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REGENTS AT RANDOM

NY Algebra II Regents Exam Questions
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Algebra II Regents at Random

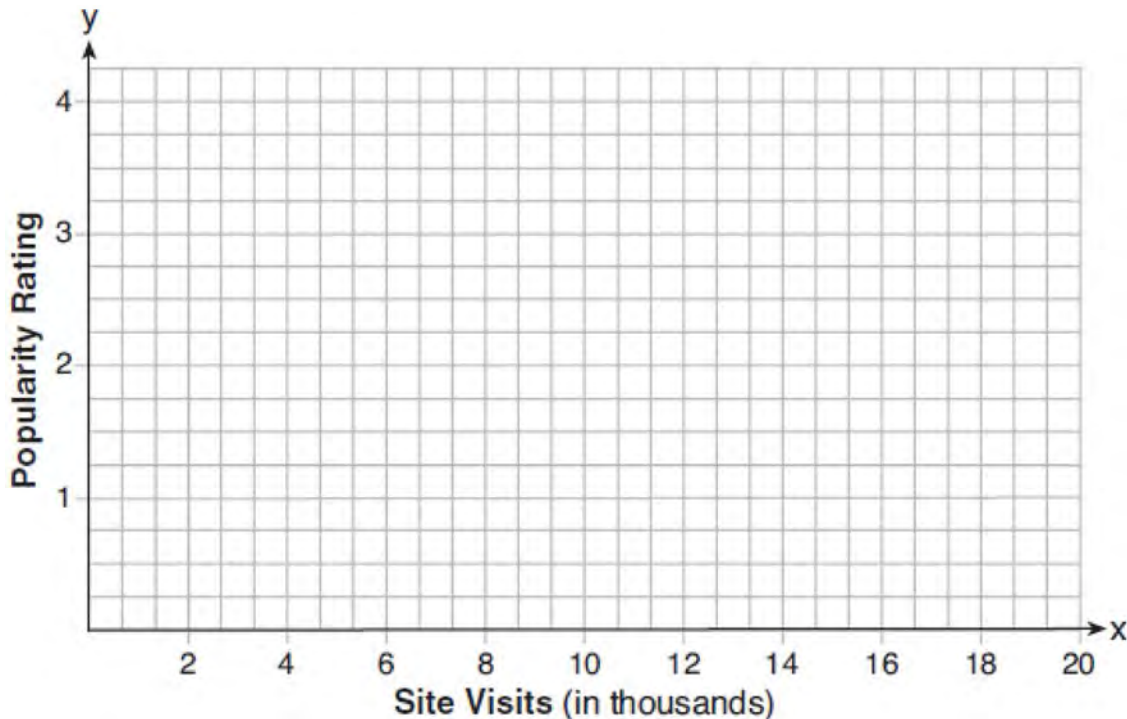
- 1 Jake wants to buy a car and hopes to save at least \$5000 for a down payment. The table below summarizes the amount of money he plans to save each week.

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) $\frac{1-2.5^{n-1}}{1-2.5}$
- 2 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) $(x+6)(x+1)$
- 3 Explain why $81^{\frac{3}{4}}$ equals 27.
- 4 For which values of x , rounded to the nearest hundredth, will $|x^2 - 9| - 3 = \log_3 x$?
- 1) 2.29 and 3.63
2) 2.37 and 3.54
3) 2.84 and 3.17
4) 2.92 and 3.06
- 5 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) $\sqrt{a^3}$
- 6 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) $-\frac{\sqrt{8}}{3}$

- 7 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.



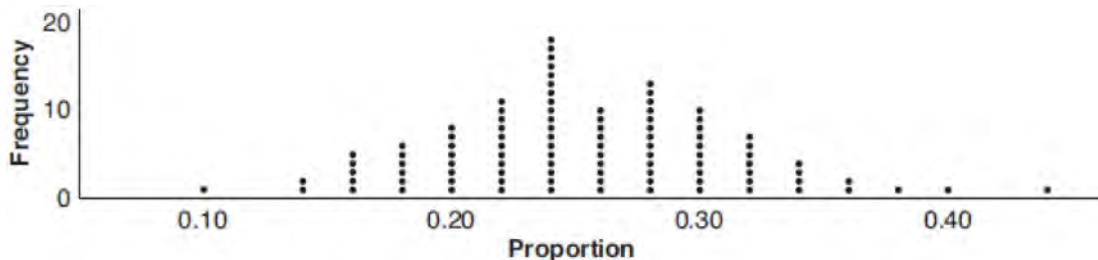
An alternative rating model is represented by $R(x) = \frac{1}{2}x - 6$, where x is the number of visits per week in thousands. Graph $R(x)$ on the same set of axes. For what number of weekly visits will the two models provide the same rating?

- 8 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
- 9 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.

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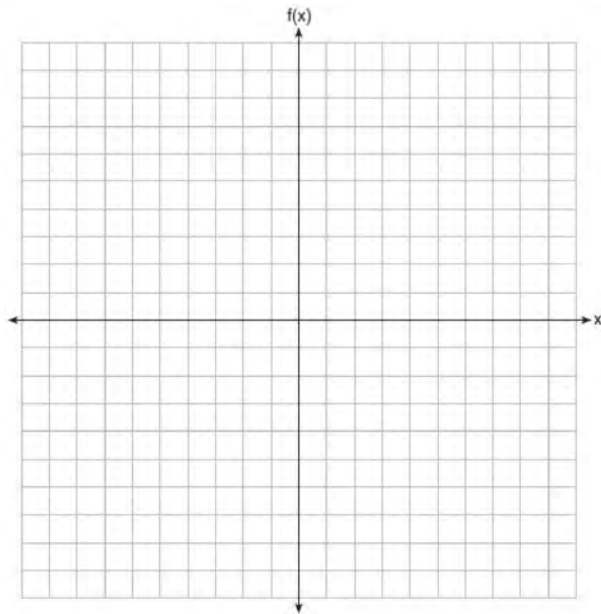
- 10 A group of students was trying to determine the proportion of candies in a bag that are blue. The company claims that 24% of candies in bags are blue. A simulation was run 100 times with a sample size of 50, based on the premise that 24% of the candies are blue. The approximately normal results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

- | | |
|---|--|
| <p>1) (0.194,0.314)</p> <p>2) (0.134,0.374)</p> | <p>3) (-0.448,0.568)</p> <p>4) (0.254,0.374)</p> |
|---|--|
-
- 11 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
- 12 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) $5x^2 + x - 3$
- 13 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.

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



- 15 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) $1 + \frac{1}{x+2}$

- 16 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

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

- 18 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

19 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

20 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

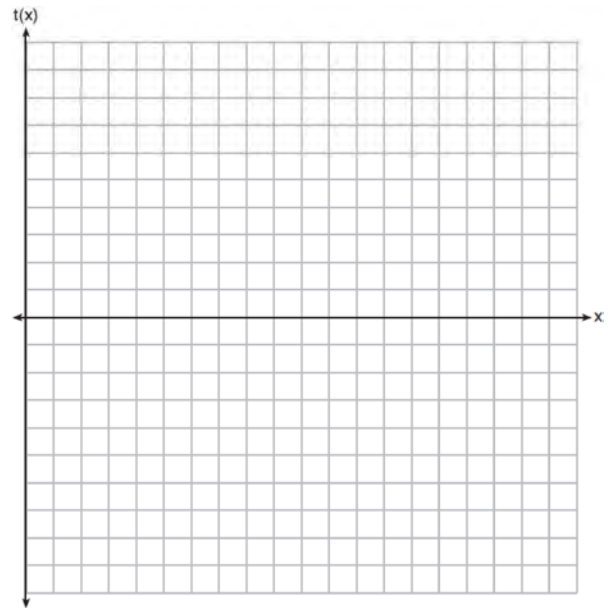
22 If the function $g(x) = ab^x$ represents exponential growth, which statement about $g(x)$ is *false*?

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

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

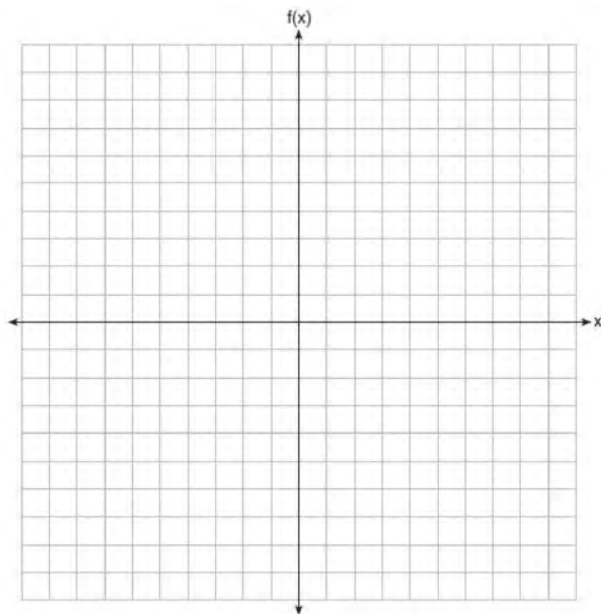
23 Graph $t(x) = 3 \sin(2x) + 2$ over the domain $[0, 2\pi]$ on the set of axes below.



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



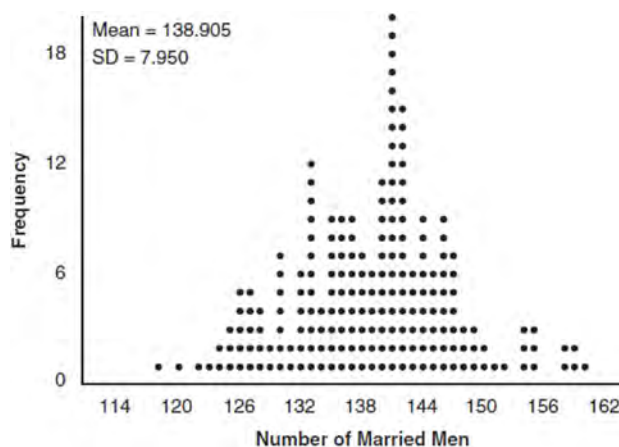
- 25 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$. Is $b(x)$ a factor of $a(x)$? Explain.

- 26 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) $400(1.001121184)^{52t}$

- 27 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.

- 28 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.



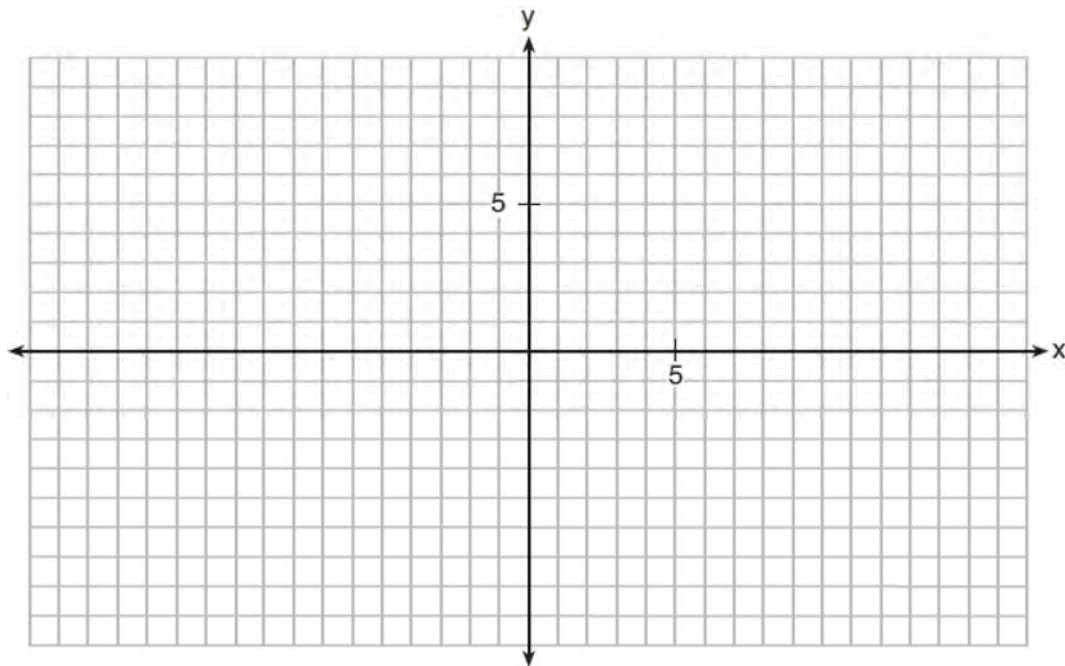
- a) Based on the simulation, create an interval in which the middle 95% of the number of married men may fall. Round your answer to the *nearest integer*.
- b) A study claims "50 percent of men 21 and older in the United States are married." Do your results from part a contradict this claim? Explain.

- 29 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.

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



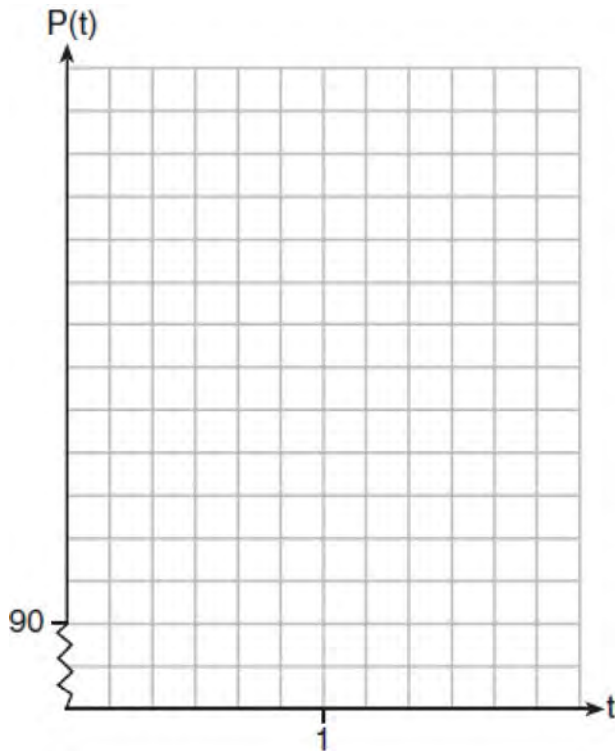
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- 31 The resting blood pressure of an adult patient can be modeled by the function P below, where $P(t)$ is the pressure in millimeters of mercury after time t in seconds.

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

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.

- 32 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

- 33 Which expression is equivalent to

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

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

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

- 35 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}

- 36 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) $y = 166.67(1.0032737)^t$

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

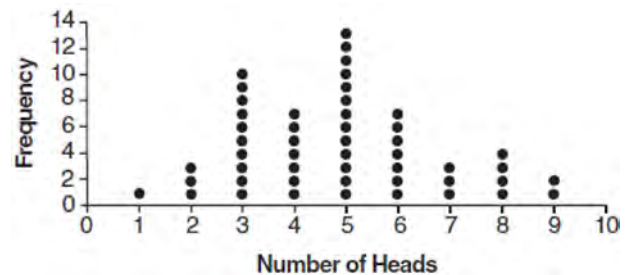
- 38 An angle, θ , is in standard position and its terminal side passes through the point $(2, -1)$. Find the *exact* value of $\sin \theta$.

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

- 40 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

- 41 Solve algebraically for all values of x :
 $\sqrt{6 - 2x} + x = 2(x + 15) - 9$

- 42 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.

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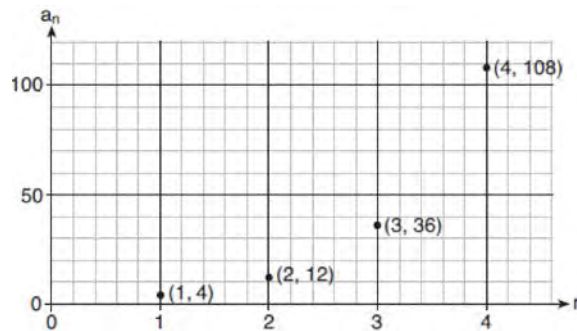
- 43 The Fahrenheit temperature, $F(t)$, of a heated object at time t , in minutes, can be modeled by the function below. F_s is the surrounding temperature, F_0 is the initial temperature of the object, and k is a constant.

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

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
- 44 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
- 45 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

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



- 47 Solve the given equation algebraically for all values of x . $3\sqrt{x} - 2x = -5$
- 48 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
- 49 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) $(n + 3)(n - 3)(n - 6)(n + 2)$

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

51 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) $2x^3 - 4x^2 - x$

52 What is the solution set of the equation

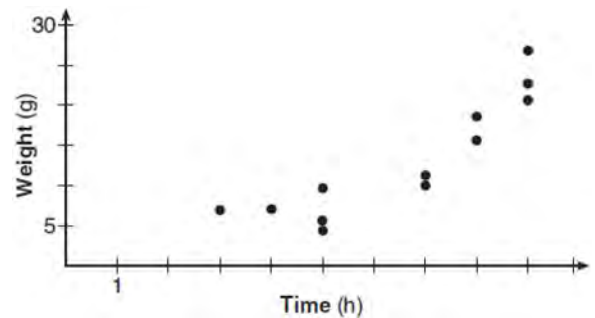
$$\frac{2}{3x+1} = \frac{1}{x} - \frac{6x}{3x+1}?$$

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

53 Completely factor the following expression:

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

54 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) $w = 8(.75)^t$

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

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

56 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.

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57 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) $[1, 30]$

58 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

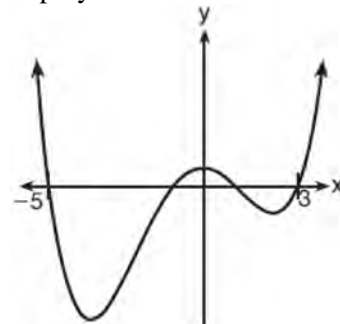
59 The parabola described by the equation $y = \frac{1}{12}(x - 2)^2 + 2$ has the directrix at $y = -1$. The focus of the parabola is

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

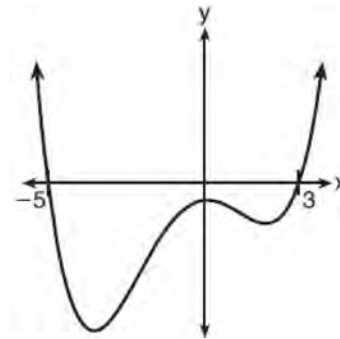
60 The graph of $y = \log_2 x$ is translated to the right 1 unit and down 1 unit. The coordinates of the x -intercept of the translated graph are

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

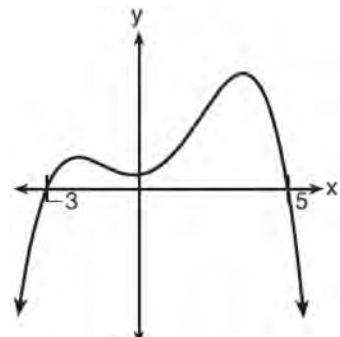
61 A 4th degree polynomial has zeros $-5, 3, i,$ and $-i$. Which graph could represent the function defined by this polynomial?



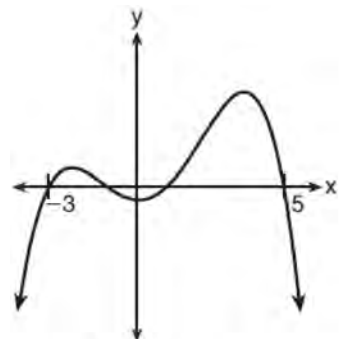
1)



2)



3)



4)

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62 Which function is even?

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

63 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

64 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%

65 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) $\frac{-c+d}{d+2c}$

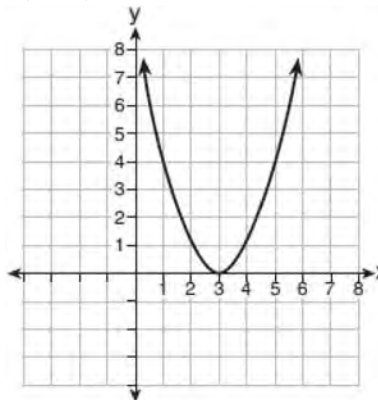
66 If $f(x) = x^2 + 9$ and $g(x) = x + 3$, which operation would not result in a polynomial expression?

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

67 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) $2x^2 + 32 = 0$

68 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.

Algebra II Regents Exam Questions at Random

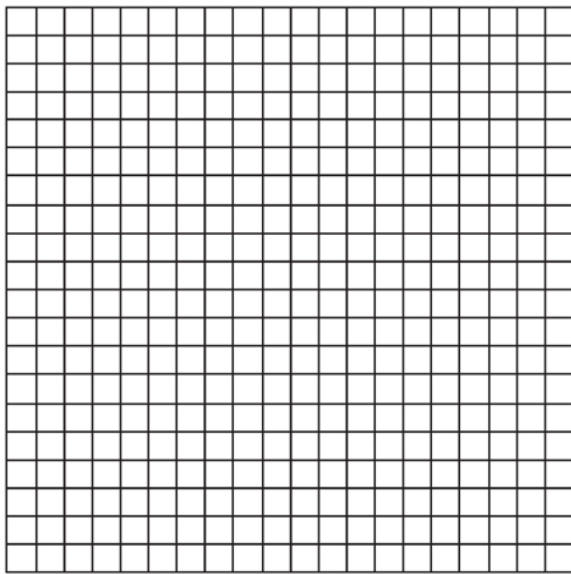
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- 69 The populations of two small towns at the beginning of 2018 and their annual population growth rate are shown in the table below.

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

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

- 1) 7
2) 20
3) 68
4) 125
- 70 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.



- 72 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.

- 73 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) $y = 2.5 - 2.5\left((2.7^2)^{-.05x}\right)$
3) $y = 2.5 - 2.5\left(\frac{1}{2.7^{.10x}}\right)$
4) $y = 2.5 - 2.5(2.7^{-2})(2.7^{.05x})$

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

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

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

How can this sequence best be modeled recursively?

- 1) $m_1 = 2000$
 $m_n = m_{n-1} - 320$
- 2) $m_n = 2000(0.84)^{n-1}$
- 3) $m_1 = 2000$
 $m_n = (0.84)m_{n-1}$
- 4) $m_n = 2000(0.84)^{n+1}$
- 75 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) $\{ \}$
- 76 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) $g(x) = \log_3 x - 5$
- 77 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) $\{(0, 6), (5, 21)\}$
- 78 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) $P(t) = 3500(1.34489)^{\frac{t}{12}}$
- 79 The value(s) of x that satisfy $\sqrt{x^2 - 4x - 5} = 2x - 10$ are
- 1) $\{5\}$
 2) $\{7\}$
 3) $\{5, 7\}$
 4) $\{3, 5, 7\}$
- 80 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t .

Algebra II Regents Exam Questions at Random

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

- 82 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
- 83 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*.

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

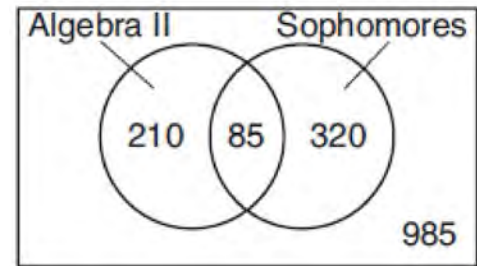
M = monthly payment

P = amount borrowed

r = annual interest rate

n = total number of monthly payments

- 84 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) $\frac{85}{1600}$
- 85 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
- 86 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.

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87 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

88 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%

89 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.

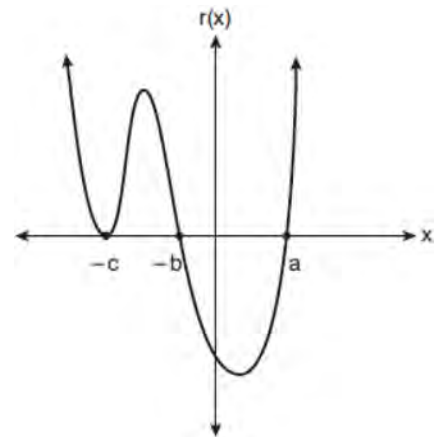
90 What is the inverse of the function $y = 4x + 5$?

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

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

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

93 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) $f(x + 1) + 3$

Algebra II Regents Exam Questions at Random

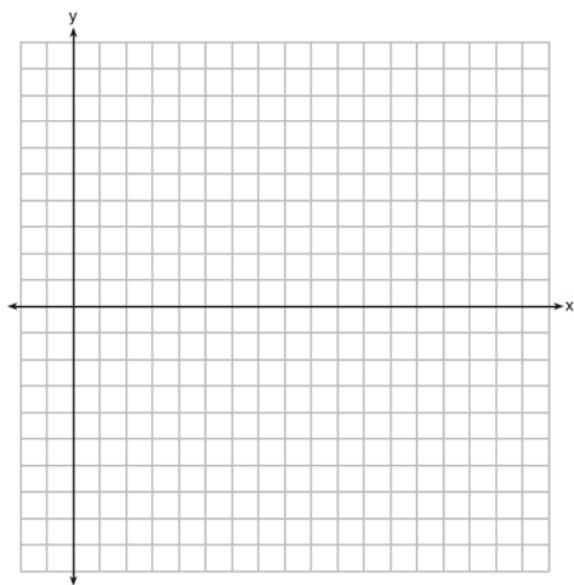
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- 94 A major car company analyzes its revenue, $R(x)$, and costs $C(x)$, in millions of dollars over a fifteen-year period. The company represents its revenue and costs as a function of time, in years, x , using the given functions.

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

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

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.

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

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

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

- 97 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) $y = -6$

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

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

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

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

- 99 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.

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

$$y = x - 28$$

Algebra II Regents Exam Questions at Random

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- 105 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].

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

- 107 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.

- 108 Which table best represents an exponential relationship?

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

1)

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

2)

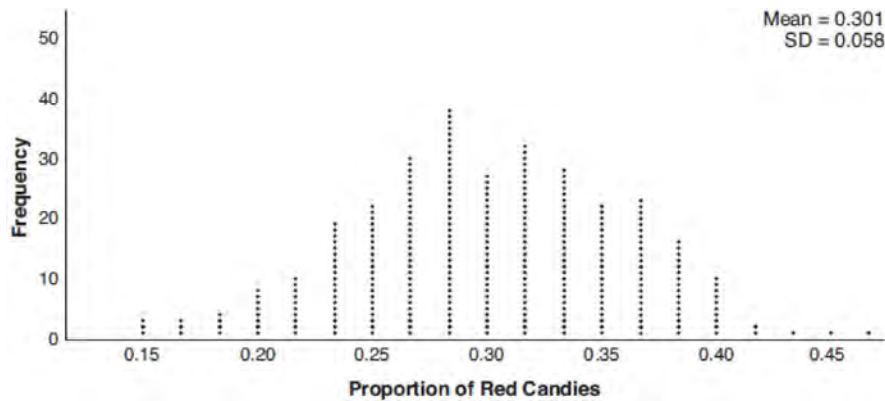
x	y
0	0
1	1
2	4
3	9
4	16

3)

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

4)

- 109 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.

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

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

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

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

- 111 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) $a_0 = 75,000$

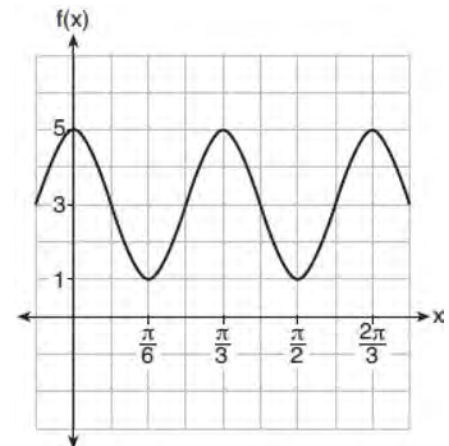
$$a_n = (0.92)^n$$

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

4) $a_0 = 75,000$

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

- 112 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) $a = 2, b = 3, c = 1$

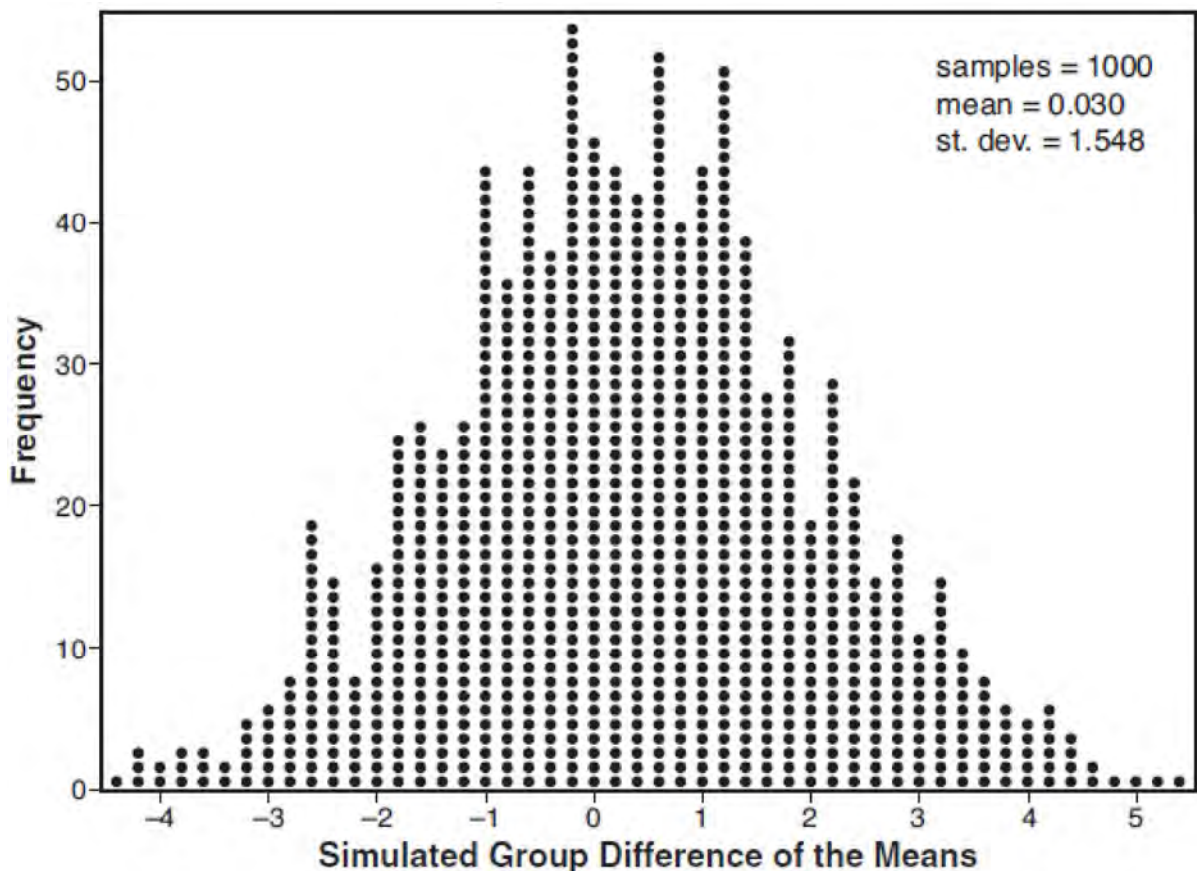
3) $a = 4, b = 6, c = 5$

4) $a = 4, b = \frac{\pi}{3}, c = 3$

113 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.

Algebra II Regents Exam Questions at Random

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

- 115 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) $8x - 4i$

- 116 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*.

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

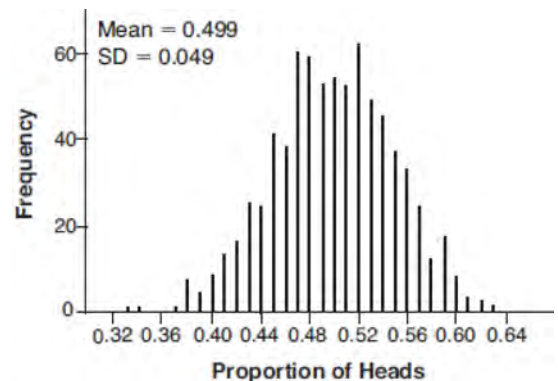
Use this explanation to evaluate $9^{\frac{5}{2}}$.

- 118 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.

- 119 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.

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- 120 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*.
- 121 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
- 122 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) $-19 + 27i$
- 123 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
- 124 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) $(-2, -1)$
- 125 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.
- 126 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.

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

128 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

129 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) $-3x^2 - 6xi - 18$

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

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

131 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) $P(A) = 0.15, P(B) = 0.05$

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

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

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

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

134 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, $x = 0$.

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135 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

136 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

137 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

138 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.

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

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

140 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) $\frac{24}{7}$

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

142 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 $y \neq 0$.

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- 143 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

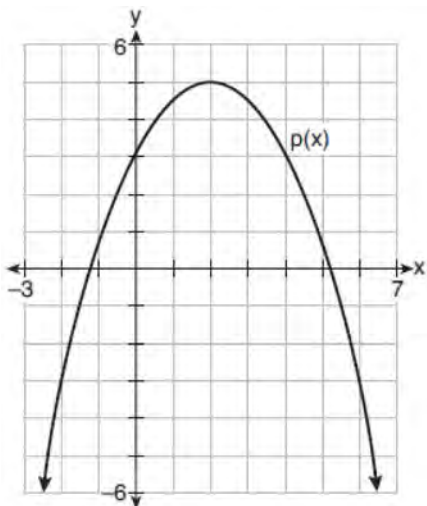
Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer. In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s , to the *nearest mph*. Any B values that round to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

- 144 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.

- 145 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
- 146 Elizabeth tried to find the product of $(2 + 4i)$ and $(3 - i)$, and her work is shown below.

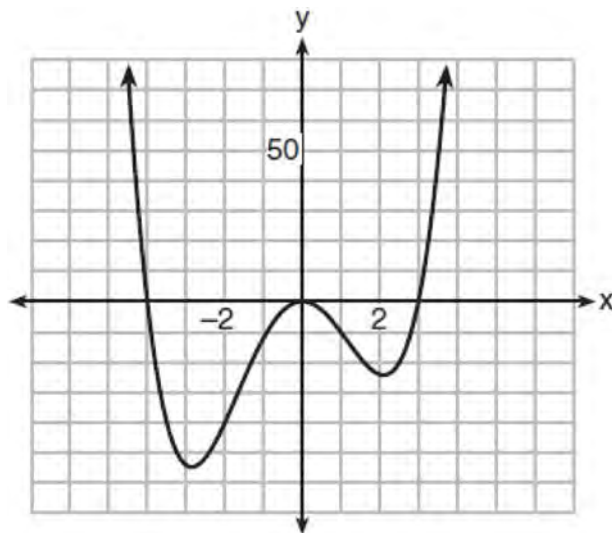
$$\begin{aligned} & (2 + 4i)(3 - i) \\ &= 6 - 2i + 12i - 4i^2 \\ &= 6 + 10i - 4i^2 \\ &= 6 + 10i - 4(1) \\ &= 6 + 10i - 4 \\ &= 2 + 10i \end{aligned}$$

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

- 147 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) $g(x) = -\frac{1}{2}x - 16$

- 148 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 $g(x)$.

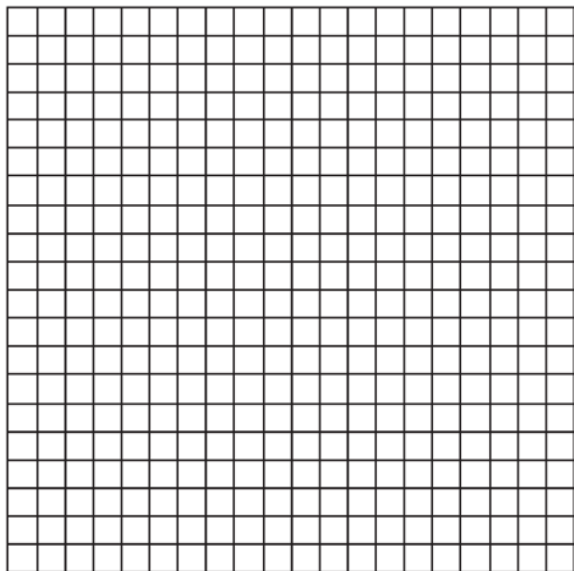
- 149 The expression $(x + a)(x + b)$ can *not* be written as
- 1) $a(x + b) + x(x + b)$
 - 2) $x^2 + abx + ab$
 - 3) $x^2 + (a + b)x + ab$
 - 4) $x(x + a) + b(x + a)$

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

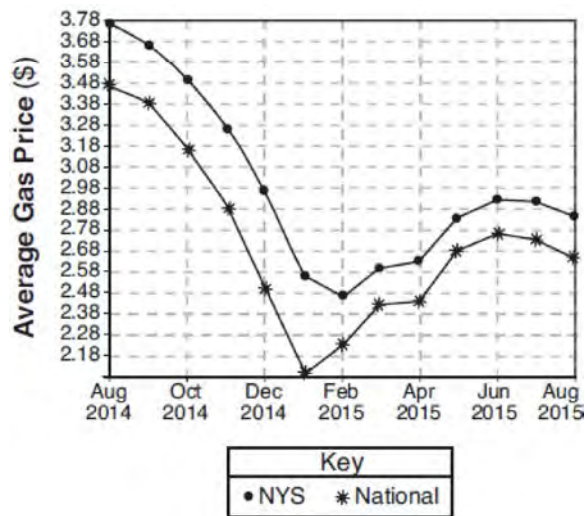
151 Griffin is riding his bike down the street in Churchville, N.Y. at a constant speed, when a nail gets caught in one of his tires. The height of the nail above the ground, in inches, can be represented by the trigonometric function

$f(t) = -13 \cos(0.8\pi t) + 13$, 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.

152 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) $G(x) - C$

153 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

154 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

155 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) $4\sqrt{x^3} + 2\sqrt[5]{x^3}$

156 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

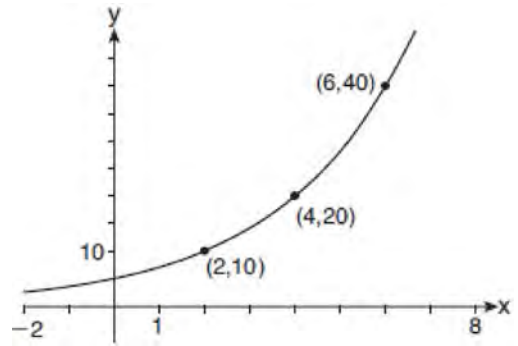
157 Which expression(s) are equivalent to $\frac{x^2 - 4x}{2x}$,

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

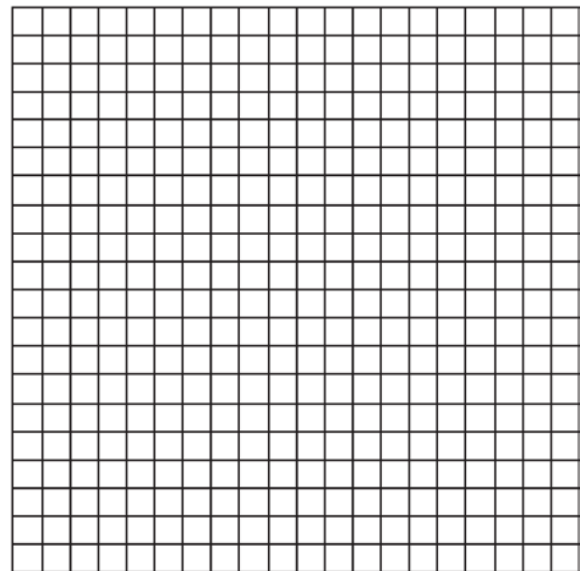
158 The graph of $y = f(x)$ is shown below.



Which expression defines $f(x)$?

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

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



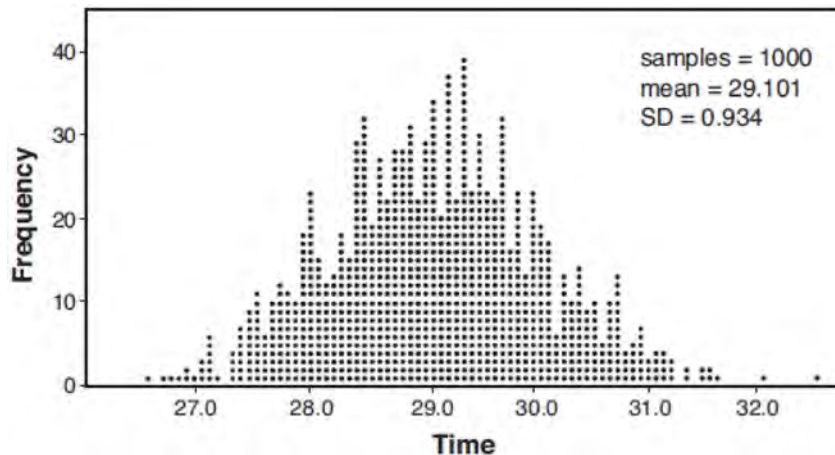
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- 160 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

\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*.

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

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

- 163 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?

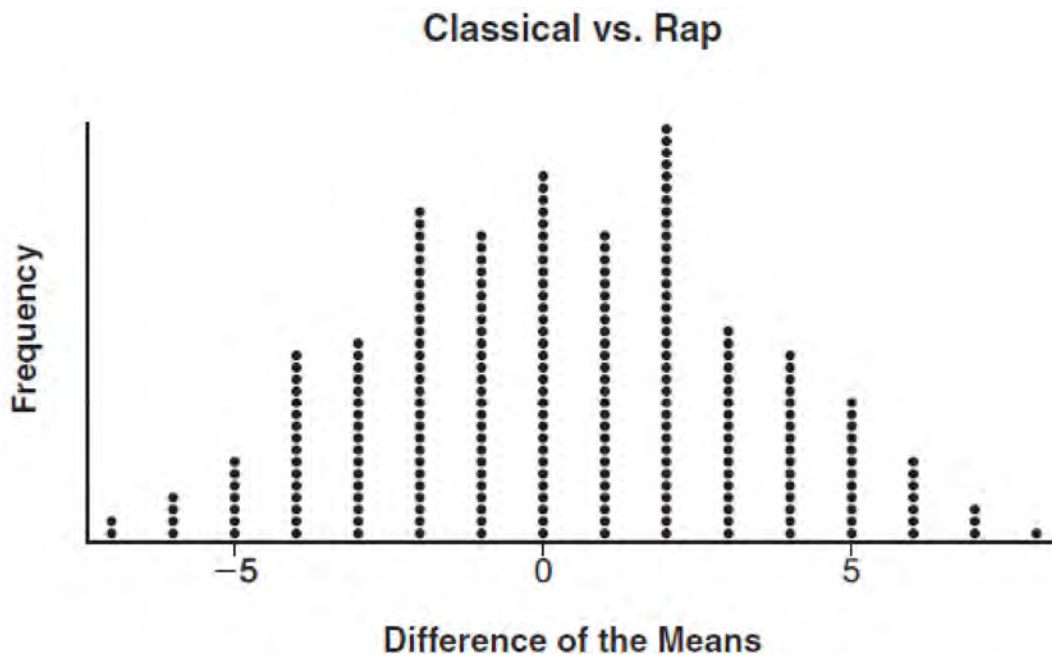
- 1) Every hour, the amount of pain reliever remaining is cut in half.
- 2) In 12 hours, there is no pain reliever remaining in the body.
- 3) In 24 hours, there is no pain reliever remaining in the body.
- 4) In 12 hours, 110 mg of pain reliever is remaining.

- 164 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.

- 165 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*.

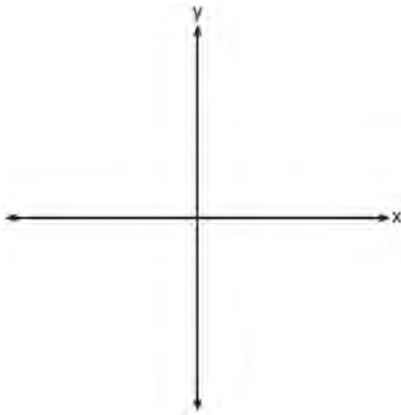
- 166 Determine for which polynomial(s) $(x + 2)$ is a factor. Explain your answer.

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

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

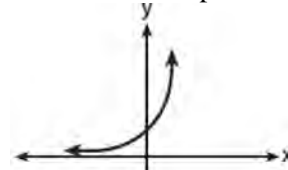
- 167 Which situation could be modeled using a geometric sequence?
- 1) A cell phone company charges \$30.00 per month for 2 gigabytes of data and \$12.50 for each additional gigabyte of data.
 - 2) The temperature in your car is 79° . You lower the temperature of your air conditioning by 2° every 3 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.

- 168 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.

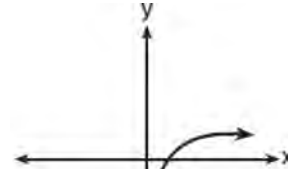


- 169 Evaluate $j(-1)$ given $j(x) = 2x^4 - x^3 - 35x^2 + 16x + 48$. Explain what your answer tells you about $x + 1$ as a factor. Algebraically find the remaining zeros of $j(x)$.

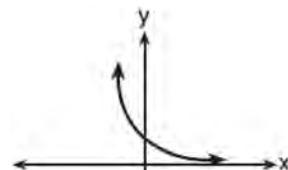
- 170 Which sketch best represents the graph of $x = 3^y$?



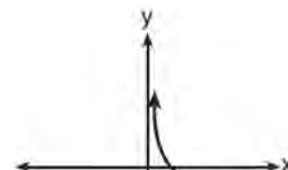
1)



2)



3)



4)

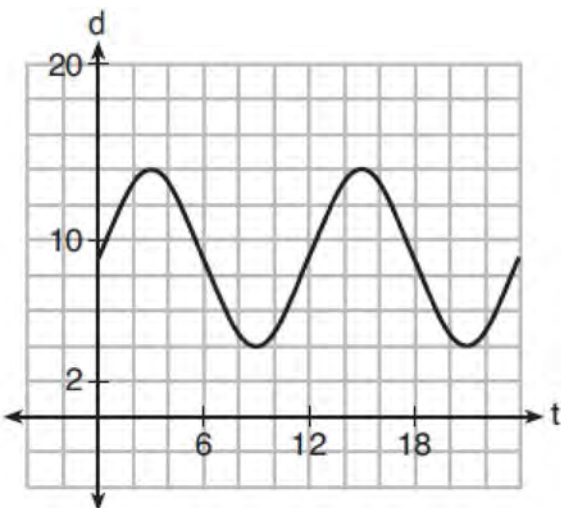
- 171 Write a recursive formula for the sequence 6, 9, 13.5, 20.25, ...

- 172 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.

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

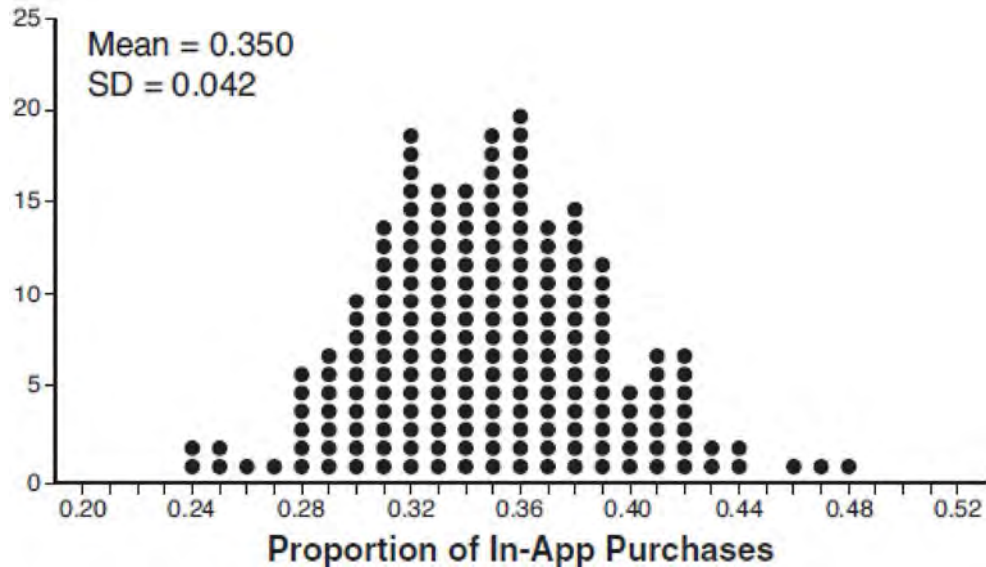
- 174 On average, college seniors graduating in 2012 could compute their growing student loan debt using the function $D(t) = 29,400(1.068)^t$, where t is time in years. Which expression is equivalent to $29,400(1.068)^t$ and could be used by students to identify an approximate daily interest rate on 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) $29,400 \left(1.068^{\frac{1}{365}}\right)^{365t}$

- 175 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) $\pm i$

- 176 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.



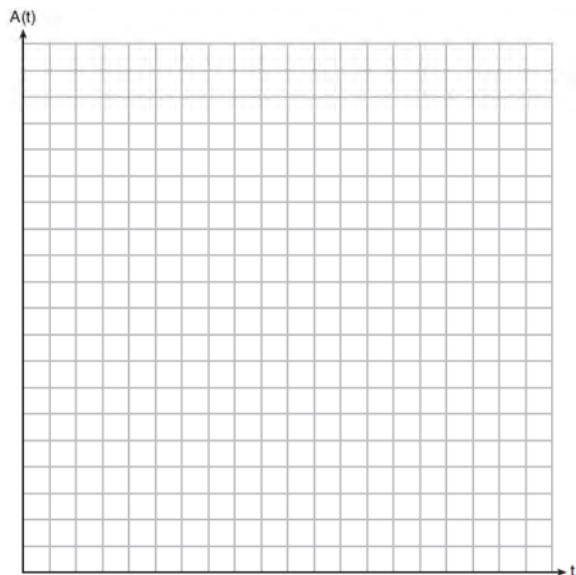
Considering the middle 95% of the data, determine the margin of error, to the *nearest hundredth*, for the simulated results. In the given context, explain what this value represents.

- 177 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
- 178 Write $-\frac{1}{2}i^3(\sqrt{-9}-4)-3i^2$ in simplest $a+bi$ form.
- 179 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
- 180 Solve the equation $2x^2 + 5x + 8 = 0$. Express the answer in $a+bi$ form.

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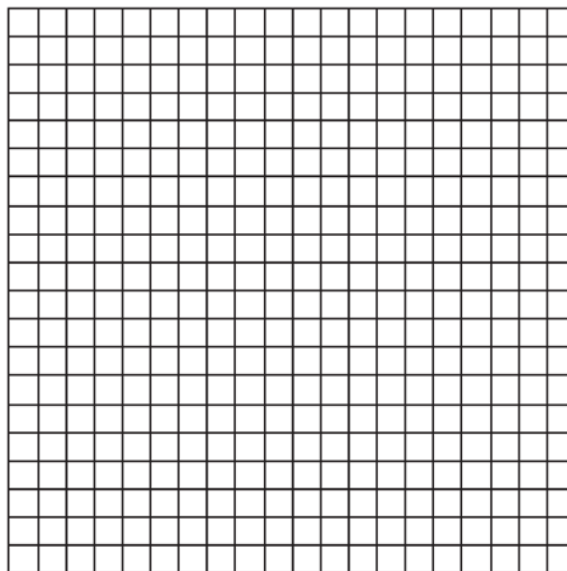
- 181 Tony is evaluating his retirement savings. He currently has \$318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account. Write a function, $A(t)$, 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.

- 182 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.

- 183 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 .



- 184 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) $3^{\frac{3}{2}}x^2y^{\frac{7}{6}}$
- 185 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) $\pm 2i, 2$

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186 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

187 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) $\frac{16x + y}{124}$

188 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

189 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

190 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

191 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.

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

193 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 $0 \leq t \leq 10$.

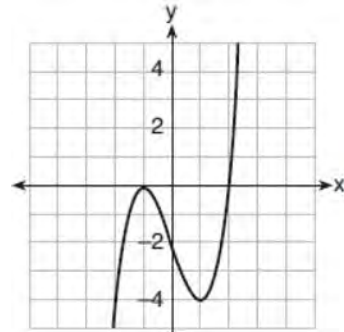
If $G(t)$ is the average price of gas in dollars and t represents the number of months since January 1st, the absolute maximum $G(t)$ reaches over the given domain is about

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

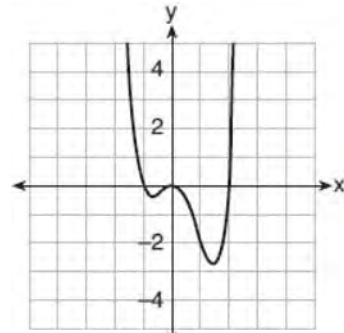
194 The expression $\frac{9x^2 - 2}{3x + 1}$ is equivalent to

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

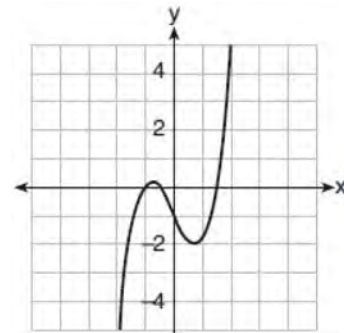
195 Which graph represents a polynomial function that contains $x^2 + 2x + 1$ as a factor?



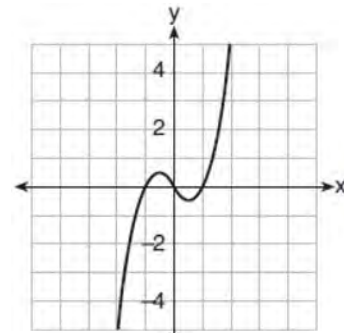
1)



2)



3)



4)

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

	Juan Wins	Felipe Wins
Short Practice Time	8	10
Long Practice Time	15	12

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

- 197 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.

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

- 198 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

- 200 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 $P(1) = 0$.

- 201 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

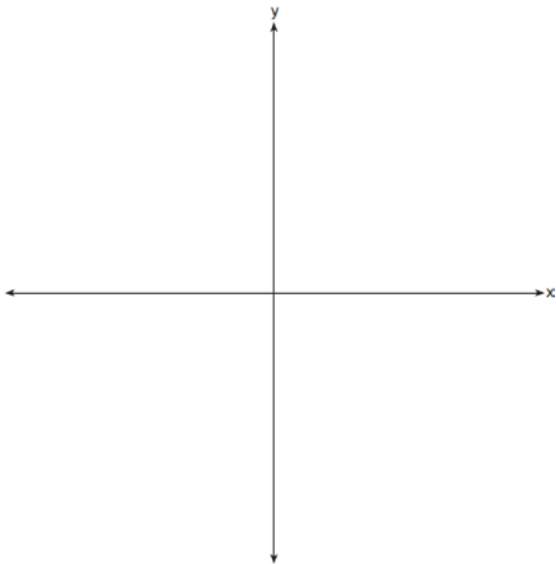
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202 If \$5000 is put into a savings account that pays 3.5% interest compounded monthly, how much money, to the *nearest ten cents*, would be in that account after 6 years, assuming no money was added or withdrawn?

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

203 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 $r(x) = a(x)$.



204 Determine the quotient and remainder when $(6a^3 + 11a^2 - 4a - 9)$ is divided by $(3a - 2)$.

Express your answer in the form $q(a) + \frac{r(a)}{d(a)}$.

205 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*.

206 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

207 How many solutions exist for

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

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

208 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

Algebra II Regents Exam Questions at Random

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

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

211 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%

212 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.

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

214 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) $f^{-1}(x) = \pm\sqrt[3]{x+2}$

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

216 Given the following polynomials

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

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

$$z = ab + bc + ac$$

Which identity is true?

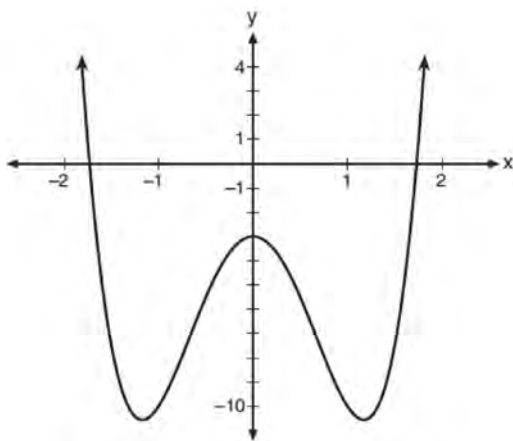
1) $x = y - z$

2) $x = y + z$

3) $x = y - 2z$

4) $x = y + 2z$

- 217 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.
- 218 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.

- 219 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.

- 220 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) $a_n = 2.5 + 0.5n$

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

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

Algebra II Regents at Random

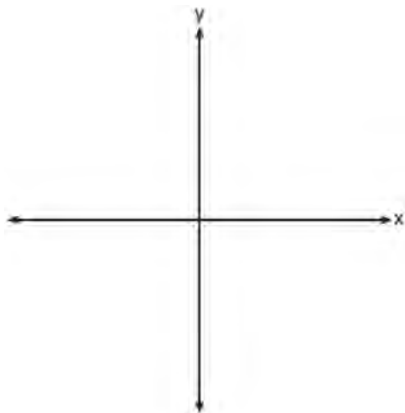
222 The function $f(x) = 2^{-0.25x} \bullet \sin\left(\frac{\pi}{2}x\right)$ represents a damped sound wave function. What is the average rate of change for this function on the interval $[-7, 7]$, to the nearest hundredth?

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

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

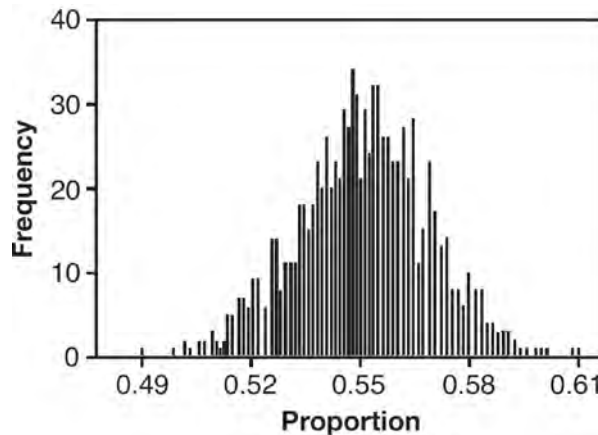
- 1) $-\frac{2}{3} \pm 6i\sqrt{158}$
- 2) $-\frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$
- 3) $\frac{2}{3} \pm 6i\sqrt{158}$
- 4) $\frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$

224 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.



225 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.

226 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

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

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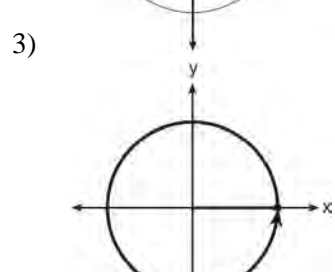
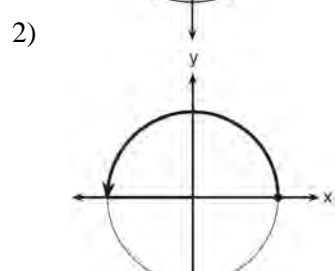
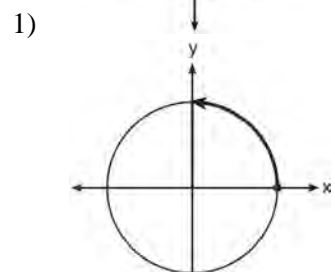
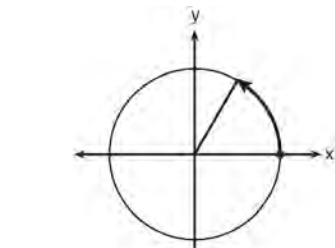
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228 What is the completely factored form of

$$k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48?$$

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

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



230 Solve the system of equations shown below algebraically.

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

$$2x + 2y = 10$$

231 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*.

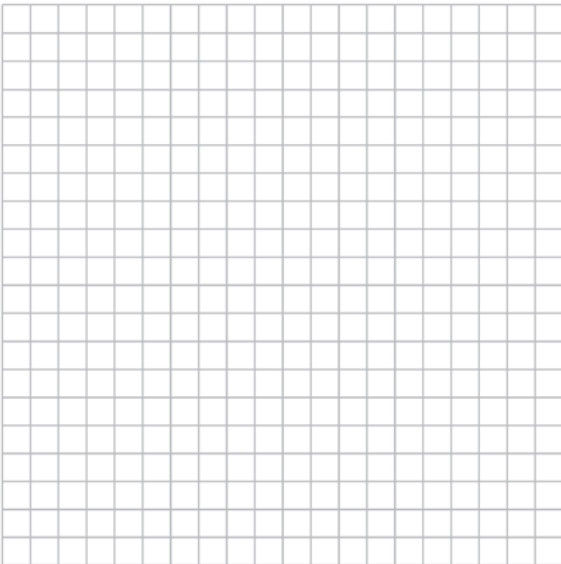
232 Which value, to the *nearest tenth*, is *not* a solution of $p(x) = q(x)$ if $p(x) = x^3 + 3x^2 - 3x - 1$ and $q(x) = 3x + 8$?

- 1) -3.9
- 2) -1.1
- 3) 2.1
- 4) 4.7

233 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.

- 234 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.

- 235 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) $-0.15x^3 + 32x + 120$

236 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*.

- 237 Explain how $(-8)^{\frac{4}{3}}$ can be evaluated using properties of rational exponents to result in an integer answer.
- 238 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 $g(x)$.

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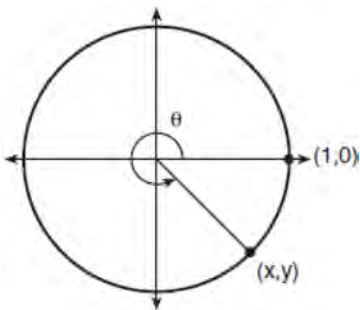
239 According to a pricing website, Indroid phones lose 58% of their cash value over 1.5 years. Which expression can be used to estimate the value of a \$300 Indroid phone in 1.5 years?

- 1) $300e^{-0.87}$
- 2) $300e^{-0.63}$
- 3) $300e^{-0.58}$
- 4) $300e^{-0.42}$

240 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

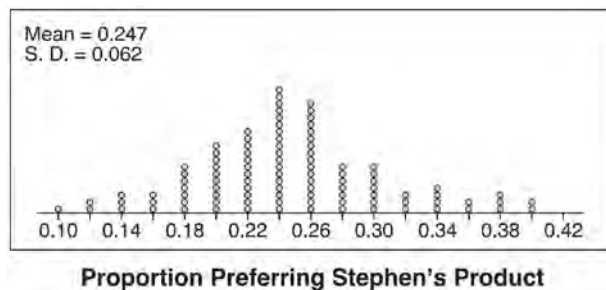
241 Using the unit circle below, explain why $\csc \theta = \frac{1}{y}$.



242 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) $\{0, 3, -4\}$

243 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.

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

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

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- 245 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.

- 246 Which statement regarding the graphs of the functions below is *untrue*?

$$f(x) = 3 \sin 2x, \text{ from } -\pi < x < \pi$$

$$g(x) = (x - 0.5)(x + 4)(x - 2)$$

$$h(x) = \log_2 x$$

$$j(x) = -|4x - 2| + 3$$

- 1) $f(x)$ and $j(x)$ have a maximum y -value of 3.
 - 2) $f(x)$, $h(x)$, and $j(x)$ have one y -intercept.
 - 3) $g(x)$ and $j(x)$ have the same end behavior as $x \rightarrow -\infty$.
 - 4) $g(x)$, $h(x)$, and $j(x)$ have rational zeros.
- 247 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.

- 248 The expression $\left(\frac{m^2}{m^{\frac{1}{3}}}\right)^{-\frac{1}{2}}$ is equivalent to

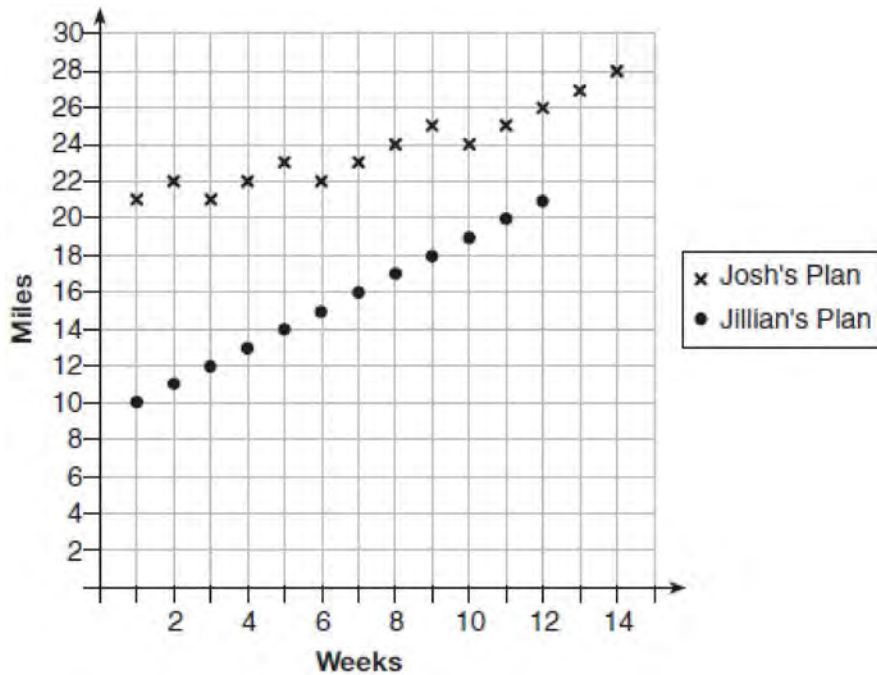
- 1) $-\sqrt[6]{m^5}$
- 2) $\frac{1}{\sqrt[6]{m^5}}$
- 3) $-\sqrt[5]{m}$
- 4) $\frac{1}{\sqrt[5]{m}}$

- 249 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.

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- 250 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.

- 251 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

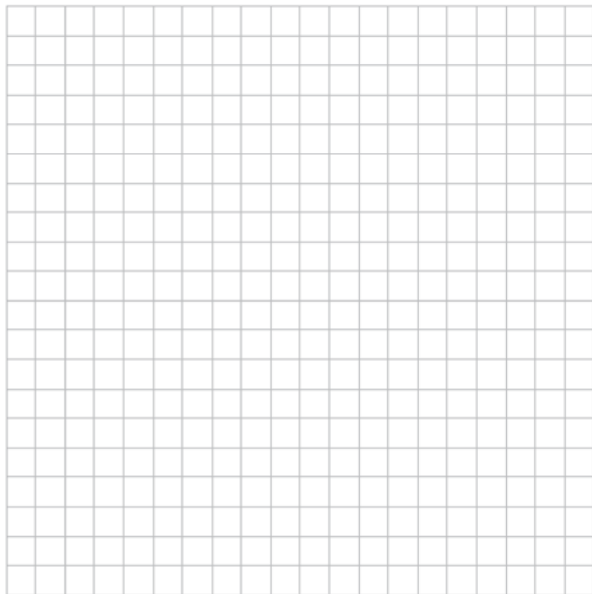
- 252 The expression $\frac{6x^3 + 17x^2 + 10x + 2}{2x + 3}$ equals

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

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

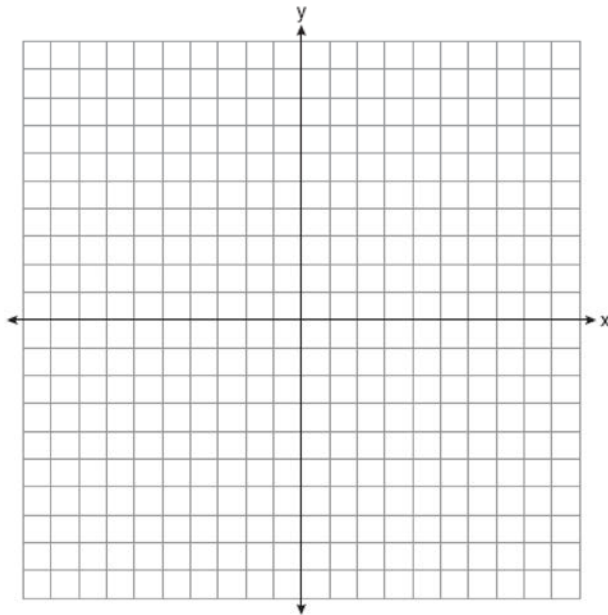
- 1) $\frac{9ix^6\sqrt[3]{4}}{y\sqrt[3]{y^2}}$
- 2) $\frac{9ix^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$
- 3) $\frac{9x^6\sqrt[3]{4}}{y\sqrt[3]{y}}$
- 4) $\frac{9x^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$

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



255 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.

256 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 $(0, 2)$.



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

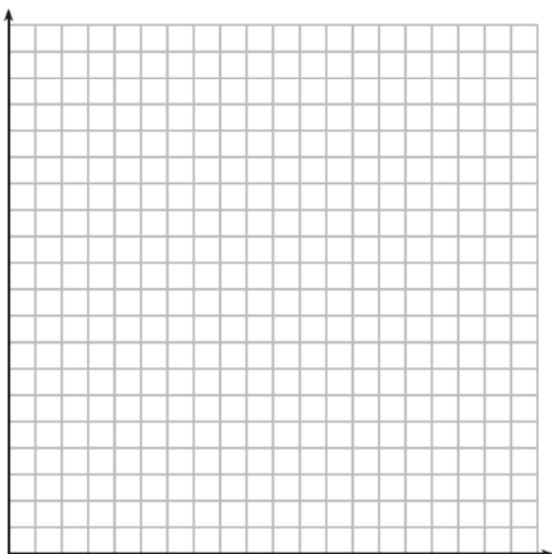
258 The function $p(t) = 110e^{0.03922t}$ models the population of a city, in millions, t years after 2010. As of today, consider the following two statements:
 I. The current population is 110 million.
 II. The population increases continuously by approximately 3.9% per year.

This model supports

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

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

260 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.

261 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.

262 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) $2x^2 + 1 + \frac{4}{x + 2}$

263 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) $(300, 400)$

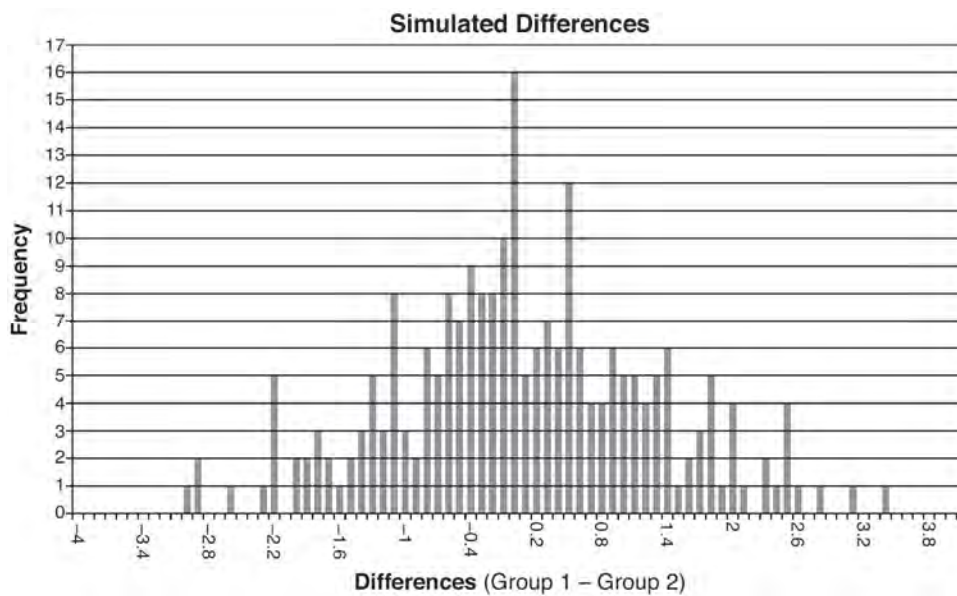
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264 Ayva designed an experiment to determine the effect of a new energy drink on a group of 20 volunteer students. Ten students were randomly selected to form group 1 while the remaining 10 made up group 2. Each student in group 1 drank one energy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

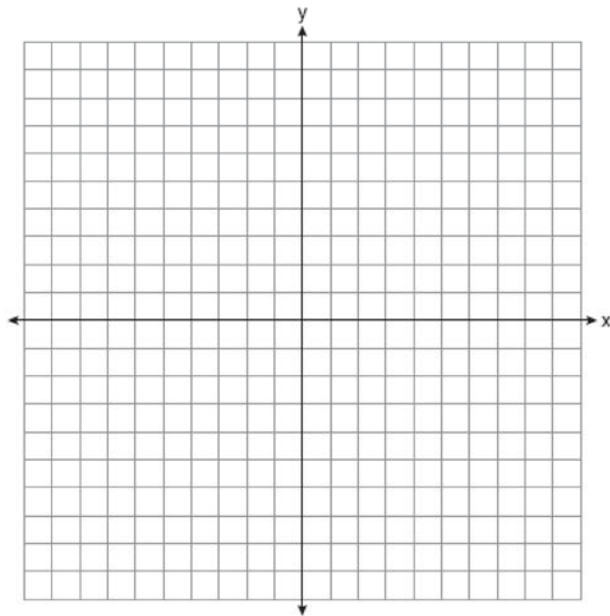
Ayva thinks drinking energy drinks makes students read faster. Using information from the experimental design or the results, explain why Ayva's hypothesis may be *incorrect*. Using the given results, Ayva randomly mixes the 20 reading times, splits them into two groups of 10, and simulates the difference 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.

265 Find algebraically the zeros for

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



266 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) $A = 100(0.116381)^t$

267 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

268 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

269 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.

270 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

271 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.

272 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.

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

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

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

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

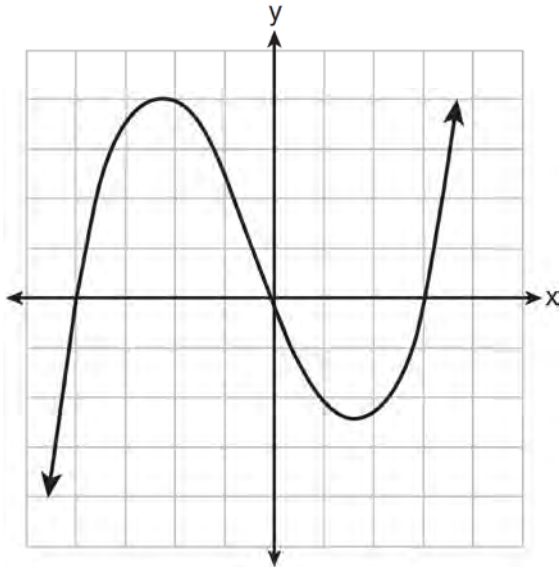
277 Over the set of integers, factor the expression $4x^3 - x^2 + 16x - 4$ completely.

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- 278 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.
- 279 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) $a_0 = 1000$
 $a_n = a_{n-1}(1.018) + 750n$
- 280 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) $9k^2 - 12ki + 4$
- 281 Algebraically determine the values of x that satisfy the system of equations below.
- $$y = -2x + 1$$
- $$y = -2x^2 + 3x + 1$$
- 282 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 $y = -4$.
- 283 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

284 The graph of $p(x)$ is shown below.

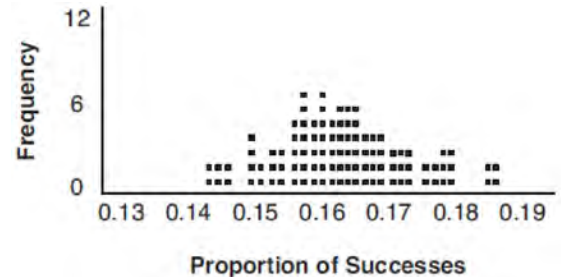


What is the remainder when $p(x)$ is divided by $x + 4$?

- 1) $x - 4$
- 2) -4
- 3) 0
- 4) 4

285 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.

286 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 $\approx .16$

287 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

288 What is the solution, if any, of the equation

$$\frac{2}{x+3} - \frac{3}{4-x} = \frac{2x-2}{x^2-x-12}?$$

- 1) -1
- 2) -5
- 3) all real numbers
- 4) no real solution

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- 289 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.
- 290 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) $x - 7$
- 291 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.
- 292 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
- 293 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) $\frac{m(c)}{g(c)} = \frac{-1}{1 - c}$
- 294 Solve algebraically for all values of x :
- $$\sqrt{x - 5} + x = 7$$
- 295 In 2010, the population of New York State was approximately 19,378,000 with an annual growth rate of 1.5%. Assuming the growth rate is maintained for a large number of years, which equation can be used to predict the population of New York State t years after 2010?
- 1) $P_t = 19,378,000(1.5)^t$
 - 2) $P_0 = 19,378,000$
 $P_t = 19,378,000 + 1.015P_{t-1}$
 - 3) $P_t = 19,378,000(1.015)^{t-1}$
 - 4) $P_0 = 19,378,000$
 $P_t = 1.015P_{t-1}$
- 296 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) $(x^2 - 4)^2 - 5(x^2 - 4) - 6 = (x^2 - 7)(x^2 - 6)$

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

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

298 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.

299 What are the zeros of $P(m) = (m^2 - 4)(m^2 + 1)$?

- 1) 2 and -2 , only
- 2) 2, -2 , and -4
- 3) -4 , i , and $-i$
- 4) 2, -2 , i , and $-i$

300 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.

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

302 Solve the equation $\sqrt{2x - 7} + x = 5$ algebraically, and justify the solution set.

303 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 $-1 - 4i$

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

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305 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

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

306 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.

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

308 The solution set for the equation $\sqrt{56-x} = x$ is

- 1) $\{-8, 7\}$
- 2) $\{-7, 8\}$
- 3) $\{7\}$
- 4) $\{ \}$

309 Solve algebraically for all values of x :

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

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- 310 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 $n > 1$?

- 311 A solution of the equation $2x^2 + 3x + 2 = 0$ is

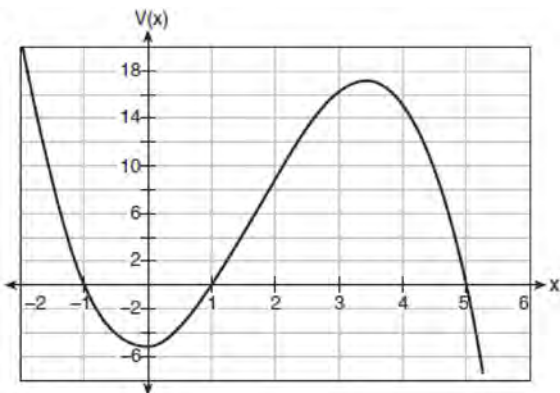
1) $-\frac{3}{4} + \frac{1}{4}i\sqrt{7}$

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

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

4) $\frac{1}{2}$

- 312 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) $[0, 3.5]$

- 313 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) $V = 120 \sin(120\pi t)$

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

- 315 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

$$H(t) = 70 \sin\left(\frac{2\pi}{7}(t - 1.75)\right) + 80, \text{ where } t \text{ is time,}$$

in minutes. Using $H(t)$ for one full rotation, this car's minimum height, in feet, is

- 1) 150
 2) 70
 3) 10
 4) 0

- 316 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.

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317 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.

318 The formula below can be used to model which scenario?

$$a_1 = 3000$$

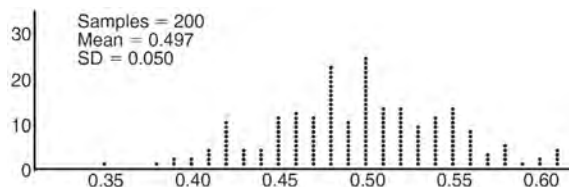
$$a_n = 0.80a_{n-1}$$

- 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.

319 Rewrite the expression

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

320 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.

321 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) $300(1.30)^{\frac{365}{14}}$

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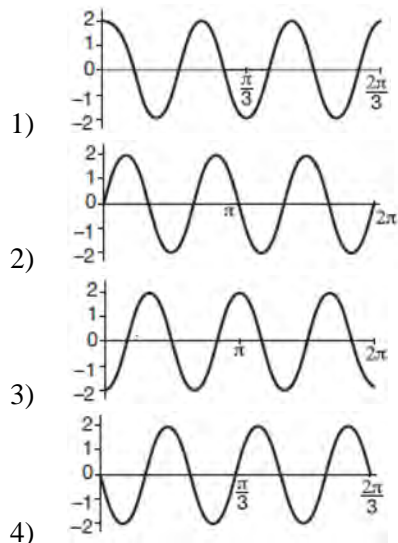
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- 322 The distance needed to stop a car after applying the brakes varies directly with the square of the car's speed. The table below shows stopping distances for various speeds.

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.

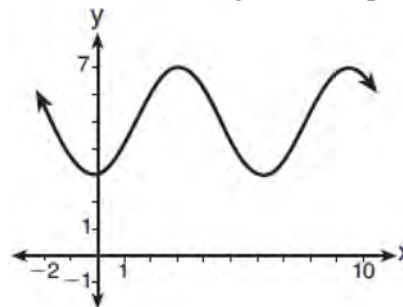
- 323 Which graph represents a cosine function with no horizontal shift, an amplitude of 2, and a period of $\frac{2\pi}{3}$?



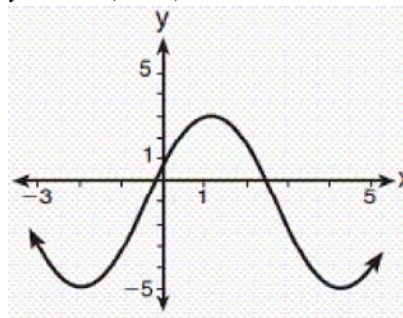
- 324 Which equation represents a parabola with the focus at $(0, -1)$ and the directrix of $y = 1$?

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

- 325 Which sinusoid has the greatest amplitude?



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



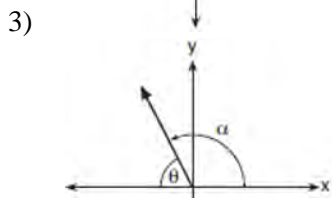
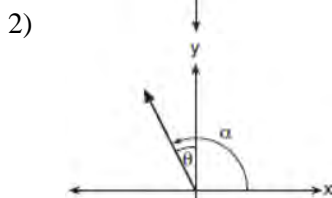
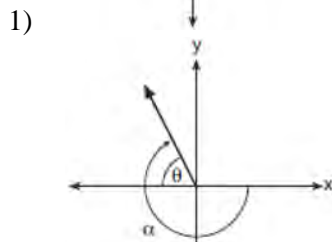
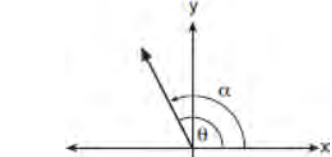
- 3)
- 4) $y = -5 \sin(\theta - 1) - 3$

- 326 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.

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



- 328 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) $m(m^2 + 3)(m^2 - 2)$

- 329 If $p(x) = ab^x$ and $r(x) = cd^x$, then $p(x) \cdot r(x)$ equals

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

- 330 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) $\left\{-\frac{7}{2}, -3\right\}$

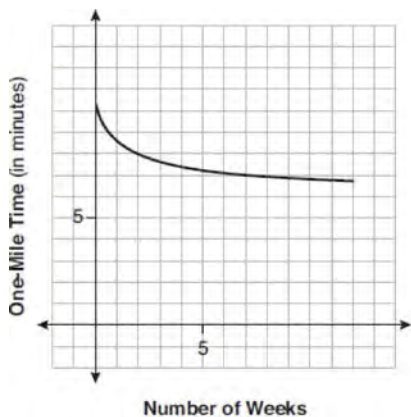
- 331 The population of Jamesburg for the years 2010-2013, respectively, was reported as follows: 250,000 250,937 251,878 252,822

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

- 332 Simplify $xi(i - 7i)^2$, where i is the imaginary unit.

- 333 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?

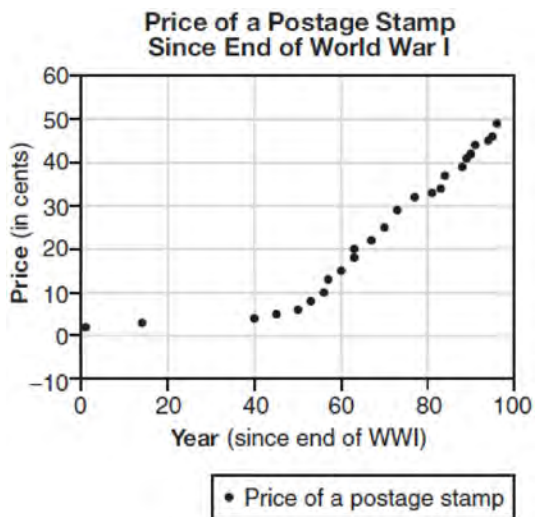
- 1) Her one-mile speed increased as the number of weeks increased.
 - 2) Her one-mile speed decreased as the number of weeks increased.
 - 3) If the trend continues, she will run under a six-minute mile by week thirteen.
 - 4) She reduced her one-mile time the most between weeks ten and twelve.
- 334 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

- 335 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)

- 336 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) $y = 24 \sin(14x) + 25$
- 337 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?

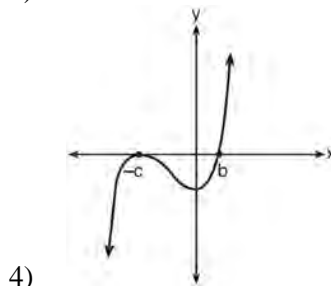
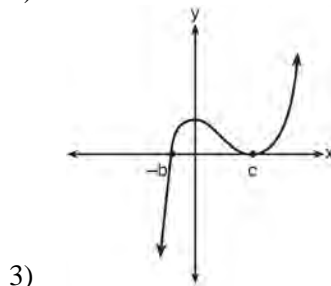
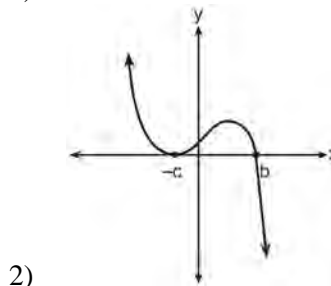
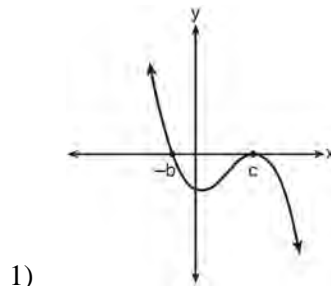
I $(m + p)^2 = m^2 + 2mp + p^2$

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

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



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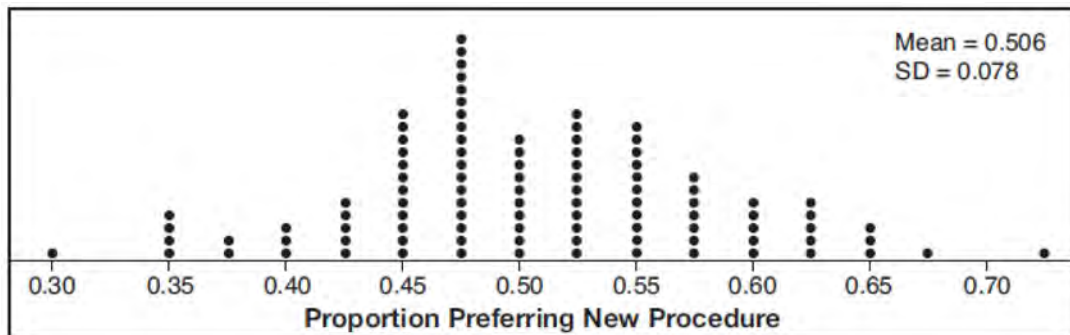
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- 339 Joelle has a credit card that has a 19.2% annual interest rate compounded monthly. She owes a total balance of B dollars after m months. Assuming she makes no payments on her account, the table below illustrates the balance she owes after m months.

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 3) month 36 to month 72
 2) month 19 to month 69 4) month 60 to month 73
- 340 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.

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- 341 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) $\frac{1}{F} - \frac{1}{W}$
- 342 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.

Age Group	Text Messages per Month		
	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) $\frac{157}{229}$
- 2) $\frac{157}{312}$
- 3) $\frac{157}{384}$
- 4) $\frac{157}{456}$

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

- 344 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.

- 345 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.

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

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347 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?

348 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.

349 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

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

350 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.

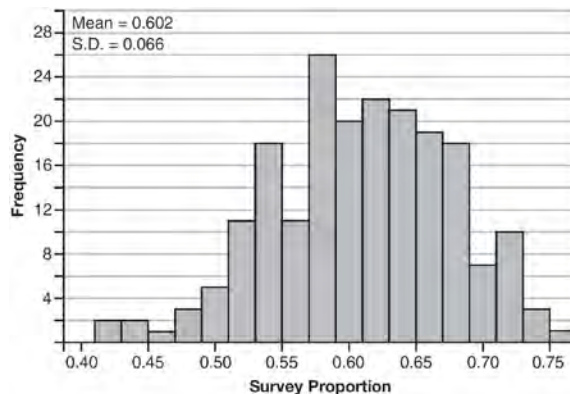
351 Which function represents exponential decay?

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

352 Describe how a controlled experiment can be created to examine the effect of ingredient X in a toothpaste.

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

354 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.

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355 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.

356 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.

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

358 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

359 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

360 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) $4(x - 3)^2 + 4(y + 9)^2 = 436$

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361 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) $2x^2 - x + 4 + \frac{1}{2x - 1}$

362 The sequence $a_1 = 6$, $a_n = 3a_{n-1}$ can also be written as

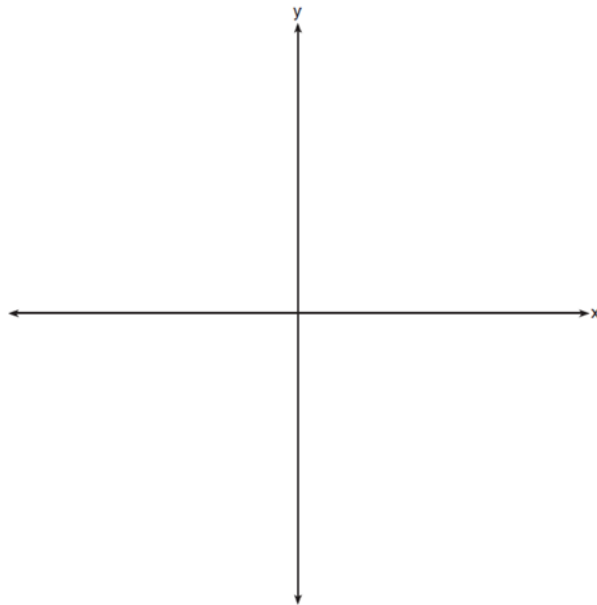
- 1) $a_n = 6 \cdot 3^n$
- 2) $a_n = 6 \cdot 3^{n+1}$
- 3) $a_n = 2 \cdot 3^n$
- 4) $a_n = 2 \cdot 3^{n+1}$

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

364 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.

365 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 .

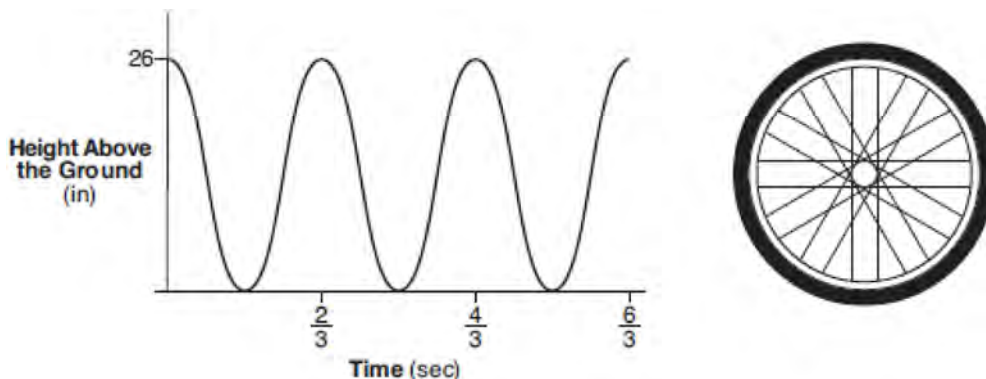


b) Explain any differences between a sketch of $y = 2\sin\left(x - \frac{\pi}{3}\right) - \frac{3}{2}$ and the sketch from part a.

366 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*.

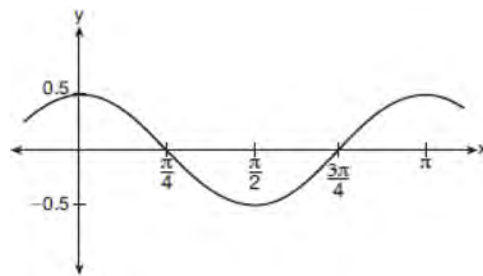
- 367 The graph below represents the height above the ground, h , in inches, of a point on a triathlete's bike wheel during a training ride in terms of time, t , in seconds.



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

- 368 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

- 370 Which equation is represented by the graph shown below?

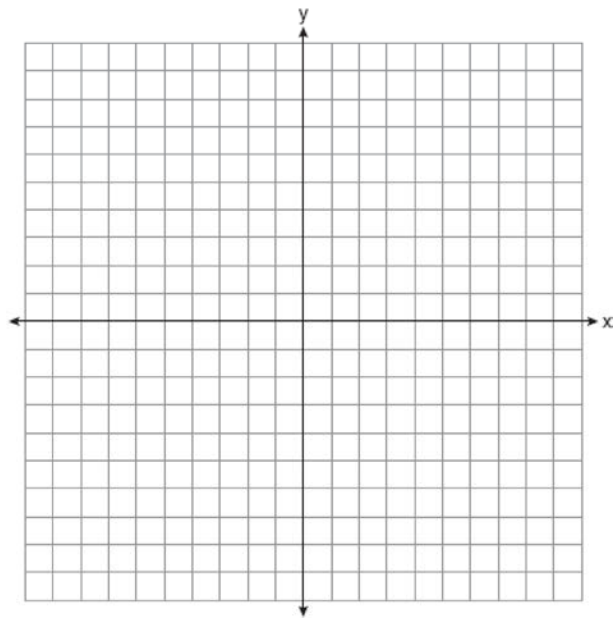


- 369 A study of the annual population of the red-winged blackbird in Ft. Mill, South Carolina, shows the population, $B(t)$, can be represented by the function $B(t) = 750(1.16)^t$, where the t represents the number of years since the study began. In terms of the monthly rate of growth, the population 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) $B(t) = 750(1.16)^{\frac{t}{12}}$

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

- 371 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.

- 372 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.

- 373 Write $\sqrt[3]{x} \cdot \sqrt{x}$ as a single term with a rational exponent.

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

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

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

- 376 The solution set for the equation

$$\sqrt{x+14} - \sqrt{2x+5} = 1$$

- 1) $\{-6\}$
- 2) $\{2\}$
- 3) $\{18\}$
- 4) $\{2, 22\}$

- 377 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.

- 378 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) $x = 3^y$

- 379 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

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

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

382 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?

383 Consider the system shown below.

$$2x - y = 4$$

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

The two solutions of the system can be described as

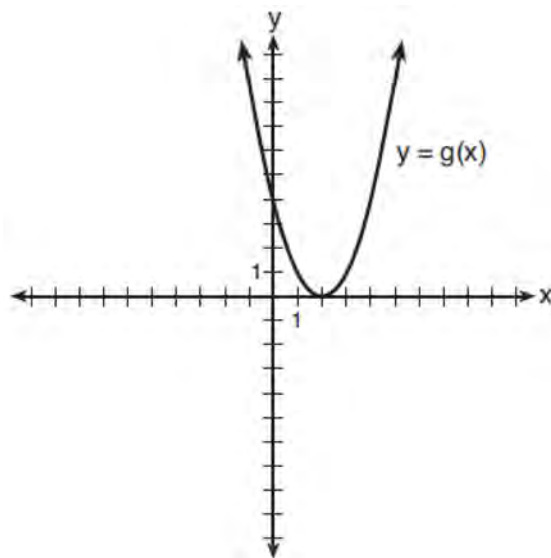
- 1) both imaginary
- 2) both irrational
- 3) both rational
- 4) one rational and one irrational

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

385 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) $\{(1, 1), (6, 16)\}$

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

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

387 If $\sin^2(32^\circ) + \cos^2(M) = 1$, then M equals

- 1) 32°
- 2) 58°
- 3) 68°
- 4) 72°

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- 388 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.

- 389 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.

- 390 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) $(1.4, 3.4)$

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

- 392 Which equation represents an odd function?
- 1) $y = \sin x$
 - 2) $y = \cos x$
 - 3) $y = (x + 1)^3$
 - 4) $y = e^{5x}$

- 393 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

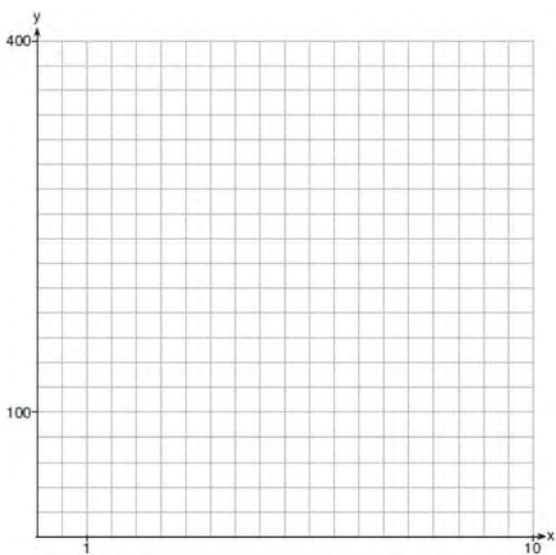
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394 Relative to the graph of $y = 3 \sin x$, what is the shift of the graph of $y = 3 \sin\left(x + \frac{\pi}{3}\right)$?

- 1) $\frac{\pi}{3}$ right
- 2) $\frac{\pi}{3}$ left
- 3) $\frac{\pi}{3}$ up
- 4) $\frac{\pi}{3}$ down

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



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

397 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

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

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

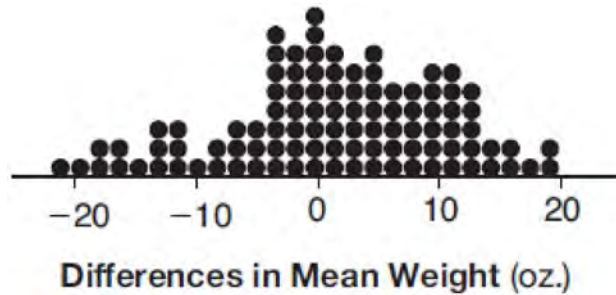
399 The completely factored form of

$$2d^4 + 6d^3 - 18d^2 - 54d$$

- 1) $2d(d^2 - 9)(d + 3)$
- 2) $2d(d^2 + 9)(d + 3)$
- 3) $2d(d + 3)^2(d - 3)$
- 4) $2d(d - 3)^2(d + 3)$

400 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.

401 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> |
|---|---|

402 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 1.0×10^{-12} W/m² (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 6.3×10^{-3} W/m² be classified?

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

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- 403 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.

- 404 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) $(1.00427)^{\frac{m}{12}}$

- 405 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

- 406 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) $\frac{8 - 8(0.10)^n}{1.10}$

- 407 Which value is *not* contained in the solution of the system shown below?

$$a + 5b - c = -20$$

$$4a - 5b + 4c = 19$$

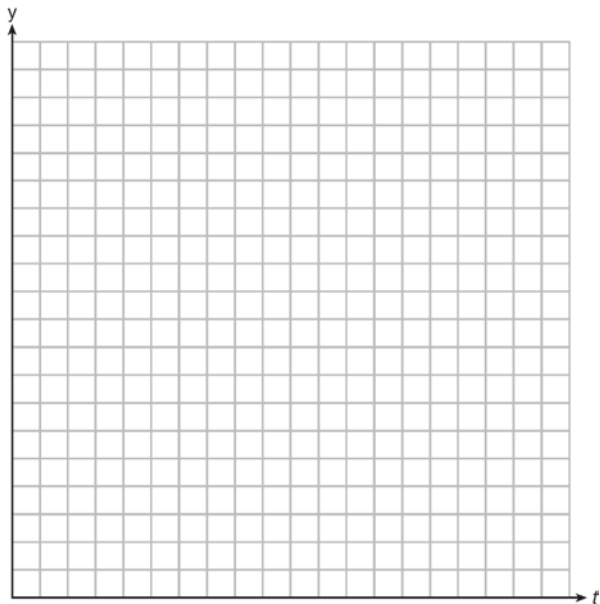
$$-a - 5b - 5c = 2$$

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

Algebra II Regents Exam Questions at Random

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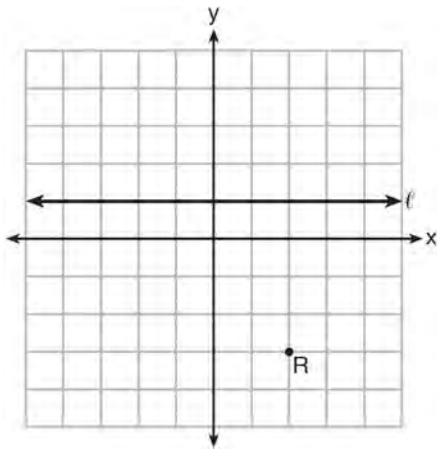
- 408 Drugs break down in the human body at different rates and therefore must be prescribed by doctors carefully to prevent complications, such as overdosing. The breakdown of a drug is represented by the function $N(t) = N_0(e)^{-rt}$, where $N(t)$ is the amount left in the body, N_0 is the initial 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.

- 409 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) $\frac{4}{5}$
- 410 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) $C(n) = \frac{329.99 + 326.34n}{n}$
- 411 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) $y^2 + 4$

- 412 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) $y = -\frac{1}{8}(x-2)^2 - 1$
- 413 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) $t^3 + 5t^2 + 6t + t^2 + 5t + 6 = (t + 1)(t + 2)(t + 3)$
- 414 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) $f(n) = -0.75 + 8(n - 1)$

- 415 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.

- 416 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
- 417 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

- 418 Solve the following system of equations algebraically for all values of x , y , and z :
- $$x + 3y + 5z = 45$$
- $$6x - 3y + 2z = -10$$
- $$-2x + 3y + 8z = 72$$

419 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) $2x^2 - 2.5x - 5 - \frac{20}{2x + 3}$

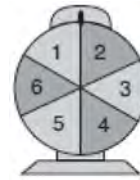
420 Jasmine decides to put \$100 in a savings account each month. The account pays 3% annual interest, compounded monthly. How much money, S , will Jasmine have after one year?

- 1) $S = 100(1.03)^{12}$
- 2) $S = \frac{100 - 100(1.0025)^{12}}{1 - 1.0025}$
- 3) $S = 100(1.0025)^{12}$
- 4) $S = \frac{100 - 100(1.03)^{12}}{1 - 1.03}$

421 Sally's high school is planning their spring musical. The revenue, R , generated can be determined by the function $R(t) = -33t^2 + 360t$, where t represents the price of a ticket. The production cost, C , of the musical is represented by the function $C(t) = 700 + 5t$. What is the highest ticket price, to the nearest dollar, they can charge in order to *not* lose money on the event?

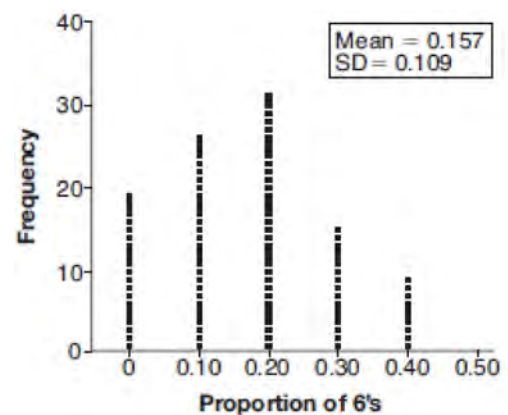
- 1) $t = 3$
- 2) $t = 5$
- 3) $t = 8$
- 4) $t = 11$

422 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.

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423 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.

424 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) $6 \pm 2\sqrt{19}$

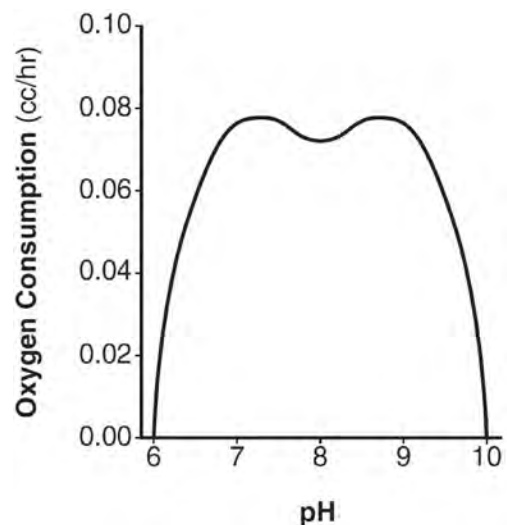
425 A student studying public policy created a model for the population of Detroit, where the population decreased 25% over a decade. He used the model $P = 714(0.75)^d$, where P is the population, in thousands, d decades after 2010. Another student, Suzanne, wants to use a model that would predict the 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) $P = 714(0.9750)^y$

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

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

427 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.

428 The x -value of which function's x -intercept is larger, f or h ? Justify your answer.

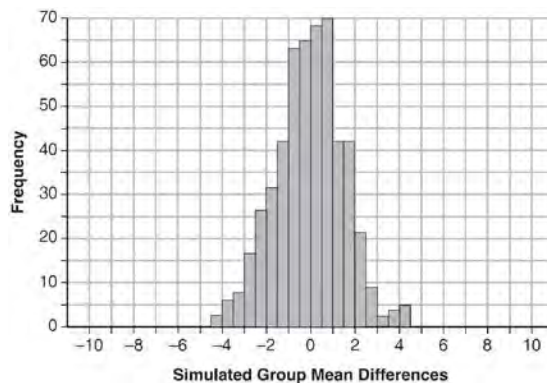
$$f(x) = \log(x - 4)$$

x	$h(x)$
-1	6
0	4
1	2
2	0
3	-2

429 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.

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- 430 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.

- 431 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) $x = \ln 4 - 3$

- 432 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) $-\frac{4}{5}$

- 433 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) $(11.29, 32.87)$

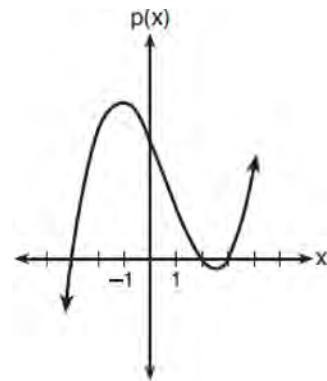
- 434 A rabbit population doubles every 4 weeks. There are currently five rabbits in a restricted area. If t represents the time, in weeks, and $P(t)$ is the population of rabbits with respect to time, about how many rabbits will there be in 98 days?

- 1) 56
- 2) 152
- 3) 3688
- 4) 81,920

- 435 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) $-3x^{-1} + x^{-2}$

- 436 The graph of the function $p(x)$ is sketched below.



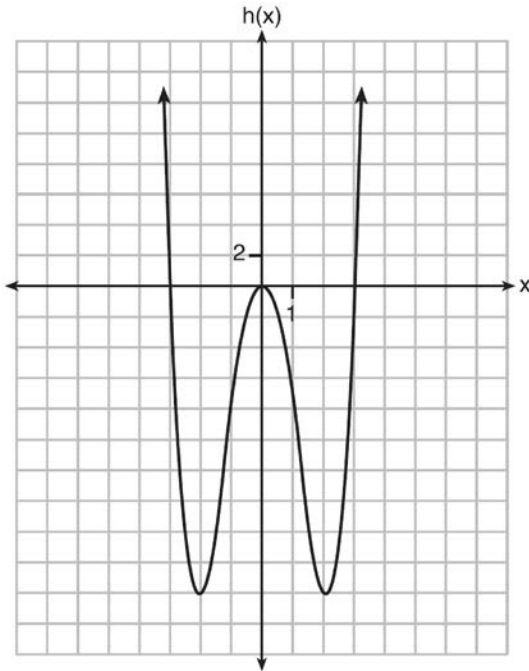
Which equation could represent $p(x)$?

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

437 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.

438 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?

Algebra II Regents at Random Answer Section

1 ANS: 1 PTS: 2 REF: 081813aai NAT: A.SSE.B.4
TOP: Series

2 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

3 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: 011832aai NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

4 ANS: 1 PTS: 2 REF: 011814aai NAT: A.REI.D.11

TOP: Other Systems

5 ANS: 4

$$\frac{n}{m} = \frac{\sqrt{a^5}}{a} = \frac{a^{\frac{5}{2}}}{a^{\frac{2}{2}}} = a^{\frac{3}{2}} = \sqrt{a^3}$$

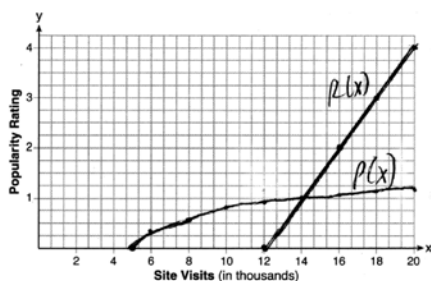
PTS: 2 REF: 011811aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

6 ANS: 1 PTS: 2 REF: 011815aai NAT: F.TF.A.2

TOP: Unit Circle

7 ANS:



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

PTS: 6 REF: 061837aai NAT: A.REI.D.11 TOP: Other Systems

8 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

9 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

10 ANS: 2

$$0.254 \pm 2(0.060) \rightarrow (0.134, 0.374)$$

PTS: 2 REF: 061913aai NAT: S.IC.B.5 TOP: Analysis of Data

11 ANS: 2



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

KEY: probability

12 ANS: 4

$$\begin{array}{r} 5x^2 + x - 3 \\ 2x - 1 \overline{) 10x^3 - 3x^2 - 7x + 3} \\ \underline{10x^3 - 5x^2} \\ 2x^2 - 7x \\ \underline{2x^2 - x} \\ -6x + 3 \\ \underline{-6x + 3} \\ 0 \end{array}$$

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

KEY: division

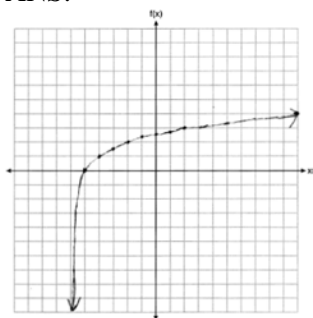
13 ANS:

$$\frac{47}{108} = \frac{1}{4} + \frac{116}{459} - P(M \text{ and } J); \text{ No, because } \frac{31}{459} \neq \frac{1}{4} \cdot \frac{116}{459}$$

$$P(M \text{ and } J) = \frac{31}{459}$$

PTS: 4 REF: 011834aai NAT: S.CP.A.3 TOP: Conditional Probability

14 ANS:



PTS: 2

REF: 061927aai

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

15 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

16 ANS: 4

PTS: 2

REF: 081906aai

NAT: S.IC.B.3

TOP: Analysis of Data

KEY: type

17 ANS: 4

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

PTS: 2

REF: 011918aai

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

18 ANS: 3

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

PTS: 2

REF: 011807aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: predict

19 ANS: 4

PTS: 2

REF: 061914aai

NAT: A.REI.D.11

TOP: Other Systems

20 ANS: 3

PTS: 2

REF: 061901aai

NAT: S.IC.B.3

TOP: Analysis of Data

KEY: type

21 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

22 ANS: 4

There is no x -intercept.

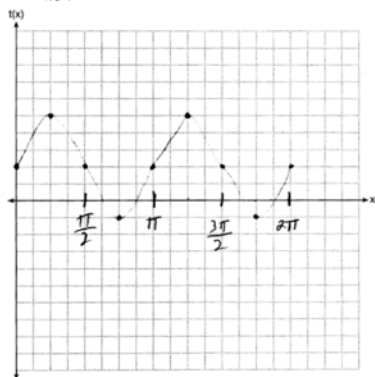
PTS: 2

REF: 011823aai

NAT: F.IF.C.7

TOP: Graphing Exponential Functions

23 ANS:



PTS: 2

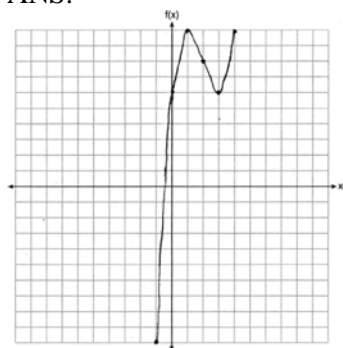
REF: 081830aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

24 ANS:



PTS: 2

REF: 061826aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

25 ANS:

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

$$\begin{array}{r} \underline{x^4 + 2x^3} \\ 4x - 10 \\ \underline{4x + 8} \\ -18 \end{array}$$

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

26 ANS: 4

$$1.06^{\frac{1}{52}}$$

PTS: 2 REF: 061924aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

27 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: 061933aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

28 ANS:

$$138.905 \pm 2 \cdot 7.95 = 123 - 155. \text{ No, since 125 (50% of 250) falls within the 95% interval.}$$

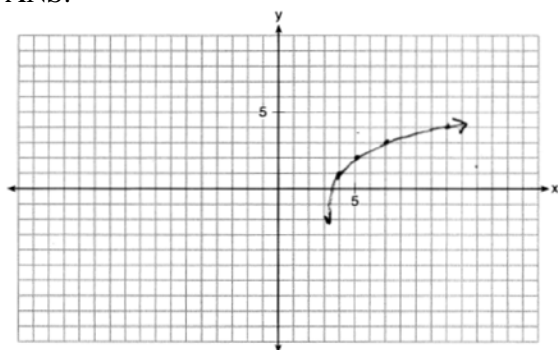
PTS: 4 REF: 011835aai NAT: S.IC.A.2 TOP: Analysis of Data

29 ANS:

q has the smaller minimum value for the domain $[-2, 2]$. h 's minimum is $-1(2(-1) + 1)$ and q 's minimum is -8 .

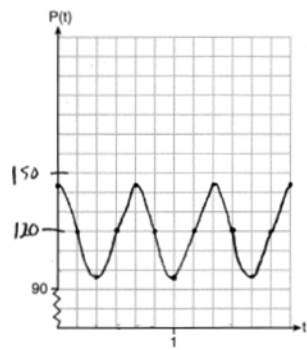
PTS: 2 REF: 011830aai NAT: F.IF.C.9 TOP: Comparing Functions

30 ANS:



PTS: 2 REF: 011932aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

31 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

32 ANS: 3

$$x^2 + (2x)^2 = 5 \quad y = 2x = \pm 2$$

$$x^2 + 4x^2 = 5$$

$$5x^2 = 5$$

$$x = \pm 1$$

PTS: 2 REF: 081916aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

33 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

34 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

35 ANS: 3

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

PTS: 2 REF: 081812aai NAT: N.RN.A.2 TOP: Operations with Radicals
KEY: with variables, index > 2

36 ANS: 3

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

PTS: 2 REF: 011906aii NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

37 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: 061821aii NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

38 ANS:

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

PTS: 2 REF: 061832aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions

KEY: extension to reals

39 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: 061803aii NAT: A.APR.D.6 TOP: Rational Expressions

KEY: factoring

40 ANS: 2

PTS: 2

REF: 011910aii

NAT: S.IC.B.3

TOP: Analysis of Data

KEY: bias

41 ANS:

$$\sqrt{6-2x} + x = 2x + 30 - 9 \quad \sqrt{6-2(-29)} \neq -29 + 21, \text{ so } -29 \text{ is extraneous.}$$

$$\sqrt{6-2x} = x + 21$$

$$\sqrt{64} \neq -8$$

$$6 - 2x = x^2 + 42x + 441$$

$$x^2 + 44x + 435 = 0$$

$$(x+29)(x+15) = 0$$

$$x = -29, -15$$

PTS: 4 REF: 061833aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

42 ANS: 2

PTS: 2

REF: 011820aii

NAT: S.IC.A.2

TOP: Analysis of Data

43 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

44 ANS: 1

PTS: 2

REF: 081903aai

NAT: F.LE.A.2

TOP: Families of Functions

45 ANS: 4

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

PTS: 2

REF: 061918aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: predict

46 ANS:

$$a_1 = 4$$

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

PTS: 2

REF: 081931aai

NAT: F.LE.A.2

TOP: Sequences

KEY: recursive

47 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

48 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

49 ANS: 2

$$n^2(n^2 - 9) + 4n(n^2 - 9) - 12(n^2 - 9)$$

$$(n^2 + 4n - 12)(n^2 - 9)$$

$$(n+6)(n-2)(n+3)(n-3)$$

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

KEY: factoring by grouping

50 ANS: 2

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

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

51 ANS: 3

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

PTS: 2 REF: 081805aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

52 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

53 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

54 ANS: 2 PTS: 2 REF: 061804aai NAT: S.ID.B.6

TOP: Regression KEY: choose model

55 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

56 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

57 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: 061807aai NAT: F.IF.B.6 TOP: Rate of Change

58 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

59 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

60 ANS: 4

$$\log_2(x - 1) - 1 = 0$$

$$\log_2(x - 1) = 1$$

$$x - 1 = 2^1$$

$$x = 3$$

PTS: 2 REF: 061819aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

61 ANS: 2

PTS: 2

REF: 061816aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

KEY: bimodalgraph

62 ANS: 2

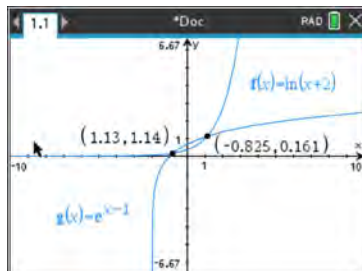
$$f(x) = f(-x)$$

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

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

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

63 ANS: 2



PTS: 2 REF: 081920aai NAT: A.REI.D.11 TOP: Other Systems

64 ANS: 1



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

65 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

66 ANS: 4 PTS: 2 REF: 081803aai NAT: F.BF.A.1
TOP: Operations with Functions

67 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

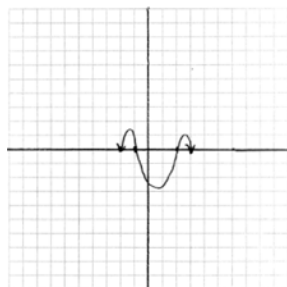
68 ANS:
 $1200 \cdot 0.784 \approx 941$

PTS: 2 REF: 081828aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: predict

69 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

70 ANS:



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

71 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

72 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

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

TOP: Modeling Exponential Functions

74 ANS: 3 PTS: 2 REF: 081909aai NAT: F.LE.A.2

TOP: Sequences KEY: recursive

75 ANS: 4

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

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

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

$$2 = x$$

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

KEY: rational solutions

76 ANS: 1 PTS: 2 REF: 011902aai NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

77 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

78 ANS: 1

$$1.025^{\frac{1}{12}} \approx 1.00206$$

PTS: 2

REF: 081924aai

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

79 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

80 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

81 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

82 ANS: 2

$$P = \frac{2\pi}{\frac{\pi}{45}} = 90$$

PTS: 2 REF: 081822aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: period

83 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: A.SSE.B.4 TOP: Series

84 ANS: 2

$$\frac{85}{210 + 85}$$

PTS: 2 REF: 081818aai NAT: S.CP.A.1 TOP: Venn Diagrams

85 ANS: 1

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

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

KEY: predict

86 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

87 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

88 ANS: 4
 $0.48 \cdot 0.25 = 0.12$

PTS: 1 REF: 061811aii NAT: S.CP.A.2 TOP: Probability of Compound Events
 KEY: probability

89 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: 011930aii NAT: F.IF.B.6 TOP: Rate of Change

90 ANS: 2
 $x = 4y + 5$

$$x - 5 = 4y$$

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

PTS: 2 REF: 061909aii NAT: F.BF.B.4 TOP: Inverse of Functions
 KEY: linear

91 ANS: 1

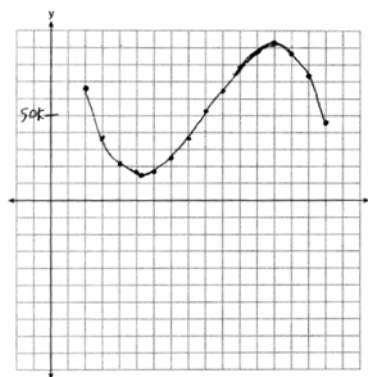
$$-\sqrt{1 - \left(-\frac{3}{4}\right)^2} = -\sqrt{\frac{16}{16} - \frac{9}{16}} = -\sqrt{\frac{7}{16}} = -\frac{\sqrt{7}}{4}$$

PTS: 2 REF: 081905aii NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

92 ANS: 4 PTS: 2 REF: 061921aii NAT: A.APR.B.3
 TOP: Graphing Polynomial Functions

93 ANS: 2 PTS: 2 REF: 081911aii NAT: F.BF.B.3
 TOP: Even and Odd Functions

94 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: 081837aii NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

95 ANS:

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

PTS: 2 REF: 081825aai NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: higher power

96 ANS: 2 PTS: 2 REF: 081904aai NAT: A.SSE.A.2

TOP: Factoring Polynomials KEY: higher power

97 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

98 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

99 ANS:

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

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

100 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

101 ANS:

$$\frac{13.9 - 9.4}{4 - 1} = 1.5 \quad \text{The average rate of change in the number of hours of daylight from January 1-April 1 is 1.5.}$$

PTS: 2 REF: 061925aai NAT: F.IF.B.6 TOP: Rate of Change

102 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

103 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

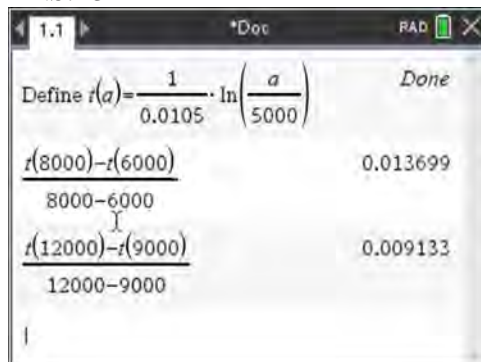
KEY: variables

104 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

105 ANS: 3



PTS: 2 REF: 081922aai NAT: F.IF.B.6 TOP: Rate of Change

106 ANS: 3 PTS: 2 REF: 011917aai NAT: F.BF.B.4

TOP: Inverse of Functions KEY: other

107 ANS:

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

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

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

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

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

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

KEY: complex solutions | completing the square

108 ANS: 1

2) linear, 3) quadratic, 4) cubic

PTS: 2 REF: 061920aai NAT: F.LE.A.2 TOP: Families of Functions

109 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

110 ANS:

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

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

KEY: three variables

111 ANS: 4 PTS: 2 REF: 081810aai NAT: F.BF.A.2

TOP: Sequences

112 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

113 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

114 ANS: 2 PTS: 2 REF: 061917aai NAT: F.LE.B.5

TOP: Modeling Exponential Functions

115 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

116 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

117 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

118 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

119 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

120 ANS:

$N(t) = 950e^{0.0475t}$ The base is e 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

121 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: A.SSE.B.3 TOP: Modeling Exponential Functions

122 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

123 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

124 ANS: 2

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

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

$$(x + 2)(x + 1) = 0$$

$$x = -2, -1$$

PTS: 2

REF: 061801aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

125 ANS: 2

PTS: 2

REF: 081908aai

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

126 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.CED.A.1

TOP: Modeling Rationals

127 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

128 ANS: 3

$$1^3 - k(1)^2 + 2(1) = 0$$

$$k = 3$$

PTS: 2

REF: 061812aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

KEY: higher power

129 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

130 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

131 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

132 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

133 ANS: 3

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

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

134 ANS: 2

PTS: 2

REF: 061802aai

NAT: F.IF.C.7

TOP: Graphing Exponential Functions

135 ANS: 3

PTS: 2

REF: 081819aai

NAT: A.REI.D.11

TOP: Other Systems

136 ANS: 4

$$3x - (-2x + 14) = 16 \quad 3(6) - 4z = 2$$

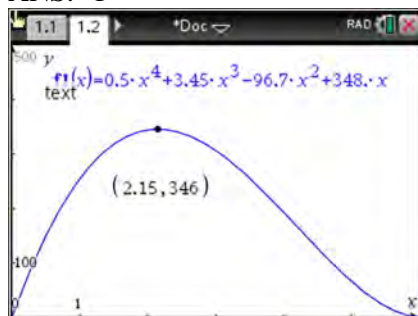
$$5x = 30 \quad -4z = -16$$

$$x = 6 \quad z = 4$$

PTS: 2 REF: 011803aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

137 ANS: 1



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

138 ANS:

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

$$t \approx 18.5$$

PTS: 4 REF: 081835aai NAT: F.LE.A.4 TOP: Exponential Growth

139 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

140 ANS: 2

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

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

141 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

142 ANS:

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

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

KEY: variables

143 ANS:

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

$$15 = 1.69\sqrt{s + 4.45} - 3.49$$

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

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

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

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

$$s \approx 115$$

$$9.5 = 1.69\sqrt{s + 4.45} - 3.49$$

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

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

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

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

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

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

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

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

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

$$s \approx 55$$

$$s \approx 64$$

PTS: 6 REF: 081937aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: context

144 ANS:

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

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

KEY: exponential

145 ANS: 4

The maximum of p is 5. The minimum of f is $-\frac{21}{4}$ ($x = \frac{-6}{2(4)} = -\frac{3}{4}$)

$$f\left(-\frac{3}{4}\right) = 4\left(-\frac{3}{4}\right)^2 + 6\left(-\frac{3}{4}\right) - 3 = 4\left(\frac{9}{16}\right) - \frac{18}{4} - \frac{12}{4} = -\frac{21}{4}. \quad \frac{20}{4} - \left(-\frac{21}{4}\right) = \frac{41}{4} = 10.25$$

PTS: 2 REF: 011922aai NAT: F.IF.C.9 TOP: Comparing Functions

146 ANS:

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

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

147 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

148 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

149 ANS: 2 PTS: 2 REF: 011806aai NAT: A.APR.C.4

TOP: Polynomial Identities

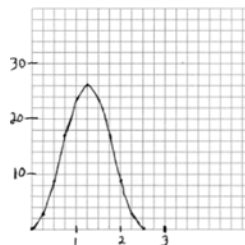
150 ANS: 2

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(5)(4)}}{2(5)} = \frac{2 \pm \sqrt{-76}}{10} = \frac{2 \pm i\sqrt{4}\sqrt{19}}{10} = \frac{1}{5} \pm \frac{i\sqrt{19}}{5}$$

PTS: 2 REF: 011905aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

151 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

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

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

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

154 ANS: 4
 $p(5) = 2(5)^3 - 3(5) + 5 = 240$

PTS: 2 REF: 011819aii NAT: A.APR.B.2 TOP: Remainder Theorem

155 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: 061820aii NAT: N.RN.A.2 TOP: Operations with Radicals
KEY: with variables, index > 2

156 ANS: 1
 $x - \frac{20}{x} = 8$

$$x^2 - 8x - 20 = 0$$

$$(x - 10)(x + 2) = 0$$

$$x = 10, -2$$

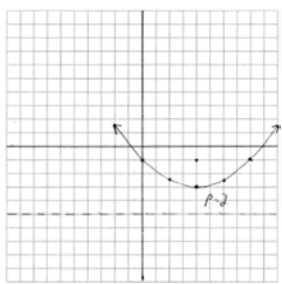
PTS: 2 REF: 061916aii NAT: A.CED.A.1 TOP: Modeling Rationals

157 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: 011921aii NAT: A.APR.D.6 TOP: Rational Expressions
KEY: factoring

158 ANS: 3 PTS: 2 REF: 061906aii NAT: F.LE.A.2
TOP: Families of Functions

159 ANS:



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

PTS: 4 REF: 061935aii NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

160 ANS:

$29.101 \pm 2 \cdot 0.934 = 27.23 - 30.97$. Yes, since 30 falls within the 95% interval.

PTS: 4 REF: 011935aii NAT: S.IC.A.2 TOP: Analysis of Data

161 ANS: 2

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

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

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

PTS: 2 REF: 011821aii NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: linear

162 ANS:

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{-7/25}{-24/25} \quad \cos \theta = \frac{-24}{25}$$

PTS: 2 REF: 061928aii NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

163 ANS: 4 PTS: 2 REF: 011805aii NAT: F.LE.B.5

TOP: Modeling Exponential Functions

164 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: 081836aii NAT: S.IC.B.5 TOP: Analysis of Data

165 ANS:

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

PTS: 2 REF: 081827aii NAT: F.IF.B.6 TOP: Rate of Change

166 ANS:

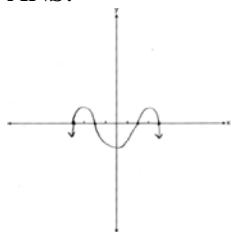
$P(-2) = 60$ $Q(-2) = 0$ $(x + 2)$ is a factor of $Q(x)$ since $Q(-2) = 0$.

PTS: 2 REF: 081929aii NAT: A.APR.B.2 TOP: Remainder Theorem

167 ANS: 3 PTS: 2 REF: 061910aii NAT: F.BF.A.2

TOP: Sequences

168 ANS:



PTS: 2 REF: 011926aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

169 ANS:

$$j(-1) = 2(-1)^4 - (-1)^3 - 35(-1)^2 + 16(-1) + 48 = 2 + 1 - 35 - 16 + 48 = 0; \quad x + 1 \text{ is a factor of } j(x);$$

$$2x^3 - 3x^2 - 32x + 48 = 0$$

$$x^2(2x - 3) - 16(2x - 3) = 0$$

$$(x^2 - 16)(2x - 3) = 0$$

$$x = \pm 4, \frac{3}{2}$$

PTS: 4 REF: 081834aai NAT: A.APR.B.2 TOP: Remainder Theorem

170 ANS: 2 PTS: 2 REF: 081816aai NAT: F.IF.C.7
TOP: Graphing Logarithmic Functions KEY: bimodalgraph

171 ANS:

$$\frac{9}{6} = 1.5 \quad a_1 = 6$$

$$a_n = 1.5 \cdot a_{n-1}$$

PTS: 2 REF: 061931aai NAT: F.BF.A.2 TOP: Sequences

172 ANS:

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

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

173 ANS: 4

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

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

174 ANS: 4

$$1 \text{ year} = 365 \text{ days}$$

PTS: 2 REF: 061823aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

175 ANS: 4

$$wx^2 + w = 0$$

$$wx^2 = -w$$

$$x^2 = -1$$

$$x = \pm i$$

PTS: 2 REF: 061912aia NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | taking square roots

176 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: 081832aia NAT: S.IC.B.4 TOP: Analysis of Data

177 ANS: 2 PTS: 2 REF: 081802aia NAT: S.IC.B.3

TOP: Analysis of Data KEY: type

178 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: 081927aia NAT: N.CN.A.2 TOP: Operations with Complex Numbers

179 ANS: 4 PTS: 2 REF: 081912aia NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions KEY: mixed

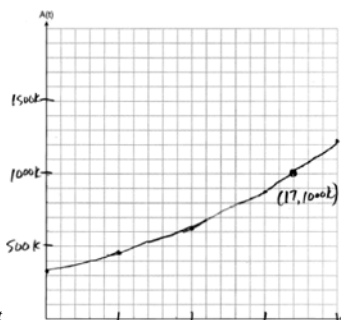
180 ANS:

$$x = \frac{-5 \pm \sqrt{5^2 + 4(2)(8)}}{2(2)} = -\frac{5}{4} \pm \frac{i\sqrt{39}}{4}$$

PTS: 2 REF: 061827aia NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

181 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).

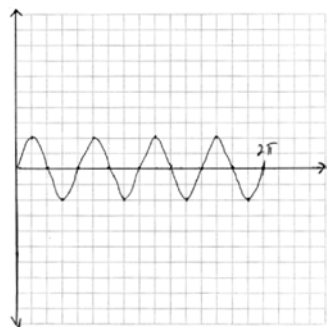
PTS: 6 REF: 011937aia NAT: A.CED.A.1 TOP: Exponential Growth

182 ANS:

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

PTS: 2 REF: 011928aia NAT: S.CP.A.3 TOP: Conditional Probability

183 ANS:



$$y = 2 \sin 4x$$

PTS: 4 REF: 081934aia NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

184 ANS: 4

$$\sqrt{3x^2y} \cdot \sqrt[3]{27x^3y^2} = 3^{\frac{1}{2}}x^{\frac{1}{2}}y^{\frac{1}{2}} \cdot 3^{\frac{2}{3}}x^{\frac{2}{3}}y^{\frac{2}{3}} = 3^{\frac{3}{2}}x^{\frac{7}{6}}y^{\frac{7}{6}}$$

PTS: 2 REF: 081914aia NAT: N.RN.A.2 TOP: Operations with Radicals

KEY: with variables, index > 2

185 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: 081821aia NAT: A.APR.B.3 TOP: Solving Polynomial Equations

186 ANS: 2

$$121(b)^2 = 64 \quad 64\left(\frac{8}{11}\right)^2 \approx 34$$

$$b = \frac{8}{11}$$

PTS: 2 REF: 011904aia NAT: F.IF.A.3 TOP: Sequences

KEY: explicit

187 ANS: 3 PTS: 2 REF: 061824aia NAT: A.CED.A.1

TOP: Modeling Rationals

188 ANS: 2 PTS: 2 REF: 011804aia NAT: F.TF.A.2

TOP: Determining Trigonometric Functions KEY: radians

189 ANS: 4 PTS: 2 REF: 081824aia NAT: S.CP.A.3

TOP: Conditional Probability

190 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: 081913aia NAT: S.CP.A.3 TOP: Conditional Probability

191 ANS:

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

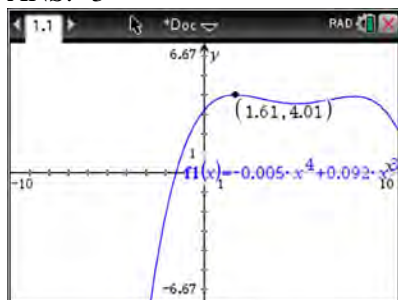
PTS: 2 REF: 061830aia NAT: F.IF.A.3 TOP: Sequences

KEY: recursive

192 ANS: 3 PTS: 2 REF: 011824aia NAT: F.BF.A.2

TOP: Sequences

193 ANS: 3



PTS: 2 REF: 011817aai NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

194 ANS: 1

$$\begin{array}{r}
 3x - 1 \\
 3x + 1 \overline{) 9x^2 + 0x - 2} \\
 \underline{9x^2 + 3x} \\
 -3x - 2 \\
 \underline{-3x - 1} \\
 -1
 \end{array}$$

PTS: 2 REF: 081910aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

195 ANS: 1

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

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

196 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

197 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

198 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: 061923aia NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

199 ANS:

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

PTS: 2 REF: 081826aia NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: variables

200 ANS: 4 PTS: 2 REF: 061907aia NAT: A.APR.B.2

TOP: Remainder Theorem

201 ANS: 4 PTS: 2 REF: 011801aia NAT: S.IC.B.3

TOP: Analysis of Data

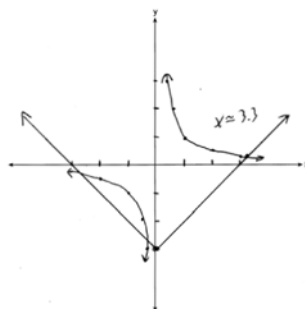
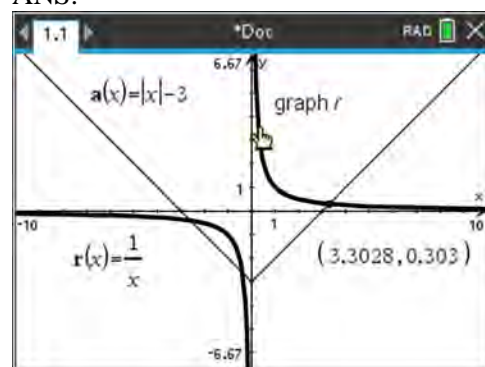
KEY: bias

202 ANS: 4

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

PTS: 2 REF: 081917aia NAT: A.CED.A.1 TOP: Exponential Growth

203 ANS:



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

204 ANS:

$$\begin{array}{r}
 \frac{2a^2 + 5a + 2}{3a - 2} \overline{) 6a^3 + 11a^2 - 4a - 9} \quad 2a^2 + 5a + 2 - \frac{5}{3a - 2} \\
 \underline{6a^3 - 4a^2} \\
 15a^2 - 4a \\
 \underline{15a^2 - 10a} \\
 6a - 9 \\
 \underline{6a - 4} \\
 -5
 \end{array}$$

PTS: 2 REF: 061829aia NAT: A.APR.D.6 TOP: Rational Expressions
 KEY: division

205 ANS:

$$\begin{aligned}
 C(t) &= 63000 \left(1 + \frac{0.0255}{12} \right)^{12t} = 63000 \left(1 + \frac{0.0255}{12} \right)^{12t} = 100000 \\
 12t \log(1.002125) &= \log \frac{100}{63} \\
 t &\approx 18.14
 \end{aligned}$$

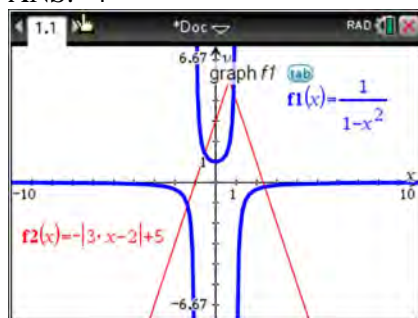
PTS: 4 REF: 061835aia NAT: A.CED.A.1 TOP: Exponential Growth

206 ANS: 4

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

PTS: 2 REF: 081921aia NAT: A.APR.B.3 TOP: Graphing Polynomial Functions

207 ANS: 4



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

208 ANS: 4

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

PTS: 2 REF: 061905aia NAT: A.SSE.B.4 TOP: Series

209 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 Growth

210 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

211 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

212 ANS:

$$(2x^2 + x - 3) \bullet (x - 1) - \left[(2x^2 + x - 3) + (x - 1) \right]$$

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

$$2x^3 - 3x^2 - 6x + 7$$

PTS: 4 REF: 011833aai NAT: F.BF.A.1 TOP: Operations with Functions

213 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

214 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

215 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

216 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

217 ANS: 1

PTS: 2

REF: 081804aai NAT: F.IF.C.9

TOP: Comparing Functions

218 ANS: 2

PTS: 2

REF: 011901aai NAT: S.ID.A.4

TOP: Normal Distributions

KEY: mean and standard deviation

219 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

220 ANS: 4

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

PTS: 2

REF: 011916aai

NAT: F.BF.A.2

TOP: Sequences

221 ANS: 1

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

PTS: 2

REF: 061908aai

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: variables

Algebra II Regents at Random Answer Section

222 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: 061721aai NAT: F.IF.B.6 TOP: Rate of Change

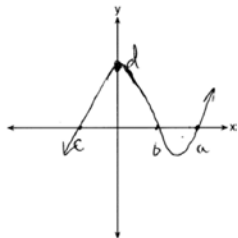
223 ANS: 4

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(6)(29)}}{2(6)} = \frac{8 \pm \sqrt{-632}}{12} = \frac{8 \pm i\sqrt{4} \sqrt{158}}{12} = \frac{2}{3} \pm \frac{1}{6} i \sqrt{158}$$

PTS: 2 REF: 011711aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

224 ANS:



PTS: 2 REF: 081732aai NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

225 ANS:

$$\begin{aligned} \sin^2 \theta + (-0.7)^2 &= 1 && \text{Since } \theta \text{ is in Quadrant II, } \sin \theta = \sqrt{.51} \text{ and } \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\sqrt{.51}}{-0.7} \approx -1.02 \\ \sin^2 \theta &= .51 \\ \sin \theta &= \pm \sqrt{.51} \end{aligned}$$

PTS: 2 REF: 081628aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

226 ANS: 2

$$ME = \left(z \sqrt{\frac{p(1-p)}{n}} \right) = \left(1.96 \sqrt{\frac{(0.55)(0.45)}{900}} \right) \approx 0.03$$

PTS: 2 REF: 081612aai NAT: S.IC.B.4 TOP: Analysis of Data

227 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

228 ANS: 4

$$k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48$$

$$k^2(k^2 - 4) + 8k(k^2 - 4) + 12(k^2 - 4)$$

$$(k^2 - 4)(k^2 + 8k + 12)$$

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

PTS: 2 REF: fall1505aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

229 ANS: 1

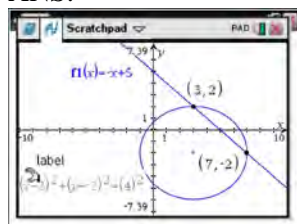
PTS: 2

REF: 081616aai

NAT: F.TF.A.1

TOP: Unit Circle KEY: bimodalgraph

230 ANS:



$$y = -x + 5 \quad y = -7 + 5 = -2$$

$$(x - 3)^2 + (-x + 5 + 2)^2 = 16 \quad y = -3 + 5 = 2$$

$$x^2 - 6x + 9 + x^2 - 14x + 49 = 16$$

$$2x^2 - 20x + 42 = 0$$

$$x^2 - 10x + 21 = 0$$

$$(x - 7)(x - 3) = 0$$

$$x = 7, 3$$

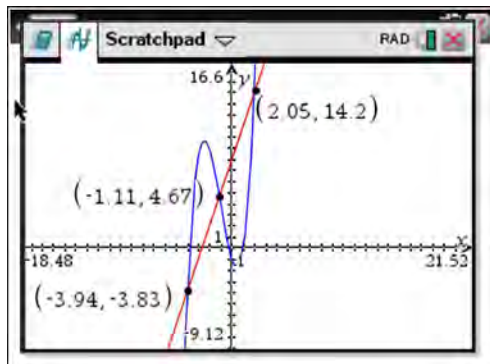
PTS: 4 REF: 061633aai NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

231 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

232 ANS: 4

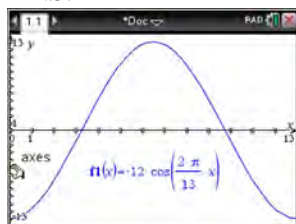


PTS: 2 REF: 061622aai NAT: A.REI.D.11 TOP: Other Systems

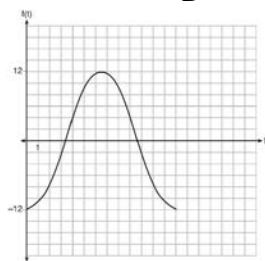
233 ANS: 1 PTS: 2 REF: 081722aai NAT: S.IC.B.6

TOP: Analysis of Data

234 ANS:



The amplitude, 12, can be interpreted from the situation, since the water level has a minimum of -12 and a maximum of 12 . The value of A is -12 since at $8:30$ it is low tide. The period of the function is 13 hours, and is expressed in the function through the parameter B . By experimentation with technology or using the relation $P = \frac{2\pi}{B}$ (where P is the period), it is determined that $B = \frac{2\pi}{13}$.



$$f(t) = -12 \cos\left(\frac{2\pi}{13} t\right)$$

In order to answer the question about when to fish, the student must interpret the function and determine which choice, $7:30$ pm or $10:30$ pm, is on an increasing interval. Since the function is increasing from $t = 13$ to $t = 19.5$ (which corresponds to $9:30$ pm to $4:00$ am), $10:30$ is the appropriate choice.

PTS: 6 REF: spr1514aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

235 ANS: 2

$$x(30 - 0.01x) - (0.15x^3 + 0.01x^2 + 2x + 120) = 30x - 0.01x^2 - 0.15x^3 - 0.01x^2 - 2x - 120$$

$$= -0.15x^3 - 0.02x^2 + 28x - 120$$

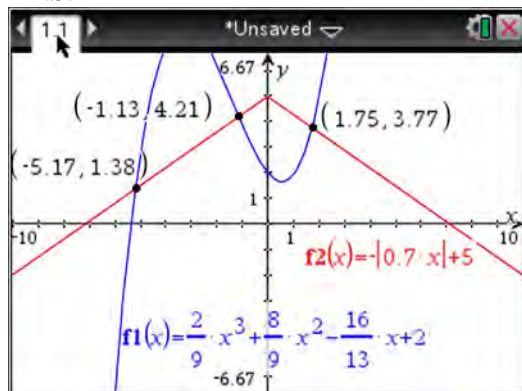
PTS: 2

REF: 061709aai

NAT: F.BF.A.1

TOP: Operations with Functions

236 ANS:



PTS: 2

REF: fall1510aai

NAT: A.REI.D.11

TOP: Other Systems

237 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

238 ANS: 2

PTS: 2

REF: 011720aai

NAT: A.APR.B.2

TOP: Remainder Theorem

239 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

240 ANS: 1



PTS: 2

REF: 081711aai

NAT: S.ID.A.4

TOP: Normal Distributions

KEY: percent

241 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

242 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

243 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

244 ANS:

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

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

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

PTS: 2

REF: 081727aai

NAT: A.APR.C.4

TOP: Polynomial Identities

245 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

246 ANS: 2

 $h(x)$ does not have a y -intercept.

PTS: 2 REF: 011719aai NAT: F.IF.C.9 TOP: Comparing Functions

247 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

248 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

249 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: 061715aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

KEY: maximum/minimum

250 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

251 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: 061714aai

NAT: S.CP.B.7

TOP: Theoretical Probability

252 ANS: 1

$$\begin{array}{r} 3x^2 + 4x - 1 \\ 2x + 3 \overline{) 6x^3 + 17x^2 + 10x + 2} \\ \underline{6x^3 + 9x^2} \\ 8x^2 + 10x \\ \underline{8x^2 + 12x} \\ -2x + 2 \\ \underline{-2x - 3} \\ 5 \end{array}$$

PTS: 2

REF: fall1503aai

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: division

253 ANS: 4

$$\left(\frac{-54x^9}{y^4} \right)^{\frac{2}{3}} = \frac{(2 \cdot -27)^{\frac{2}{3}} x^{\frac{18}{3}}}{y^{\frac{8}{3}}} = \frac{2^{\frac{2}{3}} \cdot 9x^6}{y^2 \cdot y^{\frac{2}{3}}} = \frac{9x^6 \sqrt[3]{4}}{y^2 \sqrt[3]{y^2}}$$

PTS: 2

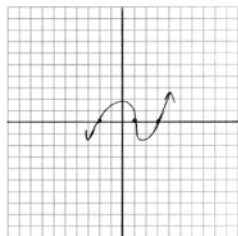
REF: 081723aai

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: variables

254 ANS:



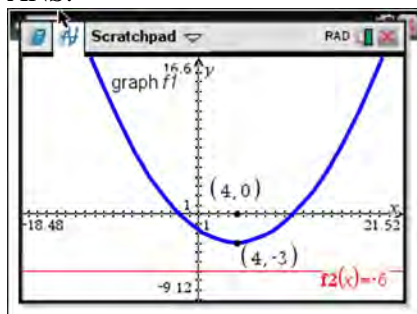
PTS: 2

REF: 011729aai

NAT: F.IF.C.7

TOP: Graphing Polynomial Functions

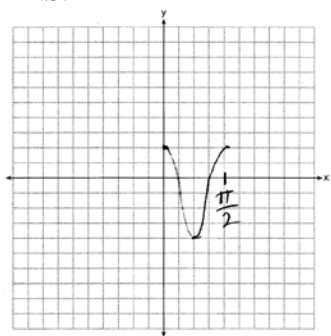
255 ANS:



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

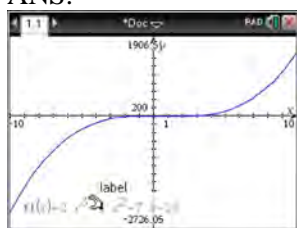
256 ANS:



PTS: 2 REF: 061628aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: graph

257 ANS:



$$\begin{array}{r}
 2x^2 + 6x + 23 \\
 x - 5 \overline{) 2x^3 - 4x^2 - 7x - 10} \\
 \underline{2x^3 - 10x^2} \\
 6x^2 - 7x \\
 \underline{6x^2 - 30x} \\
 23x - 10 \\
 \underline{23x - 115} \\
 105
 \end{array}$$

Since there is a remainder, $x - 5$ is not a factor.

PTS: 2 REF: 061627aai NAT: A.APR.B.2 TOP: Remainder Theorem

258 ANS: 2

The 2010 population is 110 million.

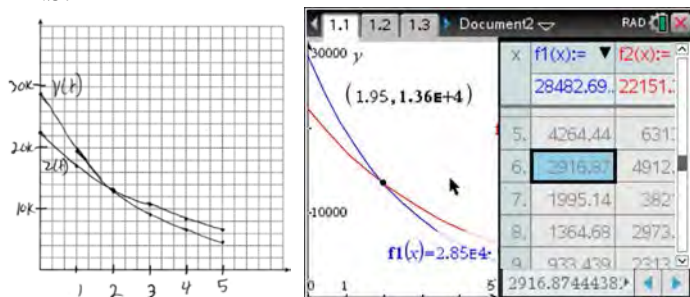
PTS: 2 REF: 061718aai NAT: F.LE.B.5 TOP: Modeling Exponential Functions

259 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

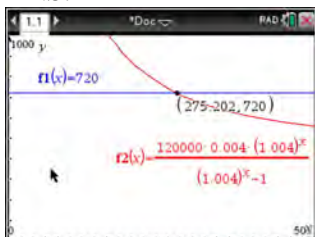
260 ANS:



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

261 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: spr1509aai NAT: A.CED.A.1 TOP: Exponential Growth

262 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

263 ANS: 2 PTS: 2 REF: 081610aii NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

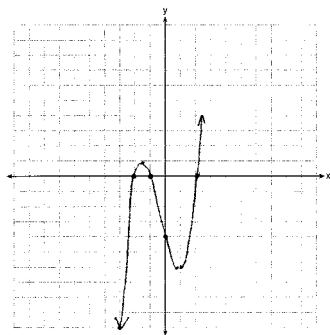
264 ANS:

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: 081636aii NAT: S.IC.B.5 TOP: Analysis of Data

265 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: 081633aii NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

266 ANS: 3

$$\left(\frac{1}{2}\right)^{\frac{1}{73.83}} \approx 0.990656$$

PTS: 2 REF: 081710aia NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

267 ANS: 3 PTS: 2 REF: 081705aia NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

268 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

269 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: 081728aia NAT: S.IC.A.2 TOP: Analysis of Data

270 ANS: 4

$$496 \pm 2(115)$$

PTS: 2 REF: 011718aia NAT: S.ID.A.4 TOP: Normal Distributions

KEY: interval

271 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: 061732aia NAT: S.CP.A.4 TOP: Conditional Probability

272 ANS:

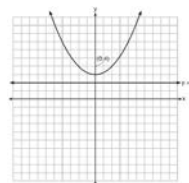
$$20000 = PMT \left(\frac{1 - (1 + 0.00625)^{-60}}{0.00625} \right) \quad 21000 - x = 300 \left(\frac{1 - (1 + 0.00625)^{-60}}{0.00625} \right)$$

$$PMT \approx 400.76$$

$$x \approx 6028$$

PTS: 4 REF: 011736aia NAT: A.SSE.B.4 TOP: Series

273 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: spr1502aii NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

274 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: 061616aii NAT: F.BF.B.4 TOP: Inverse of Functions

KEY: linear

275 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: fall1511aii NAT: A.APR.C.4 TOP: Polynomial Identities

276 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

277 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

278 ANS: 3

PTS: 2

REF: 011706aai

NAT: S.IC.B.3

TOP: Analysis of Data

KEY: type

279 ANS: 3

PTS: 2

REF: 081724aai

NAT: F.BF.A.2

TOP: Sequences

280 ANS: 3

$$(3k - 2i)^2 = 9k^2 - 12ki + 4i^2 = 9k^2 - 12ki - 4$$

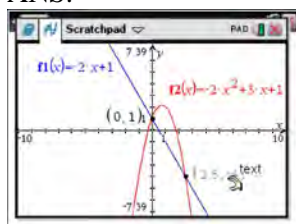
PTS: 2

REF: 081702aai

NAT: N.CN.A.2

TOP: Operations with Complex Numbers

281 ANS:



$$-2x + 1 = -2x^2 + 3x + 1$$

$$2x^2 - 5x = 0$$

$$x(2x - 5) = 0$$

$$x = 0, \frac{5}{2}$$

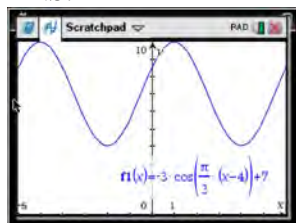
PTS: 2

REF: fall1507aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

282 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

283 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

284 ANS: 3

Since $x + 4$ is a factor of $p(x)$, there is no remainder.

PTS: 2 REF: 081621aii NAT: A.APR.B.2 TOP: Remainder Theorem

285 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 $100 - 40(-1.041868) \approx 58.3$. Theactual 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: fall1517aii NAT: F.LE.A.2 TOP: Modeling Exponential Functions

286 ANS: 2

$$ME = \left(z \sqrt{\frac{p(1-p)}{n}} \right) = \left(1.96 \sqrt{\frac{(0.16)(0.84)}{1334}} \right) \approx 0.02$$

PTS: 2 REF: 081716aii NAT: S.IC.B.4 TOP: Analysis of Data

287 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

288 ANS: 1

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

$$2x - 8 + 3x + 9 = 2x - 2$$

$$3x = -3$$

$$x = -1$$

PTS: 2 REF: 011717aii NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

289 ANS:

$$8.75 = 1.25x^{49}$$

$$7 = x^{49}$$

$$x = \sqrt[49]{7} \approx 1.04$$

PTS: 2 REF: 081730aii NAT: F.LE.A.4 TOP: Exponential Growth

290 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.

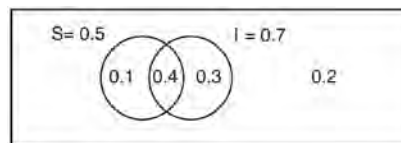
PTS: 2

REF: 081720aai

NAT: A.APR.B.2

TOP: Remainder Theorem

291 ANS:



This scenario can be modeled with a Venn Diagram:

Since $P(S \cup I) = 0.2$, $P(S \cup I) = 0.8$. Then, $P(S \cap I) = P(S) + P(I) - P(S \cup I)$ If S and I are independent, then the

$$= 0.5 + 0.7 - 0.8$$

$$= 0.4$$

Product Rule must be satisfied. However, $(0.5)(0.7) \neq 0.4$. Therefore, salary and insurance have not been treated independently.

PTS: 4

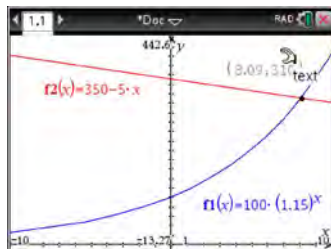
REF: spr1513aai

NAT: S.CP.A.2

TOP: Probability of Compound Events

KEY: independence

292 ANS: 2



PTS: 2

REF: 011716aai

NAT: A.REI.D.11

TOP: Other Systems

293 ANS: 4

$$\frac{m(c)}{g(c)} = \frac{c+1}{1-c^2} = \frac{c+1}{(1+c)(1-c)} = \frac{1}{1-c}$$

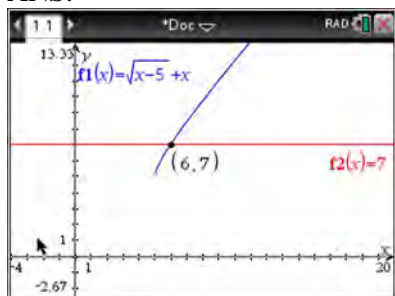
PTS: 2

REF: 061608aai

NAT: F.BF.A.1

TOP: Operations with Functions

294 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

295 ANS: 4 PTS: 2 REF: 081624aii NAT: F.BF.A.2

TOP: Sequences

296 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: 081715aii NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: multivariable

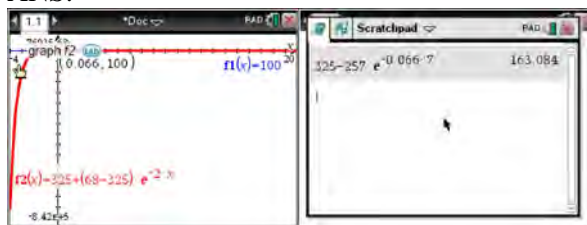
297 ANS: 1

$$\begin{array}{r|rrrrr} 2 & 1 & 0 & -4 & -4 & 8 \\ & & 2 & 4 & 0 & -8 \\ \hline & 1 & 2 & 0 & -4 & 0 \end{array}$$

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 Theorem

298 ANS:



$$100 = 325 + (68 - 325)e^{-2k} \quad T = 325 - 257e^{-0.066t}$$

$$-225 = -257e^{-2k} \quad T = 325 - 257e^{-0.066(7)} \approx 163$$

$$k = \frac{\ln\left(\frac{-225}{-257}\right)}{-2}$$

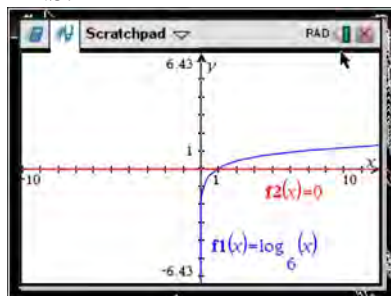
$$k \approx 0.066$$

PTS: 4 REF: fall1513aai NAT: F.LE.A.4 TOP: Exponential Growth

299 ANS: 4 PTS: 2 REF: 081708aai NAT: A.APR.B.3

TOP: Solving Polynomial Equations

300 ANS: 1



PTS: 2 REF: 061618aai NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

301 ANS: 4

The vertex is (1,0) and $p = 2$. $y = \frac{1}{4(2)}(x-1)^2 + 0$

PTS: 2 REF: 061717aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

302 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: 081635aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

303 ANS: 3

$$x^2 + 2x + 1 = -5 + 1$$

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

$$x + 1 = \pm 2i$$

$$x = -1 \pm 2i$$

PTS: 2 REF: 081703aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

304 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

305 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

306 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

307 ANS: 3 PTS: 2 REF: 061602aai NAT: A.CED.A.1

TOP: Modeling Rationals

308 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

309 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: 061730aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: extraneous solutions

310 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: spr1511aai NAT: F.LE.A.2 TOP: Sequences

KEY: recursive

311 ANS: 1

$$x = \frac{-3 \pm \sqrt{3^2 - 4(2)(2)}}{2(2)} = \frac{-3 \pm \sqrt{-7}}{4} = -\frac{3}{4} \pm \frac{i\sqrt{7}}{4}$$

PTS: 2 REF: 061612aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

312 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

313 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

314 ANS:

$$\left(x^{\frac{5}{3}}\right)^{\frac{6}{5}} = \left(y^{\frac{5}{6}}\right)^{\frac{6}{5}}$$

$$x^2 = y$$

PTS: 2

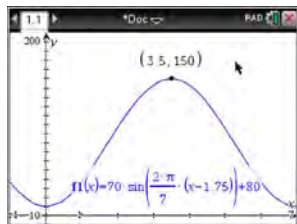
REF: 011730aai

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

KEY: variables

315 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

316 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

317 ANS:

$$A = 5000(1.045)^n \quad 5000\left(1 + \frac{.046}{4}\right)^{4(6)} - 5000(1.045)^6 \approx 6578.87 - 6511.30 \approx 67.57 \quad 10000 = 5000\left(1 + \frac{.046}{4}\right)^{4n}$$

$$B = 5000\left(1 + \frac{.046}{4}\right)^{4n}$$

$$2 = 1.0115^{4n}$$

$$\log 2 = 4n \cdot \log 1.0115$$

$$n = \frac{\log 2}{4 \log 1.0115}$$

$$n \approx 15.2$$

PTS: 6 REF: 081637aai NAT: A.CED.A.1 TOP: Exponential Growth

318 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

319 ANS:

The expression is of the form $y^2 - 5y - 6$ or $(y - 6)(y + 1)$. Let $y = 4x^2 + 5x$:

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

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

PTS: 2 REF: fall1512aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: $a > 1$

320 ANS: 3 PTS: 2 REF: 061607aai NAT: S.IC.A.2

TOP: Analysis of Data

321 ANS: 4 PTS: 2 REF: 081622aai NAT: F.BF.A.1

TOP: Modeling Exponential Functions

322 ANS:

$$\frac{306.25 - 156.25}{70 - 50} = \frac{150}{20} = 7.5 \quad \text{Between 50-70 mph, each additional mph in speed requires 7.5 more feet to stop.}$$

PTS: 2 REF: 081631aai NAT: F.IF.B.6 TOP: Rate of Change

323 ANS: 3

(3) repeats 3 times over 2π .

PTS: 2 REF: 011722aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions

KEY: recognize | bimodalgraph

324 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

325 ANS: 4 PTS: 2 REF: 081718aai NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions KEY: amplitude

326 ANS:

Amplitude, because the height of the graph shows the volume of the air.

PTS: 2 REF: 081625aai NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: mixed

327 ANS: 4 PTS: 2 REF: 081707aai NAT: F.TF.A.2

TOP: Reference Angles KEY: bimodalgraph

328 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

329 ANS: 3 PTS: 2 REF: 011710aai NAT: F.BF.A.1

TOP: Operations with Functions

330 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

331 ANS: 3 PTS: 2 REF: 061623aai NAT: F.BF.A.2

TOP: Sequences

332 ANS:

$$xi(-6i)^2 = xi(36i^2) = 36xi^3 = -36xi$$

PTS: 2 REF: 081627aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

333 ANS: 1 PTS: 2 REF: 061904aai NAT: F.IF.B.4

TOP: Relating Graphs to Events

334 ANS: 3



PTS: 2 REF: 081604aai NAT: S.ID.A.4 TOP: Normal Distributions

KEY: probability

335 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

336 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

337 ANS: 4

$$(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3 \neq x^3 + 3xy + y^3$$

PTS: 2 REF: 081620aai NAT: A.APR.C.4 TOP: Polynomial Identities

338 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

339 ANS: 4

$$(1) \frac{B(60) - B(10)}{60 - 10} \approx 28\% \quad (2) \frac{B(69) - B(19)}{69 - 19} \approx 33\% \quad (3) \frac{B(72) - B(36)}{72 - 36} \approx 38\% \quad (4) \frac{B(73) - B(60)}{73 - 60} \approx 46\%$$

PTS: 2 REF: 011721aai NAT: F.IF.B.6 TOP: Rate of Change

340 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

341 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

342 ANS: 1

$$\frac{157}{25+47+157}$$

PTS: 2 REF: 081607aai NAT: S.CP.A.4 TOP: Conditional Probability

343 ANS: 2

$$\cos \theta = \pm \sqrt{1 - \left(\frac{-\sqrt{2}}{5}\right)^2} = \pm \sqrt{\frac{25}{25} - \frac{2}{25}} = \pm \frac{\sqrt{23}}{5}$$

PTS: 2 REF: 061712aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

344 ANS:

$$P(P/K) = \frac{P(P \cap K)}{P(K)} = \frac{1.9}{2.3} \approx 82.6\% \quad \text{A key club member has an 82.6\% probability of being enrolled in AP Physics.}$$

PTS: 4 REF: 011735aai NAT: S.CP.B.6 TOP: Conditional Probability

345 ANS:



69

PTS: 2 REF: 061726aai NAT: S.ID.A.4 TOP: Normal Distributions

KEY: percent

346 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: 061631aai NAT: A.APR.C.4 TOP: Polynomial Identities

347 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

348 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

349 ANS:

$$\begin{array}{r} \overline{) 3x^2 + 7x - 20} \\ \underline{3x^2 - 6x} \\ 13x - 20 \\ \underline{13x - 26} \\ 6 \end{array} \quad 3x + 13 + \frac{6}{x-2}$$

PTS: 2

REF: 011732aai

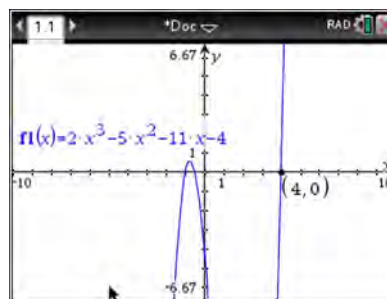
NAT: A.APR.D.6

TOP: Rational Expressions

KEY: division

350 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.

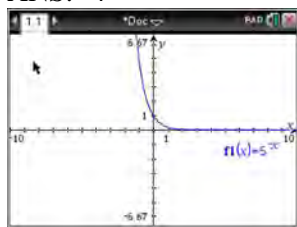
PTS: 2

REF: spr1507aai

NAT: A.APR.B.2

TOP: Remainder Theorem

351 ANS: 4



$$y = 5^{-t} = \left(\frac{1}{5}\right)^t$$

PTS: 2 REF: 061615aai NAT: F.IF.C.7 TOP: Graphing Exponential Functions

352 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

353 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

354 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

355 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

356 ANS: 2

PTS: 2

REF: 081717aai

NAT: S.IC.B.3

TOP: Analysis of Data

KEY: type

357 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

358 ANS: 4 PTS: 2 REF: 061716aai NAT: N.RN.A.2
TOP: Radicals and Rational Exponents KEY: variables

359 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
360 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

361 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

362 ANS: 3 PTS: 2 REF: 081618aai NAT: F.LE.A.2
TOP: Sequences KEY: recursive

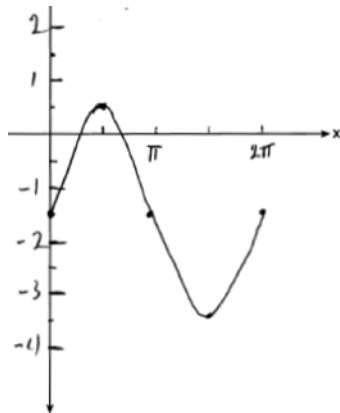
363 ANS: 1
(2) is not recursive

PTS: 2 REF: 081608aai NAT: F.LE.A.2 TOP: Sequences
KEY: recursive

364 ANS:
 $a_1 = 4$ $a_8 = 639$
 $a_n = 2a_{n-1} + 1$

PTS: 2 REF: 081729aai NAT: F.LE.A.2 TOP: Sequences
KEY: recursive

365 ANS:

Part a sketch is shifted $\frac{\pi}{3}$ units right.

PTS: 4

REF: 081735aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: graph

366 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

367 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

368 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

369 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: spr1504aii NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

370 ANS: 1 PTS: 2 REF: 061708aii NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

371 ANS:

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ A and B are independent since $P(A \cap B) = P(A) \cdot P(B)$

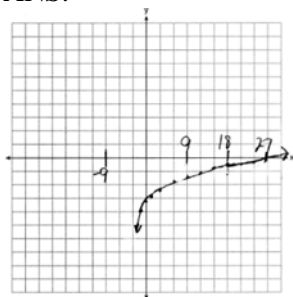
$$0.8 = 0.6 + 0.5 - P(A \cap B) \qquad 0.3 = 0.6 \cdot 0.5$$

$$P(A \cap B) = 0.3 \qquad 0.3 = 0.3$$

PTS: 2 REF: 081632aii NAT: S.CP.A.2 TOP: Probability of Compound Events

KEY: independence

372 ANS:

As $x \rightarrow -3, y \rightarrow -\infty$. As $x \rightarrow \infty, y \rightarrow \infty$.

PTS: 4 REF: 061735aii NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

373 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: 061731aii NAT: N.RN.A.2 TOP: Operations with Radicals

KEY: with variables, index > 2

374 ANS:

$$\frac{3p}{p-5} = \frac{p+2}{p+3}$$

$$3p^2 + 9p = p^2 - 3p - 10$$

$$2p^2 + 12p + 10 = 0$$

$$p^2 + 6p + 5 = 0$$

$$(p+5)(p+1) = 0$$

$$p = -5, -1$$

PTS: 4 REF: 081733aii NAT: A.REI.A.2 TOP: Solving Rationals

KEY: rational solutions

375 ANS:

$$\frac{x^{\frac{8}{3}}}{x^{\frac{4}{3}}} = x^y$$

$$x^{\frac{4}{3}} = x^y$$

$$\frac{4}{3} = y$$

PTS: 2 REF: spr1505aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

KEY: numbers

376 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: 081704aii NAT: A.REI.A.2 TOP: Solving Radicals

KEY: advanced

377 ANS:

$r(2) = -6$. Since there is a remainder when the cubic is divided by $x - 2$, this binomial is not a factor.

$$\begin{array}{r|rrrr} 2 & 1 & -4 & 4 & 6 \\ & & 2 & -4 & 0 \\ \hline & 1 & -2 & 0 & -6 \end{array}$$

PTS: 2 REF: 061725aai NAT: A.APR.B.2 TOP: Remainder Theorem

378 ANS: 3 PTS: 2 REF: 011708aai NAT: F.BF.B.4
TOP: Inverse of Functions KEY: other

379 ANS: 3
Self selection causes bias.

PTS: 2 REF: 061703aai NAT: S.IC.B.3 TOP: Analysis of Data
KEY: bias

380 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: 081731aai NAT: F.BF.B.3 TOP: Even and Odd Functions

381 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

382 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

383 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

384 ANS: 4 PTS: 2 REF: 061601aai NAT: N.RN.A.2
TOP: Radicals and Rational Exponents KEY: variables

385 ANS: 4

$$y = g(x) = (x-2)^2 \quad (x-2)^2 = 3x-2 \quad y = 3(6)-2 = 16$$

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

$$x^2 - 7x + 6 = 0$$

$$(x-6)(x-1) = 0$$

$$x = 6, 1$$

PTS: 2

REF: 011705aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

386 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

387 ANS: 1

PTS: 2

REF: 011704aai

NAT: F.TF.C.8

TOP: Simplifying Trigonometric Expressions

388 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

389 ANS:

$$0 = \sqrt{t} - 2t + 6 \quad 2\left(\frac{9}{4}\right) - 6 < 0, \text{ so } \frac{9}{4} \text{ is extraneous.}$$

$$2t - 6 = \sqrt{t}$$

$$4t^2 - 24t + 36 = t$$

$$4t^2 - 25t + 36 = 0$$

$$(4t - 9)(t - 4) = 0$$

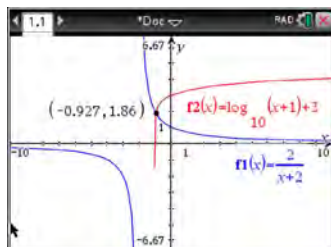
$$t = \frac{9}{4}, 4$$

$$(\sqrt{1} - 2(1) + 6) - (\sqrt{3} - 2(3) + 6) = 5 - \sqrt{3} \approx 3.268 \quad 327 \text{ mph}$$

PTS: 6 REF: 011737aai NAT: A.REI.A.2 TOP: Solving Radicals

KEY: context

390 ANS: 2



PTS: 2 REF: 011712aai NAT: A.REI.D.11 TOP: Other Systems

391 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 Theorem

392 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

393 ANS: 1

$$x^2 + 2x - 8 = 0$$

$$(x + 4)(x - 2) = 0$$

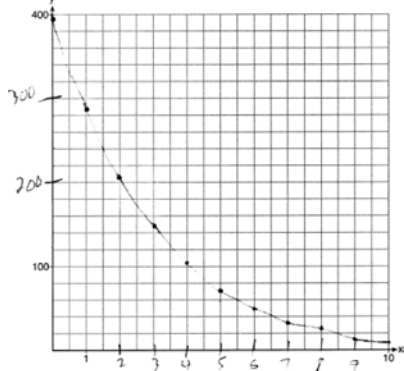
$$x = -4, 2$$

PTS: 2 REF: 081701aai NAT: A.APR.D.6 TOP: Undefined Rationals

394 ANS: 2 PTS: 2 REF: 011701aai NAT: F.IF.B.4

TOP: Graphing Trigonometric Functions

395 ANS:



PTS: 2 REF: 061729aai NAT: F.IF.C.7 TOP: Graphing Exponential Functions

396 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

397 ANS: 2



PTS: 2 REF: 081603aai NAT: A.REI.D.11 TOP: Other Systems

398 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

399 ANS: 3

$$2d(d^3 + 3d^2 - 9d - 27)$$

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

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

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

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

PTS: 2 REF: 081615aai NAT: A.SSE.A.2 TOP: Factoring Polynomials

KEY: factoring by grouping

400 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

401 ANS: 2 PTS: 2 REF: 011709aai NAT: S.IC.B.5

TOP: Analysis of Data

402 ANS: 3

$$d = 10 \log \frac{6.3 \times 10^{-3}}{1.0 \times 10^{-12}} \approx 98$$

PTS: 2 REF: 011715aai NAT: F.IF.B.4 TOP: Evaluating Logarithmic Expressions

403 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

404 ANS: 3

$$1.0525^{\frac{1}{12}} \approx 1.00427$$

PTS: 2 REF: 061621aai NAT: F.BF.A.1 TOP: Modeling Exponential Functions

405 ANS: 3

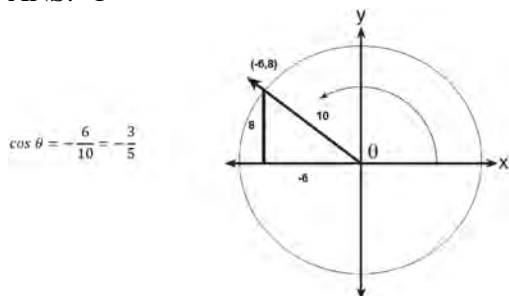
$$\log_{0.8} \left(\frac{V}{17000} \right) = t \quad \frac{17,000(0.8)^3 - 17,000(0.8)^1}{3-1} \approx -2450$$

$$0.8^t = \frac{V}{17000}$$

$$V = 17000(0.8)^t$$

PTS: 2 REF: 081709aai NAT: F.IF.B.6 TOP: Rate of Change

409 ANS: 1



PTS: 2 REF: 061617aai NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

410 ANS: 3 PTS: 2 REF: 061722aai NAT: A.CED.A.1
TOP: Modeling Rationals

411 ANS: 2
 $(2 - yi)(2 - yi) = 4 - 4yi + y^2 i^2 = -y^2 - 4yi + 4$

PTS: 2 REF: 061603aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers
412 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
413 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
414 ANS: 3 PTS: 2 REF: 061720aai NAT: F.LE.A.2
TOP: Sequences KEY: explicit

415 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: A.SSE.B.4 TOP: Series
416 ANS: 4 PTS: 2 REF: 061706aai NAT: F.IF.B.4
TOP: Graphing Trigonometric Functions

417 ANS: 1

$$d = 18; r = \pm \frac{5}{4}$$

PTS: 2 REF: 011714aai NAT: F.IF.A.3 TOP: Sequences

KEY: explicit

418 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: spr1510aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

419 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

420 ANS: 2 PTS: 2 REF: 061724aai NAT: A.SSE.B.4

TOP: Series

421 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

422 ANS: 3 PTS: 2 REF: 061710aai NAT: S.IC.A.2

TOP: Analysis of Data

423 ANS:

$$\frac{6.25 - 2.25}{21 - 5} = \frac{4}{16} = \$0.25 \text{ fine per day. } 2.25 - 5(.25) = \$1 \text{ replacement fee. } a_n = 1.25 + (n - 1)(.25). a_{60} = \$16$$

PTS: 4 REF: 081734aai NAT: F.BF.A.2 TOP: Sequences

424 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: fall1504aai NAT: A.REI.B.4 TOP: Solving Quadratics

KEY: complex solutions | completing the square

425 ANS: 3

$$0.75^{\frac{1}{10}} \approx .9716$$

PTS: 2 REF: 061713aai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

426 ANS:

$$x + y + z = 1 \quad x + y + z = 1 \quad x + y + z = 1 \quad -2z - z = 3 \quad y - (-1) = 3 \quad x + 2 - 1 = 1$$

$$x + 2y + 3z = 1 \quad \underline{x + 2y + 3z = 1} \quad \underline{-x + 3y - 5z = 11} \quad -3z = 3 \quad y = 2 \quad x = 0$$

$$-x + 3y - 5z = 11 \quad y + 2z = 0 \quad 4y - 4z = 12 \quad z = -1$$

$$y = -2z \quad y - z = 3$$

PTS: 4 REF: 061733aai NAT: A.REI.C.6 TOP: Solving Linear Systems

KEY: three variables

427 ANS: 2 PTS: 2 REF: 061620aai NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

428 ANS:

$0 = \log_{10}(x - 4)$ The x -intercept of h is $(2, 0)$. f has the larger value.

$$10^0 = x - 4$$

$$1 = x - 4$$

$$x = 5$$

PTS: 2 REF: 081630aai NAT: F.IF.C.9 TOP: Comparing Functions

429 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: fall1514aii

NAT: S.IC.B.5

TOP: Analysis of Data

430 ANS:

$\left(\ln \frac{1}{2}\right)$
1590 is negative, so $M(t)$ represents decay.

PTS: 2

REF: 011728aii

NAT: F.IF.C.7

TOP: Graphing Exponential Functions

431 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

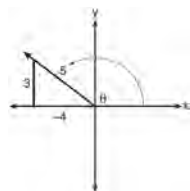
NAT: F.LE.A.4

TOP: Exponential Equations

KEY: without common base

432 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

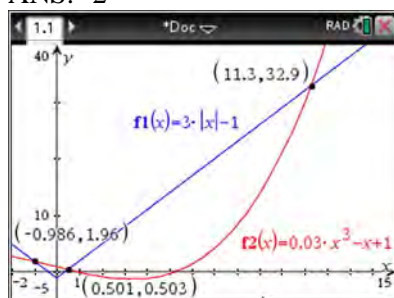
REF: spr1503aii

NAT: F.TF.A.2

TOP: Determining Trigonometric Functions

KEY: extension to reals

433 ANS: 2



PTS: 2 REF: 061705aai NAT: A.REI.D.11 TOP: Other Systems

434 ANS: 1

$$P(28) = 5(2)^{\frac{98}{28}} \approx 56$$

PTS: 2 REF: 011702aai NAT: F.LE.A.2 TOP: Modeling Exponential Functions

435 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: variables436 ANS: 1 PTS: 2 REF: 061701aai NAT: A.APR.B.3
TOP: Graphing Polynomial Functions

437 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

438 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: fall1516aai NAT: S.ID.A.4 TOP: Normal Distributions
KEY: probability