: 061824aai

NAT: A.CED.A.1

TOP: Modeling Rationals

182 ANS: 4

$$0.48 \cdot 0.25 = 0.12$$

PTS: 1

REF: 061811aai

NAT: S.CP.A.2

TOP: Probability of Compound Events

KEY: probability

183 ANS: 1

$$\frac{N(10) - N(1)}{10 - 1} \approx -2.03, \frac{N(20) - N(10)}{20 - 10} \approx -1.63, \frac{N(25) - N(15)}{25 - 15} \approx -1.46, \frac{N(30) - N(1)}{30 - 1} \approx -1.64$$

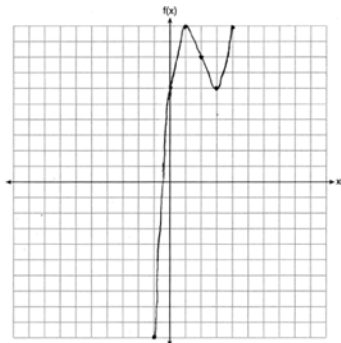
PTS: 2

REF: 061807aii

NAT: F.IF.B.6

TOP: Rate of Change

184 ANS:



PTS: 2

REF: 061826aii

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

185 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: 011922aii

NAT: F.IF.C.9

TOP: Comparing Functions

186 ANS: 1

PTS: 2

REF: 011815aii

NAT: F.TF.A.2

TOP: Unit Circle

187 ANS:

$$P(A + B) = P(A) \cdot P(B|A) = 0.8 \cdot 0.85 = 0.68$$

PTS: 2

REF: 011928aii

NAT: S.CP.A.3

TOP: Conditional Probability

188 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

189 ANS:

$$16x^4 - 81 = (4x^2 + 9)(4x^2 - 9) = (4x^2 + 9)(2x + 3)(2x - 3). \text{ No, because } \pm \frac{3i}{2} \text{ are roots.}$$

PTS: 4

REF: 061933aii

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

190 ANS: 2

PTS: 2

REF: 061804aii

NAT: S.ID.B.6

TOP: Regression

KEY: choose model

191 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

192 ANS: 1

$$84.1\% \times 750 \approx 631$$

PTS: 2 REF: 011923aai NAT: S.ID.A.4 TOP: Normal Distributions

KEY: predict

193 ANS: 1

$$-4(-1) - 3 = 1 \quad 8 = \frac{2\pi}{b}$$

$$b = \frac{\pi}{4}$$

PTS: 2 REF: 081820aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

KEY: maximum/minimum

194 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: 011909aai NAT: A.REI.B.4 TOP: Using the Discriminant

KEY: determine nature of roots given equation, graph, table

195 ANS:

$$x+2 \overline{) \begin{array}{r} x^3 \\ x^4 + 2x^3 + 4x - 10 \end{array}} \quad x^3 + 4 - \frac{18}{x+2}. \text{ No, because there is a remainder.}$$

$$\underline{x^4 + 2x^3}$$

$$4x - 10$$

$$\underline{4x + 8}$$

$$-18$$

PTS: 4 REF: 011934aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

196 ANS: 4

PTS: 2

REF: 081906aai

NAT: S.IC.B.3

TOP: Analysis of Data

KEY: type

197 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

198 ANS: 4 PTS: 2 REF: 011808aai NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

199 ANS: 2

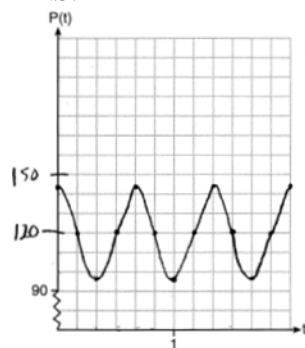
$$\text{If } \cos \theta = \frac{7}{25}, \sin \theta = \pm \frac{24}{25}, \text{ and } \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\pm \frac{24}{25}}{\frac{7}{25}} = \pm \frac{24}{7}$$

PTS: 2 REF: 081811aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

200 ANS: 1 PTS: 2 REF: 081804aai NAT: F.IF.C.9

TOP: Comparing Functions

201 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: 011837aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

202 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

203 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

204 ANS: 3 PTS: 2 REF: 081819aai NAT: A.REI.D.11

TOP: Other Systems

205 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

206 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

207 ANS:

$$f(x) = x^2(x + 4)(x - 3); \quad g(x) = (x + 2)^2(x + 6)(x - 1)$$

PTS: 4 REF: 011836aai NAT: A.APR.B.3 TOP: Graphing Polynomial Functions

208 ANS:

$$(a + b)^3 = a^3 + b^3 \quad \text{No. Erin's shortcut only works if } a = 0, b = 0 \text{ or } a = -b.$$

$$a^3 + 3a^2b + 3ab^2 + b^3 = a^3 + b^3$$

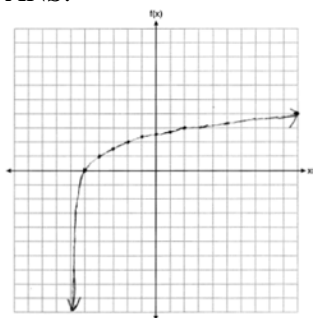
$$3ab^2 + 3a^2b = 0$$

$$3ab(b + a) = 0$$

$$a = 0, b = 0, a = -b$$

PTS: 2 REF: 011927aai NAT: A.APR.C.4 TOP: Polynomial Identities

209 ANS:



PTS: 2

REF: 061927aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

210 ANS: 4

PTS: 2

REF: 011805aai

NAT: F.LE.B.5

TOP: Modeling Exponential Functions

211 ANS:

$$\frac{-1}{\sqrt{2^2 + (-1)^2}} = -\frac{1}{\sqrt{5}}$$

PTS: 2

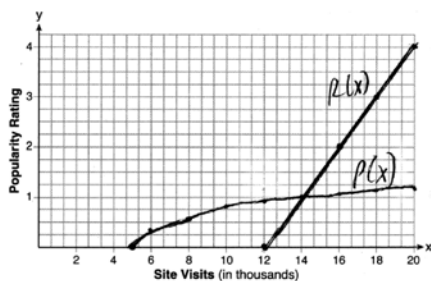
REF: 061832aai

NAT: F.TF.A.2

TOP: Determining Trigonometric Functions

KEY: extension to reals

212 ANS:



$$P(16) = \log(16 - 4) \approx 1.1, \quad , 14000$$

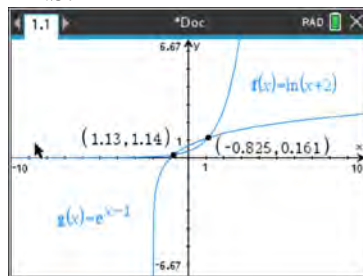
PTS: 6

REF: 061837aai

NAT: A.REI.D.11

TOP: Other Systems

213 ANS: 2



PTS: 2

REF: 081920aai

NAT: A.REI.D.11

TOP: Other Systems

214 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

215 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

216 ANS:

$$a_1 = 4$$

$$a_n = 3a_{n-1}$$

PTS: 2 REF: 081931aai NAT: F.LE.A.2 TOP: Sequences

KEY: recursive

217 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

218 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: Graphing Polynomial Functions

219 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

220 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

221 ANS: 2 PTS: 2 REF: 011804aai NAT: F.TF.A.2
TOP: Determining Trigonometric Functions KEY: radians

222 ANS: 4
The vertex is (2,2) and $p = 3$. $3 + 2 = 5$

PTS: 2 REF: 081823aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions
223 ANS: 2 PTS: 2 REF: 011820aai NAT: S.IC.A.2
TOP: Analysis of Data

224 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
225 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

226 ANS:
 $\frac{p(8) - p(4)}{8 - 4} \approx 48.78$

PTS: 2 REF: 081827aai NAT: F.IF.B.6 TOP: Rate of Change
227 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
228 ANS:
 $250(1) + 2450 = 2700$ The maximum lung capacity of a person is 2700 mL.

PTS: 2 REF: 081928aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

229 ANS: 4

$$\begin{array}{r}
 \overline{) 10x^3 - 3x^2 - 7x + 3} \\
 \underline{10x^3 - 5x^2} \\
 2x^2 - 7x \\
 \underline{2x^2 - x} \\
 -6x + 3 \\
 \underline{-6x + 3} \\
 0
 \end{array}$$

PTS: 2 REF: 011809aai NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

230 ANS: 2

$$1.00643^{12} \approx 1.08$$

PTS: 2 REF: 081808aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

231 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

232 ANS: 2

PTS: 2 REF: 081904aai NAT: A.SSE.A.2
 TOP: Factoring Polynomials KEY: higher power

233 ANS: 1

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

PTS: 2 REF: 011919aai NAT: A.APR.B.3 TOP: Graphing Polynomial Functions

234 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: 011936aai NAT: A.REI.A.2 TOP: Solving Radicals
 KEY: extraneous solutions

235 ANS:

$$i^2 = -1, \text{ and not } 1; 10 + 10i$$

PTS: 2 REF: 011825aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

236 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

237 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

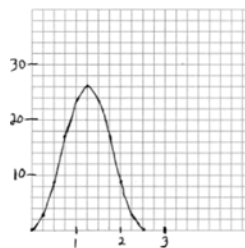
REF: 011931aai

NAT: F.TF.A.2

TOP: Unit Circle

238 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

239 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

240 ANS: 3

$$8r^3 = 216 \quad S_{12} = \frac{8 - 8(3)^{12}}{1 - 3} = 2125760$$

$$r^3 = 27$$

$$r = 3$$

PTS: 2 REF: 081902aai NAT: A.SSE.B.4 TOP: Series

KEY: geometric

241 ANS: 4

$$a_1 = 2.5 + 0.5(1) = 3$$

PTS: 2 REF: 011916aai NAT: F.BF.A.2 TOP: Sequences

242 ANS: 3

$$440 \times 2.3\% \approx 10$$

PTS: 2 REF: 011807aai NAT: S.ID.A.4 TOP: Normal Distributions

KEY: predict

243 ANS: 4

$$a = \frac{14-4}{2} = 5, d = \frac{14+4}{2} = 9$$

PTS: 2 REF: 061810aai NAT: F.TF.B.5 TOP: Modeling Trigonometric Functions

244 ANS: 3

TOP: Inverse of Functions

PTS: 2

REF: 011917aai

NAT: F.BF.B.4

KEY: other

245 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

246 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

247 ANS: 1

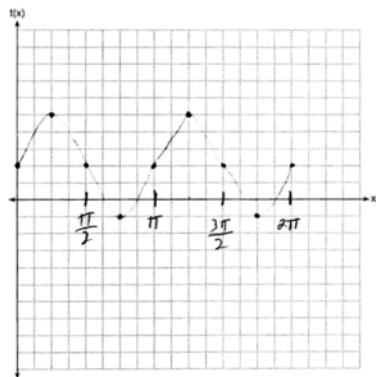
PTS: 2

REF: 081903aai

NAT: F.LE.A.2

TOP: Families of Functions

248 ANS:



PTS: 2

REF: 081830aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

249 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: other

250 ANS: 2



PTS: 2 REF: 061817aai NAT: S.ID.A.4 TOP: Normal Distributions
 KEY: probability

251 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: 061902aai NAT: A.APR.C.4 TOP: Polynomial Identities

252 ANS: 1 PTS: 2 REF: 061904aai NAT: F.IF.B.6
 TOP: Rate of Change

253 ANS:

$$P(-2) = 60 \quad Q(-2) = 0 \quad (x+2) \text{ is a factor of } Q(x) \text{ since } Q(-2) = 0.$$

PTS: 2 REF: 081929aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

254 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: 061833aai NAT: A.REI.A.2 TOP: Solving Radicals
 KEY: extraneous solutions

255 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: 061813aai NAT: F.BF.A.1 TOP: Operations with Functions

256 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

257 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

258 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: 061915aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

259 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

260 ANS: 1

TOP: Series

PTS: 2

KEY: geometric

REF: 081813aai

NAT: A.SSE.B.4

261 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: other

262 ANS: 3

TOP: Sequences

PTS: 2

REF: 061910aai

NAT: F.BF.A.2

263 ANS: 2

$$y = \frac{1}{2}x + 8 \quad x = \frac{1}{2}y + 8$$

$$2x = y + 16$$

$$y = 2x - 16$$

PTS: 2 REF: 081806aai NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: linear

264 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

265 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

266 ANS: 4 PTS: 2 REF: 061921aai NAT: A.APR.B.3

TOP: Graphing Polynomial Functions

267 ANS:

$$\begin{array}{rcll} a + 4b + 6c = 23 & a + 2b + c = 2 & 8b + 3c = 16 & 2b + 5(4) = 21 \quad a + 4\left(\frac{1}{2}\right) + 6(4) = 23 \\ a + 2b + c = 2 & -a + 6b + 2c = 14 & 8b + 20c = 84 & 2b = 1 & a + 2 + 24 = 23 \\ 2b + 5c = 21 & 8b + 3c = 16 & 17c = 68 & b = \frac{1}{2} & a = -3 \\ & & c = 4 & & \end{array}$$

PTS: 4 REF: 011933aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

268 ANS:

$\frac{B(11) - B(8)}{11 - 8} \approx -10.1$ The average monthly high temperature decreases 10.1° each month from August to November.

PTS: 2 REF: 011930aai NAT: F.IF.B.6 TOP: Rate of Change

269 ANS:

$$x^2 - 6x = -17 \quad \text{The solution is imaginary because the parabola and line do not intersect.}$$

$$x^2 - 6x + 9 = -17 + 9$$

$$(x - 3)^2 = -8$$

$$x - 3 = \pm 2i\sqrt{2}$$

$$x = 3 \pm 2i\sqrt{2}$$

PTS: 4 REF: 081936aii NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

270 ANS:

$$\frac{165 + 66 - 33}{825} = \frac{198}{825}$$

PTS: 2 REF: 081925aii NAT: S.CP.B.6 TOP: Conditional Probability

271 ANS: 1

$$(x^{\frac{3}{2}})^2 = x^3$$

PTS: 2 REF: 061908aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

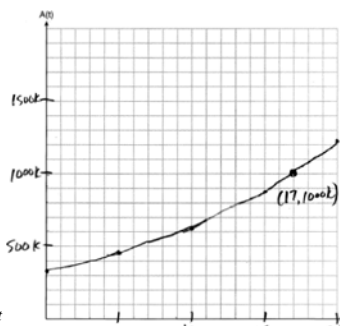
KEY: variables

272 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: 011830aii NAT: F.IF.C.9 TOP: Comparing Functions

273 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

274 ANS: 3

$$\begin{array}{r}
 2x^3 - 4x^2 - x + \frac{14}{x+6} \\
 x+6 \overline{) 2x^4 + 8x^3 - 25x^2 - 6x + 14} \\
 \underline{2x^4 + 12x^3} \\
 -4x^3 - 25x^2 \\
 \underline{-4x^3 - 24x^2} \\
 -x^2 - 6x \\
 \underline{-x^2 - 6x} \\
 14
 \end{array}$$

PTS: 2

REF: 081805aai

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: division

275 ANS: 3

PTS: 2

REF: 061906aai

NAT: F.LE.A.2

TOP: Families of Functions

276 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

277 ANS: 4

PTS: 2

REF: 081810aai

NAT: F.BF.A.2

TOP: Sequences

278 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

279 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.IF.A.3

TOP: Sequences

KEY: explicit

280 ANS: 3

PTS: 2

REF: 081909aai

NAT: F.BF.A.2

TOP: Sequences

KEY: recursive

281 ANS: 4

$$5000\left(1 + \frac{.035}{12}\right)^{12 \cdot 6} \approx 6166.50$$

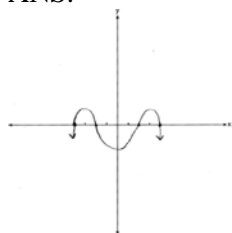
PTS: 2

REF: 081917aai

NAT: F.LE.A.2

TOP: Modeling Exponential Functions

282 ANS:



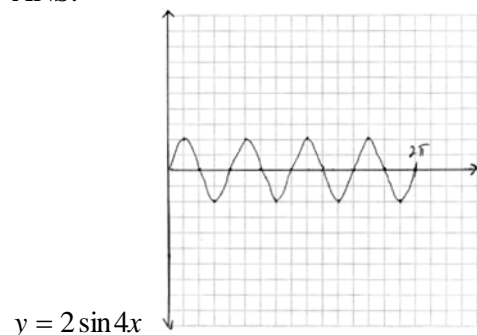
PTS: 2

REF: 011926aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

283 ANS:



PTS: 4

REF: 081934aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

284 ANS:

$$1200 \cdot 0.784 \approx 941$$

PTS: 2

REF: 081828aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: predict

285 ANS: 4 PTS: 2 REF: 081817aii NAT: F.BF.B.3
TOP: Transformations with Functions

286 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: 081916aii NAT: A.REI.C.7 TOP: Quadratic-Linear Systems
 287 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: 081821aii NAT: A.APR.B.3 TOP: Solving Polynomial Equations
 288 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
 289 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: 081834aii NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

290 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

291 ANS: 1

$$(x+7)(x-1) = x^2 + 6x - 7 = x^2 + 6x + 9 - 7 - 9 = (x+3)^2 - 16$$

PTS: 2 REF: 061808aai NAT: A.APR.C.4 TOP: Polynomial Identities

292 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

293 ANS: 2

$$x = -6(y - 2)$$

$$-\frac{x}{6} = y - 2$$

$$-\frac{x}{6} + 2 = y$$

PTS: 2 REF: 011821aai NAT: F.BF.B.4 TOP: Inverse of Functions
KEY: linear

294 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: 081927aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

295 ANS:

$$\frac{2x^{\frac{3}{2}}}{2x^{\frac{2}{2}}} = x^{\frac{1}{2}} = \sqrt{x}$$

PTS: 2 REF: 081826aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents
KEY: variables

296 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. $(\sqrt{9})^5 = 243$

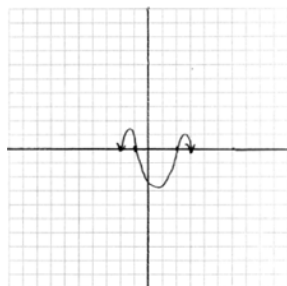
PTS: 2 REF: 081926aai NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

297 ANS: 3

$$T(19) = 8 \sin(0.3(19) - 3) + 74 \approx 77$$

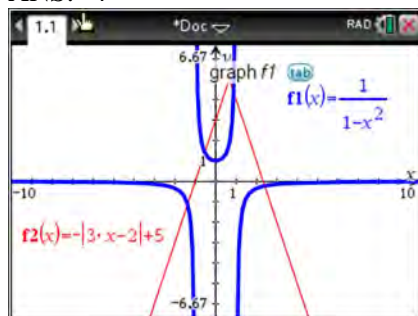
PTS: 2 REF: 061922aai NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: radians

298 ANS:



PTS: 2 REF: 011831aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

299 ANS: 4



PTS: 2 REF: 011924aai NAT: A.REI.D.11 TOP: Other Systems

300 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

301 ANS: 4

PTS: 2 REF: 081912aai NAT: F.IF.C.7
TOP: Graphing Trigonometric Functions KEY: mixed

302 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

303 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

304 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

305 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: 011829aai NAT: A.REI.D.11 TOP: Other Systems

306 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

307 ANS:

$$\frac{103}{110 + 103} = \frac{103}{213}$$

PTS: 2 REF: 061825aai NAT: S.CP.A.4 TOP: Conditional Probability

308 ANS:

$$D = 1.223(2.652)^A$$

PTS: 2 REF: 011826aai NAT: S.ID.B.6 TOP: Regression

KEY: exponential

309 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

310 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: 061829aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

311 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

312 ANS: 4

$$(x^6 y^4 - 9)(x^4 - 16)$$

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

PTS: 2 REF: 081814aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

313 ANS: 2

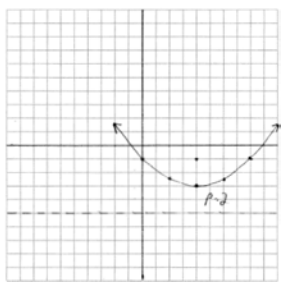
PTS: 2

REF: 061917aai

NAT: F.LE.B.5

TOP: Modeling Exponential Functions

314 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: 061935aai

NAT: G.GPE.A.2

TOP: Graphing Quadratic Functions

315 ANS:

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

PTS: 2

REF: 081825aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

KEY: higher power

316 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

317 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

318 ANS: 1

$$x - \frac{4}{x-1} = 2 \quad x = \frac{3 \pm \sqrt{(-3)^2 - 4(1)(-2)}}{2(1)} = \frac{3 \pm \sqrt{17}}{2}$$

$$x(x-1) - 4 = 2(x-1)$$

$$x^2 - x - 4 = 2x - 2$$

$$x^2 - 3x - 2 = 0$$

PTS: 2 REF: 011812aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

319 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: 081831aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

320 ANS:

$$\frac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}} = \frac{x^{\frac{2}{3}} y^{\frac{5}{3}}}{x^{\frac{3}{4}} y} = \frac{x^{\frac{8}{12}} y^{\frac{20}{12}}}{x^{\frac{9}{12}} y^{\frac{12}{12}}} = x^{-\frac{1}{12}} y^{\frac{2}{3}}$$

PTS: 2 REF: 011925aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

321 ANS: 4 PTS: 2 REF: 081803aai NAT: F.BF.A.1

TOP: Operations with Functions

322 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

- 323 ANS: 2 PTS: 2 REF: 081816aia NAT: F.IF.C.7
TOP: Graphing Logarithmic Functions KEY: bimodalgraph
- 324 ANS: 4
 $3x - (-2x + 14) = 16$ $3(6) - 4z = 2$
 $5x = 30$ $-4z = -16$
 $x = 6$ $z = 4$
- PTS: 2 REF: 011803aia NAT: A.REI.C.6 TOP: Solving Linear Systems
KEY: three variables
- 325 ANS: 2
 $P = \frac{2\pi}{\frac{\pi}{45}} = 90$
- PTS: 2 REF: 081822aia NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: period
- 326 ANS: 4
1 year = 365 days
- PTS: 2 REF: 061823aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions
- 327 ANS: 2 PTS: 2 REF: 061816aia NAT: F.IF.C.7
TOP: Graphing Polynomial Functions KEY: bimodalgraph
- 328 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: 011832aia NAT: N.RN.A.1 TOP: Radicals and Rational Exponents
- 329 ANS: 1
2) linear, 3) quadratic, 4) cubic
- PTS: 2 REF: 061920aia NAT: F.LE.A.2 TOP: Families of Functions
- 330 ANS: 2
 $0.254 \pm 2(0.060) \rightarrow (0.134, 0.374)$
- PTS: 2 REF: 061913aia NAT: S.IC.B.5 TOP: Analysis of Data
- 331 ANS: 4 PTS: 2 REF: 061914aia NAT: A.REI.D.11
TOP: Other Systems
- 332 ANS: 1 PTS: 2 REF: 011814aia NAT: A.REI.D.11
TOP: Other Systems
- 333 ANS: 2 PTS: 2 REF: 011806aia NAT: A.APR.C.4
TOP: Polynomial Identities

334 ANS:

$$\begin{aligned} & (2x^2 + x - 3) \cdot (x - 1) - \left[(2x^2 + x - 3) + (x - 1) \right] \\ & (2x^3 - 2x^2 + x^2 - x - 3x + 3) - (2x^2 + 2x - 4) \\ & 2x^3 - 3x^2 - 6x + 7 \end{aligned}$$

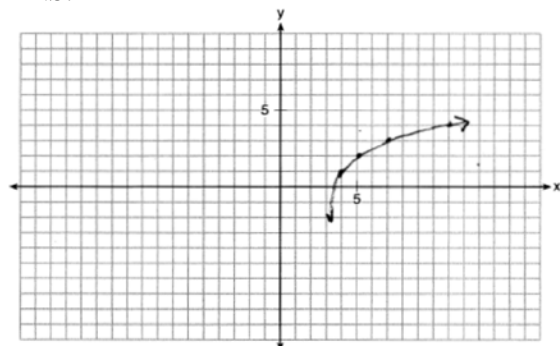
PTS: 4

REF: 011833aai

NAT: F.BF.A.1

TOP: Operations with Functions

335 ANS:



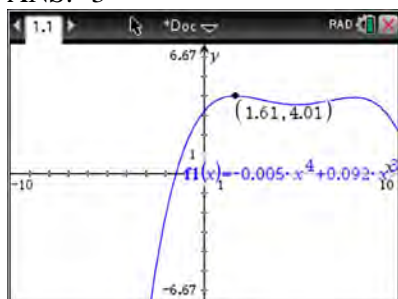
PTS: 2

REF: 011932aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

336 ANS: 3



PTS: 2

REF: 011817aai

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

337 ANS:

$$2 = e^{0.0375t}$$

$$t \approx 18.5$$

PTS: 4

REF: 081835aai

NAT: F.LE.A.4

TOP: Exponential Growth

338 ANS: 3

$$1.04^{\frac{1}{12}} \approx 1.0032737$$

PTS: 2

REF: 011906aai

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

339 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: 081933aai NAT: F.LE.A.2 TOP: Modeling Exponential Functions

340 ANS: 3

$$\text{The vertex is } (-3,5) \text{ and } p = 2. \quad y = \frac{-1}{4(2)}(x+3)^2 + 5$$

PTS: 2 REF: 011914aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

341 ANS: 4

$$1.06^{\frac{1}{52}}$$

PTS: 2 REF: 061924aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

342 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: bias

343 ANS: 3 PTS: 2 REF: 061901aai NAT: S.IC.B.3

TOP: Analysis of Data KEY: type

344 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

345 ANS: 1

$$\begin{array}{r} 3x - 1 \\ 3x + 1 \overline{) 9x^2 + 0x - 2} \end{array}$$

$$\underline{9x^2 + 3x}$$

$$-3x - 2$$

$$\underline{-3x - 1}$$

$$-1$$

PTS: 2 REF: 081910aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

346 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: 061903aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

347 ANS: 2 PTS: 2 REF: 011901aai NAT: S.ID.A.4

TOP: Normal Distributions

KEY: mean and standard deviation

348 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

349 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

350 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

351 ANS: 2

$$\frac{85}{210+85}$$

PTS: 2 REF: 081818aai NAT: S.CP.A.1 TOP: Venn Diagrams

352 ANS:

$$\frac{9}{6} = 1.5 \quad a_1 = 6$$

$$a_n = 1.5 \cdot a_{n-1}$$

PTS: 2 REF: 061931aai NAT: F.LE.A.2 TOP: Sequences

KEY: recursive

353 ANS: 3

$$y = 278(0.5)^{\frac{18}{1.8}} \approx 0.271$$

PTS: 2 REF: 011920aai NAT: F.LE.A.2 TOP: Modeling Exponential Functions

354 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

355 ANS:

 $\pi < \theta < 2\pi \rightarrow$ Quadrant III or IV θ 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

356 ANS: 4

$$\sqrt{3x^2y} \cdot \sqrt[3]{27x^3y^2} = 3^{\frac{1}{2}}x^{\frac{1}{2}}y^{\frac{1}{2}} \cdot 3^{\frac{2}{3}}x^{\frac{2}{3}}y^{\frac{2}{3}} = 3^{\frac{3}{2}}x^{\frac{5}{6}}y^{\frac{7}{6}}$$

PTS: 2 REF: 081914aai NAT: N.RN.A.2 TOP: Operations with Radicals

KEY: with variables, index > 2

357 ANS:

$$\frac{13.9 - 9.4}{4 - 1} = 1.5 \text{ The average rate of change in the number of hours of daylight from January 1-April 1 is 1.5.}$$

PTS: 2 REF: 061925aai NAT: F.IF.B.6 TOP: Rate of Change

358 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

359 ANS: 2

PTS: 2

REF: 081908aai

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

360 ANS: 4

PTS: 2

REF: 011801aai

NAT: S.IC.B.3

TOP: Analysis of Data

KEY: bias

361 ANS: 3

PTS: 2

REF: 011824aai

NAT: F.BF.A.2

TOP: Sequences

362 ANS: 1

$$1.025^{\frac{1}{12}} \approx 1.00206$$

PTS: 2 REF: 081924aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

363 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

364 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

365 ANS: 4 PTS: 2 REF: 061907aai NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

366 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

367 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

368 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

369 ANS:

$$\frac{7}{2x} - \frac{2}{x+1} = \frac{1}{4}$$

$$\frac{7x+7-4x}{2x^2+2x} = \frac{1}{4}$$

$$2x^2 + 2x = 12x + 28$$

$$x^2 - 5x - 14 = 0$$

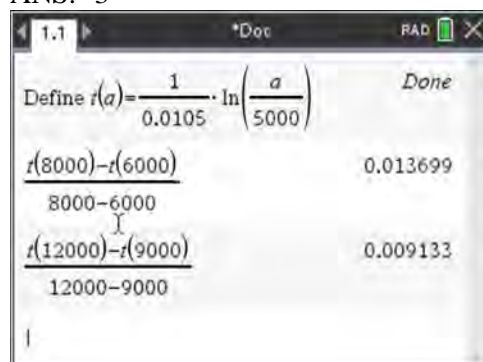
$$(x-7)(x+2) = 0$$

$$x = 7, -2$$

PTS: 2 REF: 061926aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

370 ANS: 3



The screenshot shows a TI-84 Plus calculator window with the following content:

```

1.1 *Doc RAD
Define r(a) = 1 / 0.0105 * ln(a / 5000) Done
r(8000) - r(6000) 0.013699
8000 - 6000
r(12000) - r(9000) 0.009133
12000 - 9000

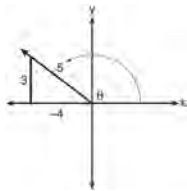
```

PTS: 2 REF: 081922aai NAT: F.IF.B.6 TOP: Rate of Change

Algebra II Regents at Random Answer Section

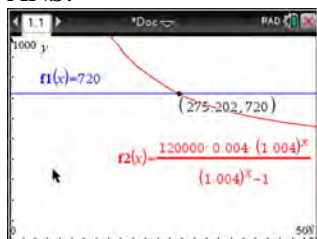
371 ANS: 1

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: spr1503aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

372 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

373 ANS:

$$\begin{array}{cccccc} 6x - 3y + 2z = -10 & x + 3y + 5z = 45 & 4x + 10z = 62 & 4x + 4(7) = 20 & 6(-2) - 3y + 2(7) = -10 & \\ -2x + 3y + 8z = 72 & 6x - 3y + 2z = -10 & 4x + 4z = 20 & 4x = -8 & -3y = -12 & \\ 4x + 10z = 62 & 7x + 7z = 35 & 6z = 42 & x = -2 & y = 4 & \\ 4x + 4z = 20 & z = 7 & & & & \end{array}$$

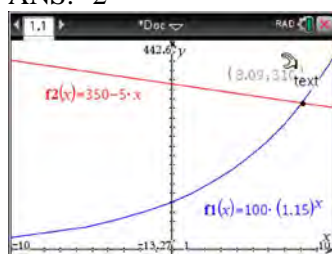
PTS: 4 REF: spr1510aii NAT: A.REI.C.6 TOP: Solving Linear Systems
KEY: three variables

374 ANS: 4

$$(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3 \neq x^3 + 3xy + y^3$$

PTS: 2 REF: 081620aii NAT: A.APR.C.4 TOP: Polynomial Identities

375 ANS: 2



PTS: 2 REF: 011716aai NAT: A.REI.D.11 TOP: Other Systems

376 ANS: 4

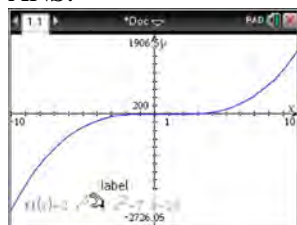
$$\text{period} = \frac{2\pi}{B}$$

$$\frac{1}{60} = \frac{2\pi}{B}$$

$$B = 120\pi$$

PTS: 2 REF: 061624aai NAT: F.TF.B.5 TOP: Modeling Trigonometric Functions

377 ANS:



$$x - 5 \overline{) 2x^3 - 4x^2 - 7x - 10} \quad \begin{array}{l} 2x^2 + 6x + 23 \\ \hline 2x^3 - 10x^2 \\ \hline 6x^2 - 7x \\ \hline 6x^2 - 30x \\ \hline 23x - 10 \\ \hline 23x - 115 \\ \hline 105 \end{array} \quad \text{Since there is a remainder, } x - 5 \text{ is not a factor.}$$

$$2x^3 - 10x^2$$

$$6x^2 - 7x$$

$$6x^2 - 30x$$

$$23x - 10$$

$$23x - 115$$

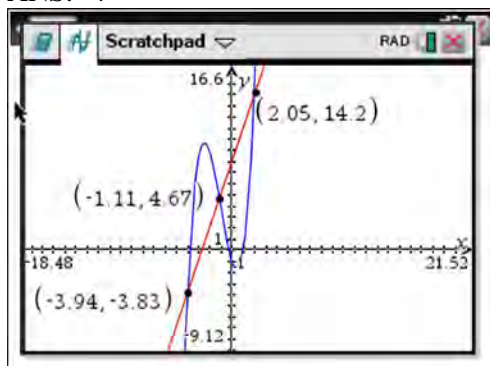
$$105$$

PTS: 2 REF: 061627aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

378 ANS: 1 PTS: 2 REF: 011704aai NAT: F.TF.C.8

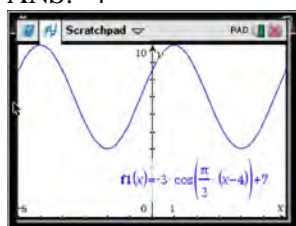
TOP: Simplifying Trigonometric Expressions

379 ANS: 4



PTS: 2 REF: 061622aai NAT: A.REI.D.11 TOP: Other Systems

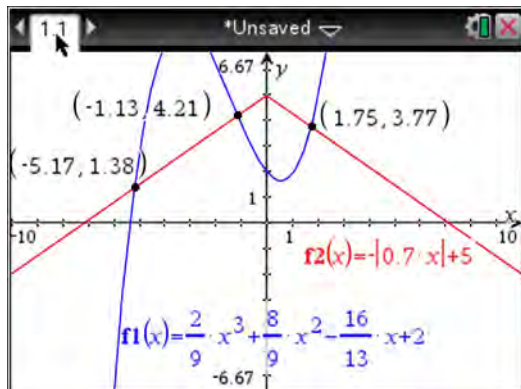
380 ANS: 4



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

381 ANS:



PTS: 2 REF: fall1510aai NAT: A.REI.D.11 TOP: Other Systems

382 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

383 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: 061709aai NAT: F.BF.A.1 TOP: Operations with Functions

384 ANS: 3

$$1.0525^{\frac{1}{12}} \approx 1.00427$$

PTS: 2 REF: 061621aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

385 ANS:

$$7 = 20(0.5)^{\frac{t}{8.02}}$$

$$\log 0.35 = \log 0.5^{\frac{t}{8.02}}$$

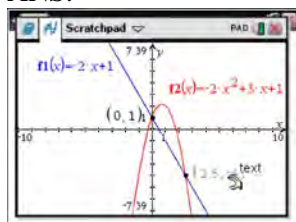
$$\log 0.35 = \frac{t \log 0.5}{8.02}$$

$$\frac{8.02 \log 0.35}{\log 0.5} = t$$

$$t \approx 12$$

PTS: 4 REF: 081634aai NAT: F.LE.A.4 TOP: Exponential Decay

386 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

387 ANS:

$$M = 172600 \cdot \frac{0.00305(1 + 0.00305)^{12 \cdot 15}}{(1 + 0.00305)^{12 \cdot 15} - 1} \approx 1247 \quad 1100 = (172600 - x) \cdot \frac{0.00305(1 + 0.00305)^{12 \cdot 15}}{(1 + 0.00305)^{12 \cdot 15} - 1}$$

$$1100 \approx (172600 - x) \cdot (0.007228)$$

$$152193 \approx 172600 - x$$

$$20407 \approx x$$

PTS: 4 REF: 061734aai NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

388 ANS: 3

Since $x + 4$ is a factor of $p(x)$, there is no remainder.

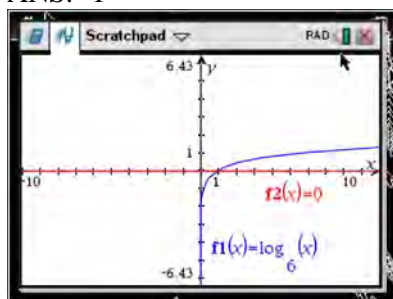
PTS: 2 REF: 081621aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

389 ANS: 4

The scenario represents a decreasing geometric sequence with a common ratio of 0.80.

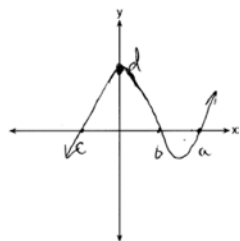
PTS: 2 REF: 061610aai NAT: F.BF.A.2 TOP: Sequences

390 ANS: 1



PTS: 2 REF: 061618aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

391 ANS:



PTS: 2 REF: 081732aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

392 ANS: 2

PTS: 2

REF: 081610aai

NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

393 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

394 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

395 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: 081605aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

396 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: spr1501aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

KEY: bimodalgraph

397 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

398 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

399 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

400 ANS: 4

 $496 \pm 2(115)$

PTS: 2

REF: 011718aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: interval

401 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

402 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

403 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

404 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: 061636aai NAT: F.IF.C.9 TOP: Comparing Functions

405 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.2 TOP: Remainder and Factor Theorems

406 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

407 ANS: 1

$$P(28) = 5(2)^{\frac{98}{28}} \approx 56$$

PTS: 2 REF: 011702aai NAT: F.LE.A.2 TOP: Modeling Exponential Functions

408 ANS:

Yes. The margin of error from this simulation indicates that 95% of the observations fall within ± 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 ± 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

409 ANS: 4 PTS: 2 REF: 081622aai NAT: F.BF.A.1

TOP: Modeling Exponential Functions

410 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: 081623aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

411 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

412 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: fall1512aii NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: $a > 1$

413 ANS: 1

$$\begin{array}{r} \overline{3x^2+4x-1} \\ 2x+3\overline{)6x^3+17x^2+10x+2} \\ \underline{6x^3+9x^2} \\ 8x^2+10x \\ \underline{8x^2+12x} \\ -2x+2 \\ \underline{-2x-3} \\ 5 \end{array}$$

PTS: 2 REF: fall1503aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

414 ANS: 3 PTS: 2 REF: 011706aii NAT: S.IC.B.3

TOP: Analysis of Data

KEY: type

415 ANS:

$$P(P/K) = \frac{P(P \wedge K)}{P(K)} = \frac{1.9}{2.3} \approx 82.6\% \quad \text{A key club member has an 82.6\% probability of being enrolled in AP Physics.}$$

PTS: 4 REF: 011735aii NAT: S.CP.B.6 TOP: Conditional Probability

416 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: 011711aii NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

417 ANS: 4 PTS: 2 REF: 081718aai NAT: F.IF.C.7
 TOP: Graphing Trigonometric Functions KEY: amplitude

418 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

419 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
 KEY: recursive

420 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
 421 ANS:

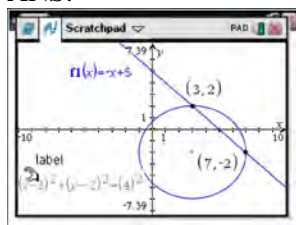
$$\frac{\frac{8}{3}}{\frac{4}{x^3}} = x^y$$

$$\frac{4}{x^3} = x^y$$

$$\frac{4}{3} = y$$

PTS: 2 REF: spr1505aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents
 KEY: numbers

422 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

423 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

424 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

425 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: 061723aai NAT: A.APR.D.6 TOP: Expressions with Negative Exponents

KEY: variables

426 ANS: 3

$$0.75^{\frac{1}{10}} \approx .9716$$

PTS: 2 REF: 061713aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

427 ANS: 1

PTS: 2

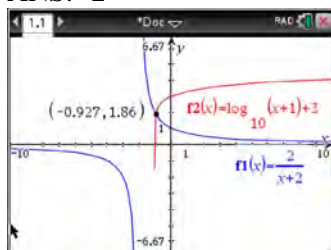
REF: 081609aai

NAT: F.BF.B.6

TOP: Sigma Notation

KEY: represent

428 ANS: 2



PTS: 2 REF: 011712aai NAT: A.REI.D.11 TOP: Other Systems

429 ANS: 3

The graph shows three real zeros, and has end behavior matching the given end behavior.

PTS: 2 REF: 061604aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

KEY: bimodalgraph

430 ANS: 2

$$\left(m^{\frac{5}{3}}\right)^{-\frac{1}{2}} = m^{-\frac{5}{6}} = \frac{1}{\sqrt[6]{m^5}}$$

PTS: 2 REF: 011707aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

431 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: 081716aai NAT: S.IC.B.4 TOP: Analysis of Data

432 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

433 ANS: 1

$$\frac{157}{25 + 47 + 157}$$

PTS: 2 REF: 081607aai NAT: S.CP.A.4 TOP: Conditional Probability

434 ANS:

No, because $P(M/R) \neq P(M)$

$$\frac{70}{180} \neq \frac{230}{490}$$

$$0.38 \neq 0.47$$

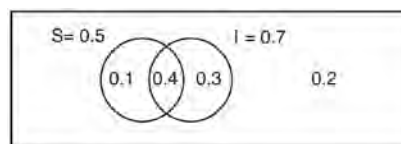
PTS: 2 REF: 011731aai NAT: S.CP.A.4 TOP: Conditional Probability

435 ANS: 1 PTS: 2 REF: 081616aai NAT: F.TF.A.1
 TOP: Unit Circle KEY: bimodalgraph

436 ANS: 1
 $d = 18; r = \pm \frac{5}{4}$

PTS: 2 REF: 011714aai NAT: F.IF.A.3 TOP: Sequences
 KEY: explicit

437 ANS:



This scenario can be modeled with a Venn Diagram: Since
 $P(S \cup I) = 0.8$, $P(S \cup I) = 0.8$. 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: spr1513aai NAT: S.CP.A.2 TOP: Probability of Compound Events
 KEY: independence

438 ANS: 3 PTS: 2 REF: 081618aai NAT: F.LE.A.2
 TOP: Sequences KEY: recursive

439 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: other

440 ANS:
 $x + y + z = 1$ $x + y + z = 1$ $x + y + z = 1$ $-2z - z = 3$ $y - (-1) = 3$ $x + 2 - 1 = 1$
 $x + 2y + 3z = 1$ $x + 2y + 3z = 1$ $-x + 3y - 5z = 11$ $-3z = 3$ $y = 2$ $x = 0$
 $-x + 3y - 5z = 11$ $y + 2z = 0$ $4y - 4z = 12$ $z = -1$
 $y = -2z$ $y - z = 3$

PTS: 4 REF: 061733aai NAT: A.REI.C.6 TOP: Solving Linear Systems
 KEY: three variables

441 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

442 ANS: 2

$$\begin{array}{r}
 2x^2 - 3x + 7 \\
 2x + 3 \overline{) 4x^3 + 0x^2 + 5x + 10} \\
 \underline{4x^3 + 6x^2} \\
 -6x^2 + 5x \\
 \underline{-6x^2 - 9x} \\
 14x + 10 \\
 \underline{14x + 21} \\
 -11
 \end{array}$$

PTS: 2

REF: 061614aai

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: division

443 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

444 ANS:

$$4\% \quad 8.75 = 1.25(1+r)^{49} \quad \text{or} \quad 8.75 = 1.25e^{49r}$$

$$7 = (1+r)^{49} \quad \ln 7 = \ln e^{49r}$$

$$r+1 = \sqrt[49]{7} \quad \ln 7 = 49r$$

$$r \approx .04 \quad r = \frac{\ln 7}{49}$$

$$r \approx .04$$

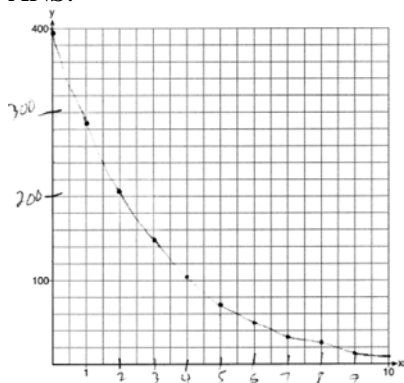
PTS: 2

REF: 081730aai

NAT: F.LE.A.4

TOP: Exponential Growth

445 ANS:



PTS: 2 REF: 061729aia NAT: F.IF.C.7 TOP: Graphing Exponential Functions

446 ANS: 3

$$(3k - 2i)^2 = 9k^2 - 12ki + 4i^2 = 9k^2 - 12ki - 4$$

PTS: 2 REF: 081702aia NAT: N.CN.A.2 TOP: Operations with Complex Numbers

447 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: 081630aia NAT: F.IF.C.9 TOP: Comparing Functions

448 ANS: 3

$$d = 10 \log \frac{6.3 \times 10^{-3}}{1.0 \times 10^{-12}} \approx 98$$

PTS: 2 REF: 011715aia NAT: F.IF.B.4 TOP: Evaluating Logarithmic Expressions

449 ANS:

$$\left(\ln \frac{1}{2} \right)$$

1590 is negative, so $M(t)$ represents decay.

PTS: 2 REF: 011728aia NAT: F.IF.C.7 TOP: Graphing Exponential Functions

450 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: 081632aia NAT: S.CP.A.2 TOP: Probability of Compound Events
KEY: independence

451 ANS:

$$P(W/D) = \frac{P(W \cap D)}{P(D)} = \frac{.4}{.5} = .8$$

PTS: 2 REF: 081726aai NAT: S.CP.B.6 TOP: Conditional Probability

452 ANS: 2

The 2010 population is 110 million.

PTS: 2 REF: 061718aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions

453 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

454 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

455 ANS: 3

PTS: 2

REF: 011708aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: other

456 ANS: 1

PTS: 2

REF: 061708aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

457 ANS: 3

$$\log_{0.8} \left(\frac{V}{17000} \right) = t \quad \frac{17,000(0.8)^3 - 17,000(0.8)^1}{3-1} \approx -2450$$

$$0.8^t = \frac{V}{17000}$$

$$V = 17000(0.8)^t$$

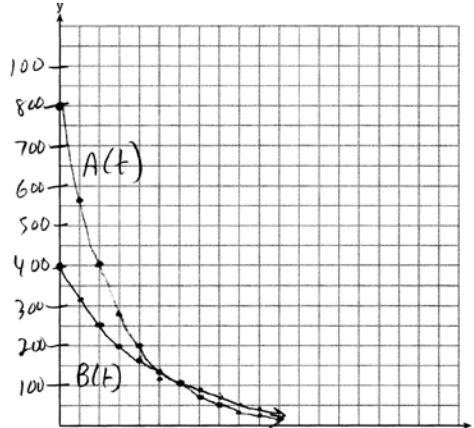
PTS: 2 REF: 081709aai NAT: F.IF.B.6 TOP: Rate of Change

458 ANS: 2

$$\begin{array}{r}
 x^2 + 0x + 1 \\
 x + 2 \overline{) x^3 + 2x^2 + x + 6} \\
 \underline{x^3 + 2x^2} \\
 0x^2 + x \\
 \underline{0x^2 + 0x} \\
 x + 6 \\
 \underline{x + 2} \\
 4
 \end{array}$$

PTS: 2 REF: 081611aii NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

459 ANS:



$$A(t) = 800e^{-0.347t}$$

$$B(t) = 400e^{-0.231t}$$

$$800e^{-0.347t} = 400e^{-0.231t} \quad 0.15 = e^{-0.347t}$$

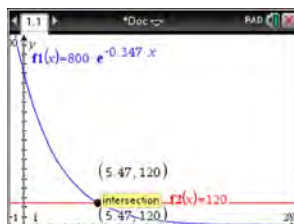
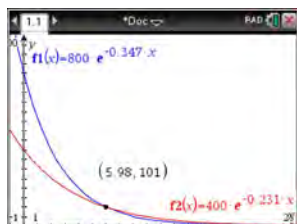
$$\ln 2e^{-0.347t} = \ln e^{-0.231t} \quad \ln 0.15 = \ln e^{-0.347t}$$

$$\ln 2 + \ln e^{-0.347t} = \ln e^{-0.231t} \quad \ln 0.15 = -0.347t \cdot \ln e$$

$$\ln 2 - 0.347t = -0.231t \quad 5.5 \approx t$$

$$\ln 2 = 0.116t$$

$$6 \approx t$$



PTS: 6 REF: 061637aii NAT: A.REI.D.11 TOP: Other Systems

460 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: 061631aii NAT: A.APR.C.4 TOP: Polynomial Identities

461 ANS: 3

$$x^2 + 2x + 1 = -5 + 1$$

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

$$x+1 = \pm 2i$$

$$x = -1 \pm 2i$$

PTS: 2 REF: 081703aii NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

462 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: 011730aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

463 ANS: 3 PTS: 2 REF: 061607aii NAT: S.IC.A.2

TOP: Analysis of Data

464 ANS: 4

$$y = g(x) = (x-2)^2 \quad (x-2)^2 = 3x-2 \quad y = 3(6)-2 = 16$$

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

$$x^2 - 7x + 6 = 0$$

$$(x-6)(x-1) = 0$$

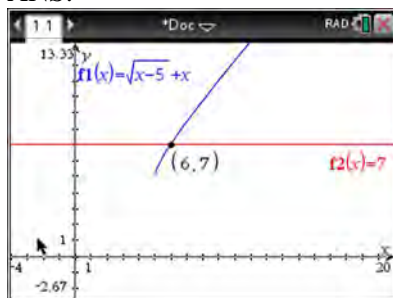
$$x = 6, 1$$

PTS: 2 REF: 011705aii NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

465 ANS: 4 PTS: 2 REF: 061716aii NAT: N.RN.A.2

TOP: Radicals and Rational Exponents KEY: variables

466 ANS:



$$\sqrt{x-5} = -x+7 \quad \sqrt{x-5} = -9+7 = -2 \text{ is extraneous.}$$

$$x-5 = x^2 - 14x + 49$$

$$0 = x^2 - 15x + 54$$

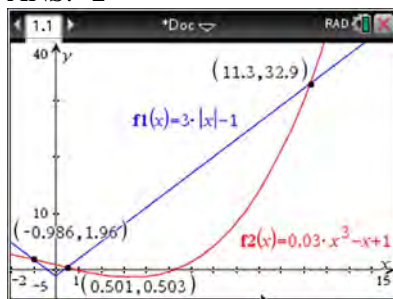
$$0 = (x-6)(x-9)$$

$$x = 6, 9$$

PTS: 2 REF: spr1508aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

467 ANS: 2



PTS: 2 REF: 061705aii NAT: A.REI.D.11 TOP: Other Systems

468 ANS:

$$\begin{array}{r} 3x+13 \\ x-2 \overline{) 3x^2+7x-20} \\ \underline{3x^2-6x} \\ 13x-20 \\ \underline{13x-26} \\ 6 \end{array} \quad 3x+13 + \frac{6}{x-2}$$

PTS: 2 REF: 011732aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

469 ANS: 3 PTS: 2 REF: 061722aii NAT: A.CED.A.1

TOP: Modeling Rationals

470 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

471 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

472 ANS: 1

(2) is not recursive

PTS: 2 REF: 081608aai NAT: F.LE.A.2 TOP: Sequences
KEY: recursive

473 ANS: 4 PTS: 2 REF: 061601aai NAT: N.RN.A.2
TOP: Radicals and Rational Exponents KEY: variables

474 ANS: 3 PTS: 2 REF: 061602aai NAT: A.CED.A.1
TOP: Modeling Rationals

475 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: 081628aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

476 ANS: 2 PTS: 2 REF: 081717aai NAT: S.IC.B.3
TOP: Analysis of Data KEY: type

477 ANS: 3 PTS: 2 REF: 081705aai NAT: F.IF.B.4
TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

478 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

479 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

480 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

481 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

482 ANS:

$$xi(-6i)^2 = xi(36i^2) = 36xi^3 = -36xi$$

PTS: 2 REF: 081627aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

483 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: fall1501aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

484 ANS: 3

$$\sqrt{56-x} = x \quad -8 \text{ is extraneous.}$$

$$56-x = x^2$$

$$0 = x^2 + x - 56$$

$$0 = (x+8)(x-7)$$

$$x = 7$$

PTS: 2 REF: 061605aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

485 ANS:

$$A = 5000(1.045)^n \quad 5000\left(1 + \frac{.046}{4}\right)^{4(6)} - 5000(1.045)^6 \approx 6578.87 - 6511.30 \approx 67.57 \quad 10000 = 5000\left(1 + \frac{.046}{4}\right)^{4n}$$

$$B = 5000\left(1 + \frac{.046}{4}\right)^{4n} \quad 2 = 1.0115^{4n}$$

$$\log 2 = 4n \cdot \log 1.0115$$

$$n = \frac{\log 2}{4 \log 1.0115}$$

$$n \approx 15.2$$

PTS: 6 REF: 081637aai NAT: A.CED.A.1 TOP: Exponential Growth

486 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: 061626aai NAT: S.IC.B.3 TOP: Analysis of Data

KEY: type

487 ANS: 2 PTS: 2 REF: 011709aai NAT: S.IC.B.5

TOP: Analysis of Data

488 ANS: 1

$$\begin{array}{r} 2x^2 + x + 5 \\ 2x - 1 \overline{) 4x^3 + 0x^2 + 9x - 5} \\ \underline{4x^3 - 2x^2} \\ 2x^2 + 9x \\ \underline{2x^2 - x} \\ 10x - 5 \\ \underline{10x - 5} \\ 0 \end{array}$$

PTS: 2 REF: 081713aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

489 ANS:

$$\sqrt[3]{x} \cdot \sqrt{x} = x^{\frac{1}{3}} \cdot x^{\frac{1}{2}} = x^{\frac{3}{6}} \cdot x^{\frac{3}{6}} = x^{\frac{5}{6}}$$

PTS: 2 REF: 061731aai NAT: N.RN.A.2 TOP: Operations with Radicals

KEY: with variables, index > 2

490 ANS: 1

The graph of $y = \sin x$ is unchanged when rotated 180° about the origin.

PTS: 2 REF: 081614aai NAT: F.BF.B.3 TOP: Even and Odd Functions

491 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

492 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

493 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: spr1504aai

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

494 ANS: 4

PTS: 2

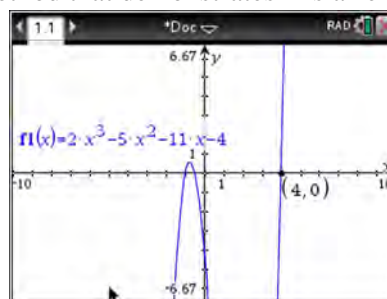
REF: 061706aai

NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

495 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: spr1507aai

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

496 ANS: 2

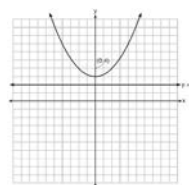
PTS: 2

REF: 011701aai

NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

497 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

498 ANS: 2

$$(2 - yi)(2 - yi) = 4 - 4yi + y^2 i^2 = -y^2 - 4yi + 4$$

PTS: 2 REF: 061603aia NAT: N.CN.A.2 TOP: Operations with Complex Numbers

499 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

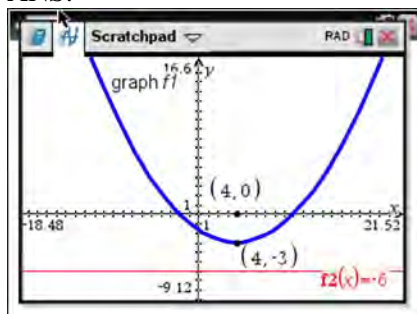
500 ANS: 3

Self selection causes bias.

PTS: 2 REF: 061703aia NAT: S.IC.B.3 TOP: Analysis of Data

KEY: bias

501 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

502 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: 081617aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

503 ANS:

$$x = (y - 3)^3 + 1$$

$$x - 1 = (y - 3)^3$$

$$\sqrt[3]{x - 1} = y - 3$$

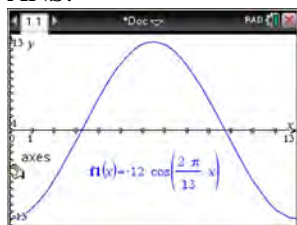
$$\sqrt[3]{x - 1} + 3 = y$$

$$f^{-1}(x) = \sqrt[3]{x - 1} + 3$$

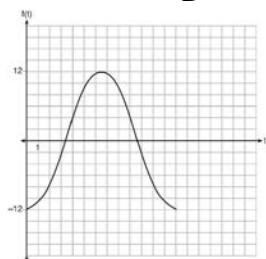
PTS: 2 REF: fall1509aai NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: other

504 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

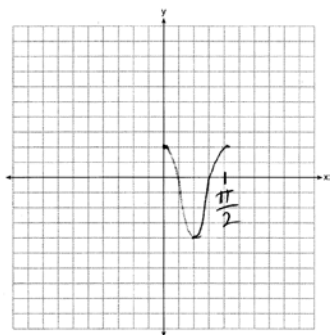
REF: spr1514aii

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

505 ANS:



PTS: 2

REF: 061628aii

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

506 ANS: 4

$$d = 32(.8)^{b-1} \quad S_n = \frac{32 - 32(.8)^{12}}{1 - .8} \approx 149$$

PTS: 2

REF: 081721aii

NAT: A.SSE.B.4

TOP: Series

KEY: geometric

507 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

508 ANS: 2

PTS: 2

REF: 061620aai

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

509 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

510 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: 061632aai

NAT: F.LE.A.4

TOP: Exponential Growth

511 ANS: 3

PTS: 2

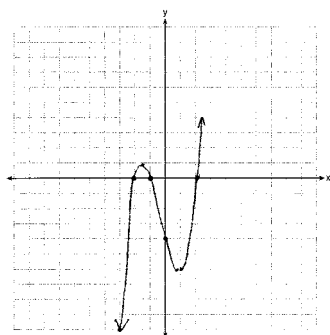
REF: 061720aai

NAT: F.LE.A.2

TOP: Sequences

KEY: explicit

512 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

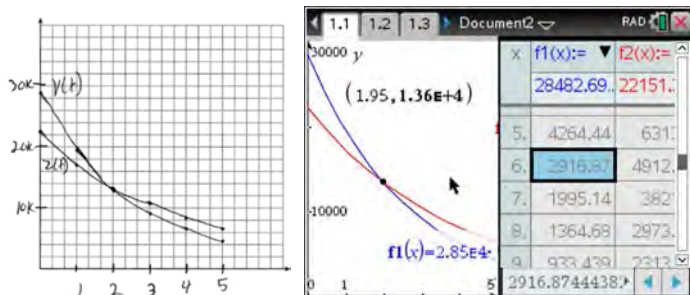
513 ANS: 2

$$\begin{array}{r|rrrr}
 -4 & 1 & -11 & 16 & 84 \\
 & & -4 & 60 & -304 \\
 \hline
 & 1 & -15 & 76 &
 \end{array}$$

Since there is a remainder when the cubic is divided by $x + 4$, this binomial is not a factor.

PTS: 2 REF: 081720aai NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

514 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

515 ANS:

$$(1 - i)(1 - i)(1 - i) = (1 - 2i + i^2)(1 - i) = -2i(1 - i) = -2i + 2i^2 = -2 - 2i$$

PTS: 2 REF: 011725aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

516 ANS: 2 PTS: 2 REF: 011720aai NAT: A.APR.B.2
TOP: Remainder and Factor Theorems

517 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: 011724aai NAT: F.IF.B.6 TOP: Rate of Change

518 ANS: 1



PTS: 2 REF: 081711aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: percent

519 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

520 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

521 ANS: 3

(3) repeats 3 times over 2π .

PTS: 2 REF: 011722aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: recognize | bimodalgraph

522 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

523 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.

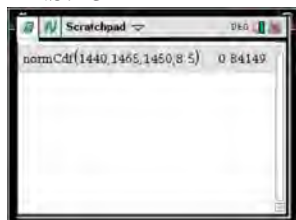
PTS: 2 REF: 081629aai NAT: S.IC.B.6 TOP: Analysis of Data

524 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

525 ANS: 3

PTS: 2 REF: 081604aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: probability

526 ANS:



69

PTS: 2 REF: 061726aai NAT: S.ID.A.4 TOP: Normal Distributions

KEY: percent

527 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

528 ANS: 2

$$\sqrt{x+14} = \sqrt{2x+5} + 1 \qquad \sqrt{22+14} - \sqrt{2(22)+5} = 1$$

$$x+14 = 2x+5+2\sqrt{2x+5}+1 \qquad 6-7 \neq 1$$

$$-x+8 = 2\sqrt{2x+5}$$

$$x^2 - 16x + 64 = 8x + 20$$

$$x^2 - 24x + 44 = 0$$

$$(x-22)(x-2) = 0$$

$$x = 2, 22$$

PTS: 2 REF: 081704aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: advanced

529 ANS: 4 PTS: 2 REF: 081707aai NAT: F.TF.A.2

TOP: Reference Angles KEY: bimodalgraph

530 ANS: 2



PTS: 2 REF: 081603aai NAT: A.REI.D.11 TOP: Other Systems

531 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: 061612aia NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

532 ANS: 4

	Bar Harbor	Phoenix
Minimum	31.386	66.491
Midline	55.3	86.729
Maximum	79.214	106.967
Range	47.828	40.476

PTS: 2 REF: 061715aia NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

KEY: maximum/minimum

533 ANS:

Amplitude, because the height of the graph shows the volume of the air.

PTS: 2 REF: 081625aia NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: mixed

534 ANS: 2 PTS: 2 REF: 061724aia NAT: A.SSE.B.4

TOP: Series KEY: geometric

535 ANS: 3 PTS: 2 REF: 061623aia NAT: F.BF.A.2

TOP: Sequences

536 ANS: 3 PTS: 2 REF: 011710aia NAT: F.BF.A.1

TOP: Operations with Functions

537 ANS: 4

$$k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$$

$$k^2(k^2 - 4) + 8k(k^2 - 4) + 12(k^2 - 4)$$

$$(k^2 - 4)(k^2 + 8k + 12)$$

$$(k + 2)(k - 2)(k + 6)(k + 2)$$

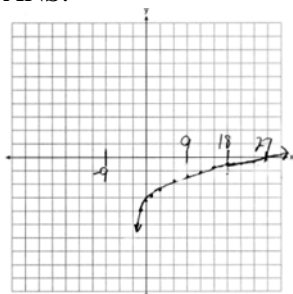
PTS: 2 REF: fall1505aia NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

538 ANS: 3 PTS: 2 REF: 081724aia NAT: F.BF.A.2

TOP: Sequences

539 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

540 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

541 ANS: 3

$$-33t^2 + 360t = 700 + 5t$$

$$-33t^2 + 355t - 700 = 0$$

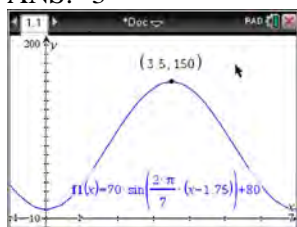
$$t = \frac{-355 \pm \sqrt{355^2 - 4(-33)(-700)}}{2(-33)} \approx 3,8$$

PTS: 2 REF: 081606aai NAT: A.REI.D.11 TOP: Quadratic-Linear Systems

542 ANS: 4 PTS: 2 REF: 081708aai NAT: A.APR.B.3

TOP: Solving Polynomial Equations

543 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

544 ANS: 2

 $h(x)$ does not have a y -intercept.

PTS: 2 REF: 011719aai NAT: F.IF.C.9 TOP: Comparing Functions

545 ANS:

$$\left(\sqrt{2x-7}\right)^2 = (5-x)^2 \quad \sqrt{2(4)-7}+4=5 \quad \sqrt{2(8)-7}+8=5$$

$$2x-7 = 25-10x+x^2 \quad \sqrt{1}=1 \quad \sqrt{9} \neq -3$$

$$0 = x^2 - 12x + 32$$

$$0 = (x-8)(x-4)$$

$$x = 4, 8$$

PTS: 4 REF: 081635aia NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

546 ANS:

$$a_1 = 4 \quad a_8 = 639$$

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

PTS: 2 REF: 081729aia NAT: F.LE.A.2 TOP: Sequences

KEY: recursive

547 ANS: 1

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

$$2x-8+3x+9 = 2x-2$$

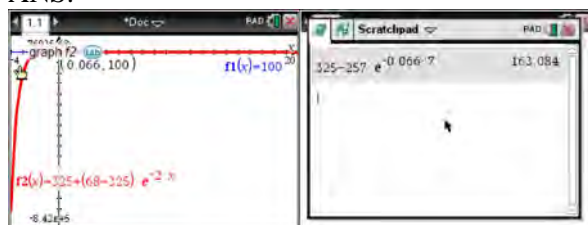
$$3x = -3$$

$$x = -1$$

PTS: 2 REF: 011717aia NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

548 ANS:



$$100 = 325 + (68 - 325)e^{-2k} \quad T = 325 - 257e^{-0.066t}$$

$$-225 = -257e^{-2k} \quad T = 325 - 257e^{-0.066(7)} \approx 163$$

$$k = \frac{\ln\left(\frac{-225}{-257}\right)}{-2}$$

$$k \approx 0.066$$

PTS: 4 REF: fall1513aia NAT: F.LE.A.4 TOP: Exponential Growth

549 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: 081734aia NAT: F.BF.A.2 TOP: Sequences

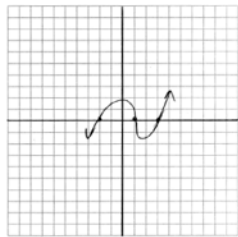
550 ANS:

$$j(-x) = (-x)^4 - 3(-x)^2 - 4 = x^2 - 3x^2 - 4$$

Since $j(x) = j(-x)$, the function is even.

PTS: 2 REF: 081731aia NAT: F.BF.B.3 TOP: Even and Odd Functions

551 ANS:



PTS: 2 REF: 011729aia NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

552 ANS: 4

The vertex is (1,0) and $p = 2$. $y = \frac{1}{4(2)}(x - 1)^2 + 0$

PTS: 2 REF: 061717aia NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

553 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: 081615aia NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

554 ANS: 1 PTS: 2 REF: 061701aia NAT: A.APR.B.3

TOP: Graphing Polynomial Functions

555 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

556 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

557 ANS: 3 PTS: 2 REF: 061710aai NAT: S.IC.A.2

TOP: Analysis of Data

558 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: 081733aai NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

559 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

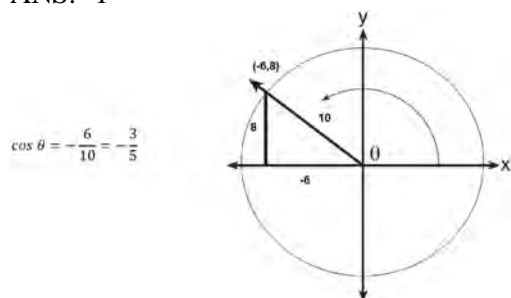
560 ANS:

$\csc \theta = \frac{1}{\sin \theta}$, 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: 011727aai NAT: F.TF.A.2 TOP: Reciprocal Trigonometric Relationships

561 ANS: 1



PTS: 2 REF: 061617aai NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

562 ANS: 1

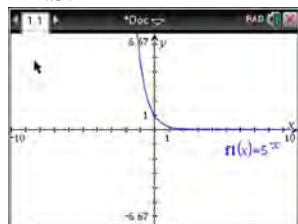
$$x^2 + 2x - 8 = 0$$

$$(x + 4)(x - 2) = 0$$

$$x = -4, 2$$

PTS: 2 REF: 081701aai NAT: A.APR.D.6 TOP: Undefined Rationals

563 ANS: 4



$$y = 5^{-x} = \left(\frac{1}{5}\right)^x$$

PTS: 2 REF: 061615aai NAT: F.IF.C.7 TOP: Graphing Exponential Functions

564 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

565 ANS: 1 PTS: 2 REF: 081722aai NAT: S.IC.B.6

TOP: Analysis of Data

566 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

567 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: 061725aia NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

568 ANS: 1

1) let $y = x + 2$, then $y^2 + 2y - 8$

$$(y + 4)(y - 2)$$

$$(x + 2 + 4)(x + 2 - 2)$$

$$(x + 6)x$$

PTS: 2 REF: 081715aia NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: multivariable

569 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: 061712aia NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

570 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

571 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

572 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: 011713aai NAT: S.ID.B.6 TOP: Regression

KEY: choose model

573 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

574 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

575 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

576 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: 081723aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

577 ANS: 1

II. Ninth graders drive to school less often; III. Students know little about adults; IV. Calculus students love math!

PTS: 2 REF: 081602aii NAT: S.IC.B.3 TOP: Analysis of Data

KEY: bias

578 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: 081727aii NAT: A.APR.C.4 TOP: Polynomial Identities

579 ANS: 4 PTS: 2 REF: 081624aii NAT: F.BF.A.2

TOP: Sequences

580 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: 011721aii NAT: F.IF.B.6 TOP: Rate of Change

581 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: 061702aii NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

582 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

583 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

584 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.LE.A.2 TOP: Sequences

KEY: recursive

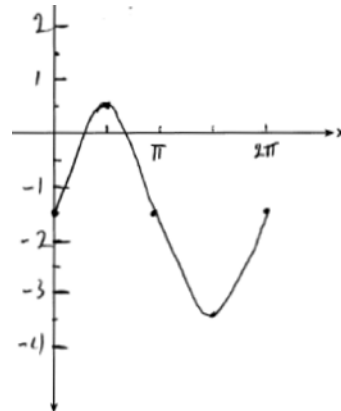
585 ANS: 1

$$\begin{array}{r|rrrrr} 2 & 1 & 0 & -4 & -4 & 8 \\ & & 2 & 4 & 0 & -8 \\ \hline & 1 & 2 & 0 & -4 & 0 \end{array}$$

Since there is no remainder when the quartic is divided by $x - 2$, this binomial is a factor.

PTS: 2 REF: 061711aii NAT: A.APR.B.2 TOP: Remainder and Factor Theorems

586 ANS:

Part a sketch is shifted $\frac{\pi}{3}$ units right.

PTS: 4 REF: 081735aii NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph