JMAP
REGENTS BY TYPE

The NY Algebra II Regents Exams Questions
from Spring 2015 to August 2022 Sorted by Type

Algebra II Multiple Choice Regents Exam Questions

1 Consider the data in the table below.

	Right Handed	Left Handed
Male	87	13
Female	89	11

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

1) $\dfrac{13}{200}$

2) $\dfrac{13}{100}$

3) $\dfrac{13}{50}$

4) $\dfrac{13}{24}$

2 A parabola has a directrix of $y = 3$ and a vertex at $(2,1)$. Which ordered pair is the focus of the parabola?
1) $(2,-1)$
2) $(2,0)$
3) $(2,2)$
4) $(2,5)$

3 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

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

5 The Hot and Tasty Coffee chain conducts a survey of its customers at its location at the Staten Island ferry terminal. After the survey is completed, the statistical consultant states that 70% of customers who took the survey said the most important factor in choosing where to get their coffee is how fast they are served. Based on this result, Hot and Tasty Coffee can infer that
1) most of its customers in New York State care most about being served quickly
2) coffee drinkers care less about taste and more about being served quickly
3) most of its customers at the Staten Island ferry terminal care most about being served quickly
4) most of its customers at transportation terminals and stations care most about being served quickly

6 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how much money, to the *nearest ten cents*, would be in that account after 6 years, assuming no money was added or withdrawn?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

7 Which expression is equivalent to $\dfrac{2x^4 + 8x^3 - 25x^2 - 6x + 14}{x+6}$?

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

2) $2x^3 - 4x^2 - x + 14$

3) $2x^3 - 4x^2 - x + \dfrac{14}{x+6}$

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

8 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 $0 \le t \le 6$
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

9 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 $(b, 0)$.

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

11 If $ae^{bt} = c$, where a, b, and c are positive, then t equals

1) $\ln\left(\dfrac{c}{ab}\right)$

2) $\ln\left(\dfrac{cb}{a}\right)$

3) $\dfrac{\ln\left(\dfrac{c}{a}\right)}{b}$

4) $\dfrac{\ln\left(\dfrac{c}{a}\right)}{\ln b}$

12 Given $\cos\theta = \dfrac{7}{25}$, 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) $-\dfrac{24}{25}$

2) $-\dfrac{24}{7}$

3) $\dfrac{24}{25}$

4) $\dfrac{24}{7}$

13 Given $p(\theta) = 3\sin\left(\frac{1}{2}\theta\right)$ on the interval

$-\pi < \theta < \pi$, the function p
1) decreases, then increases
2) increases, then decreases
3) decreases throughout the interval
4) increases throughout the interval

14 If $n = \sqrt{a^5}$ and $m = a$, where $a > 0$, an expression

for $\dfrac{n}{m}$ could be

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

2) a^4

3) $\sqrt[3]{a^2}$

4) $\sqrt{a^3}$

15 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.

16 Which description could represent the graph of
$f(x) = 4x^2(x+a) - x - a$, if a is an integer?
1) As $x \to -\infty, f(x) \to \infty$, as $x \to \infty, f(x) \to \infty$,
and the graph has 3 x-intercepts.
2) As $x \to -\infty, f(x) \to -\infty$, as $x \to \infty, f(x) \to \infty$,
and the graph has 3 x-intercepts.
3) As $x \to -\infty, f(x) \to \infty$, as $x \to \infty, f(x) \to -\infty$,
and the graph has 4 x-intercepts.
4) As $x \to -\infty, f(x) \to -\infty$, as $x \to \infty, f(x) \to \infty$,
and the graph has 4 x-intercepts.

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

18 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) $f(x) \div g(x)$

19 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

20 Which table best represents an exponential relationship?

1)

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

2)

x	y
8	0
4	1
0	2
−4	3
−8	4

3)

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

4)

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

21 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

22 Consider the system below.
$$x + y + z = 9$$
$$x - y - z = -1$$
$$x - y + z = 21$$
Which value is *not* in the solution, (x, y, z), of the system?
1) −8
2) −6
3) 11
4) 4

23 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) $\dfrac{124}{16x + y}$
2) $\dfrac{x + 16y}{124}$
3) $\dfrac{124}{x + 16y}$
4) $\dfrac{16x + y}{124}$

4

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

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

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

1) $\dfrac{59,000 - 59,000(1.1)^5}{1 - 1.1}$

2) $\dfrac{59,000 - 59,000(0.1)^5}{1 - 0.1}$

3) $\displaystyle\sum_{n=1}^{5} 59,000(1.1)^n$

4) $\displaystyle\sum_{n=1}^{5} 59,000(0.1)^{n-1}$

25 Consider $f(x) = 4x^2 + 6x - 3$, and $p(x)$ defined by the graph below.
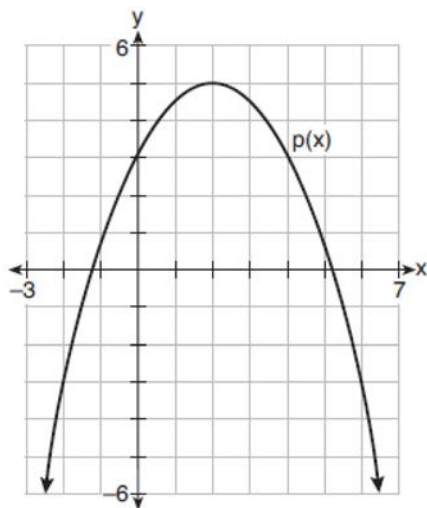
The difference between the values of the maximum of p and minimum of f is
1) 0.25
2) 1.25
3) 3.25
4) 10.25

26 What is the solution set of the equation $\dfrac{2}{x} - \dfrac{3x}{x+3} = \dfrac{x}{x+3}$?
1) $\{3\}$
2) $\left\{\dfrac{3}{2}\right\}$
3) $\{-2,3\}$
4) $\left\{-1,\dfrac{3}{2}\right\}$

27 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%

28 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) $-3x^2 - 6xi - 18$

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

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

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

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

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

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

33 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.
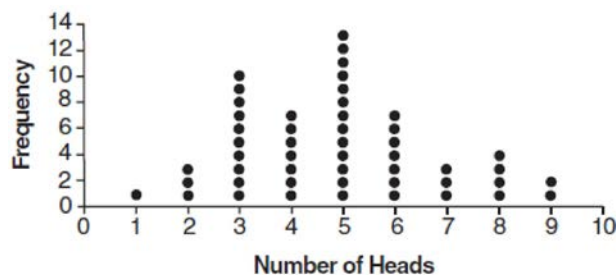
Based on the results of the simulation, which statement is *false*?

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.

34 For all real values of x, if $f(x) = (x-3)^2$ and $g(x) = (x+3)^2$, what is $f(x) - g(x)$?

1) -18
2) 0
3) $-12x$
4) $2x^2 - 12x - 18$

6

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

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

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

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

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

36 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.

37 What is the solution set of the equation $\dfrac{10}{x^2 - 2x} + \dfrac{4}{x} = \dfrac{5}{x - 2}$?
1) $\{0, 2\}$
2) $\{0\}$
3) $\{2\}$
4) $\{\ \}$

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

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

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

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

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

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

40 The depth of the water at a marker 20 feet from the shore in a bay is depicted in the graph below.
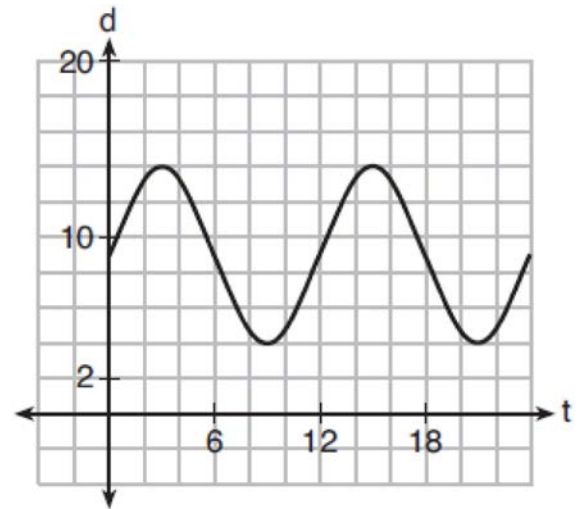
If the depth, d, is measured in feet and time, t, is measured in hours since midnight, what is an equation for the depth of the water at the marker?

1) $d = 5\cos\left(\dfrac{\pi}{6}t\right) + 9$

2) $d = 9\cos\left(\dfrac{\pi}{6}t\right) + 5$

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

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

41 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) $a_n = 2.5 + 0.5n$

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

1) $-\dfrac{\sqrt{7}}{4}$

2) $\dfrac{\sqrt{7}}{4}$

3) $-\dfrac{5}{4}$

4) $\dfrac{5}{4}$

43 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

44 In watching auditions for lead singer in a band, Liem became curious as to whether there is an association between how animated the leadsinger is and the amount of applause from the audience. He decided to watch each singer and rate the singer on a scale of 1 to 5, where 1 is the least animated and 5 is the most animated. He did this for all 5 nights of auditions and found that the more animated singers did receive louder applause. The study Liem conducted would be best described as

1) experimental
2) observational
3) a sample survey
4) a random assignment

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

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

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

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

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

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

47 Given $x \neq -2$, the expression $\dfrac{2x^2 + 5x + 8}{x+2}$ is equivalent to

1) $2x^2 + \dfrac{9}{x+2}$

2) $2x + \dfrac{7}{x+2}$

3) $2x + 1 + \dfrac{6}{x+2}$

4) $2x + 9 - \dfrac{10}{x+2}$

48 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

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

50 Consider the function $f(x) = 2x^3 + x^2 - 18x - 9$. Which statement is true?
1) $2x - 1$ is a factor of $f(x)$.
2) $x - 3$ is a factor of $f(x)$.
3) $f(3) \neq f\left(-\dfrac{1}{2}\right)$
4) $f\left(\dfrac{1}{2}\right) = 0$

51 Given $x \neq -3$, the expression $\dfrac{2x^3 + 7x^2 - 3x - 25}{x+3}$ is equivalent to

1) $2x^2 + x - 6 - \dfrac{7}{x+3}$

2) $2x^2 + 13x - 36 + \dfrac{83}{x+3}$

3) $2x^2 + x - 13$

4) $x^2 + 4x - 15 + \dfrac{20}{x+3}$

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

53 As θ increases from $-\dfrac{\pi}{2}$ to 0 radians, the value of $\cos\theta$ will
1) decrease from 1 to 0
2) decrease from 0 to −1
3) increase from −1 to 0
4) increase from 0 to 1

54 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

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

$A(t) = A_0(0.5)^{\frac{t}{0.0803}}$, where A_0 represents the initial amount of the substance. An equivalent form of this equation is
1) $A(t) = A_0(0.000178)^t$
2) $A(t) = A_0(0.945861)^t$
3) $A(t) = A_0(0.04015)^t$
4) $A(t) = A_0(1.08361)^t$

56 Which expression(s) are equivalent to $\dfrac{x^2 - 4x}{2x}$, where $x \neq 0$?

   I. $\dfrac{x}{2} - 2$ II. $\dfrac{x-4}{2}$ III. $\dfrac{x-1}{2} - \dfrac{3}{2}$
1) II, only
2) I and II
3) II and III
4) I, II, and III

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

58 An angle, θ, is rotated counterclockwise on the unit circle, with its terminal side in the second quadrant, as shown in the diagram below.
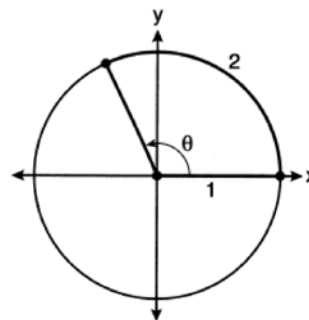
Which value represents the radian measure of angle θ?
1) 1
2) 2
3) 65.4
4) 114.6

59 If $\left(a^3 + 27\right) = (a+3)\left(a^2 + ma + 9\right)$, then m equals
1) −9
2) −3
3) 3
4) 6

60 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

61 Consider the system of equations below:

$$x + y - z = 6$$

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

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

Which number is *not* the value of any variable in the solution of the system?
1) -1
2) 2
3) 3
4) -4

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

63 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) $5x^2 + x - 3$

64 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) $(3,0)$

65 Consider the following patterns:
I. $16, -12, 9, -6.75, \ldots$
II. $1, 4, 9, 16, \ldots$
III. $6, 18, 30, 42, \ldots$
IV. $\dfrac{1}{2}, \dfrac{2}{3}, \dfrac{3}{4}, \dfrac{4}{5}, \ldots$

Which pattern is geometric?
1) I
2) II
3) III
4) IV

66 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

67 What is the inverse of $f(x) = \dfrac{x}{x + 2}$, where $x \neq -2$?
1) $f^{-1}(x) = \dfrac{2x}{x - 1}$
2) $f^{-1}(x) = \dfrac{-2x}{x - 1}$
3) $f^{-1}(x) = \dfrac{x}{x - 2}$
4) $f^{-1}(x) = \dfrac{-x}{x - 2}$

11

68 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

69 The expression $\left(a\sqrt[3]{2b^2} \right)\left(\sqrt[3]{4a^2 b} \right)$ is equivalent
to
1) $2ab\sqrt[3]{a^2}$
2) $2ab$
3) $2ab\sqrt[3]{2a^2}$
4) $2a^2 b\sqrt[3]{2b}$

70 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) $x = y + 2z$

71 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

72 Which graph represents a polynomial function that
contains $x^2 + 2x + 1$ as a factor?
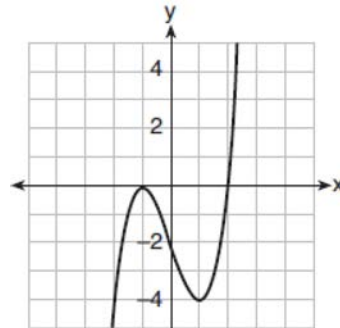
1)
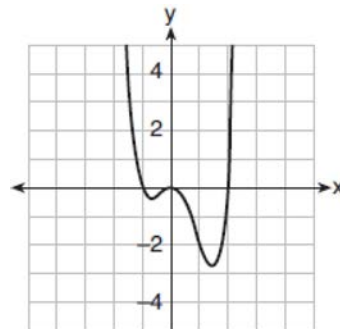
2)
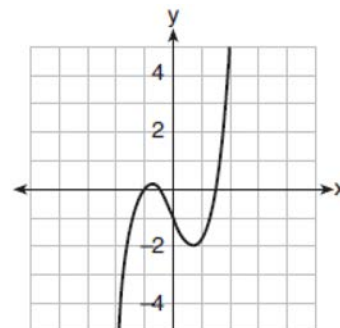
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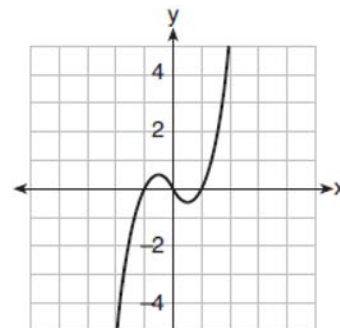
4)

73 The J& B candy company claims that 45% of the candies it produces are blue, 30% are brown, and 25% are yellow. Each bag holds 65 candies. A simulation was run 200 times, each of sample size 65, based on the premise that 45% of the candies are blue. The results of the simulation are shown below.
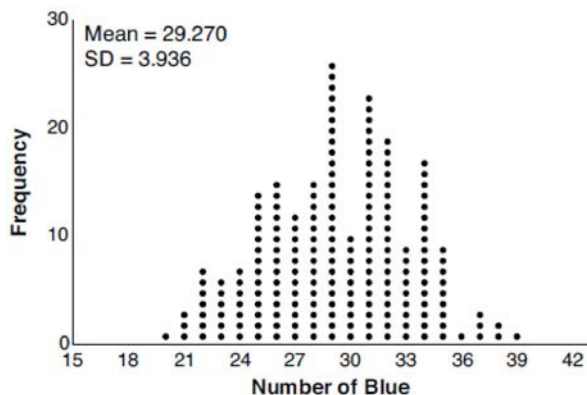
Bonnie purchased a bag of J& B's candy and counted 24 blue candies. What inference can be made regarding a bag of J& B's with only 24 blue candies?
1) The company is not meeting their production standard.
2) Bonnie's bag was a rarity and the company should not be concerned.
3) The company should change their claim to 37% blue candies are produced.
4) Bonnie's bag is within the middle 95% of the simulated data supporting the company's claim.

74 Given $y > 0$, the expression $\sqrt{3x^2y} \bullet \sqrt[3]{27x^3y^2}$ is equivalent to
1) $81x^5y^3$
2) $3^{1.5}x^2y$
3) $3^{\frac{5}{2}}x^2y^{\frac{5}{3}}$
4) $3^{\frac{3}{2}}x^2y^{\frac{7}{6}}$

75 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.
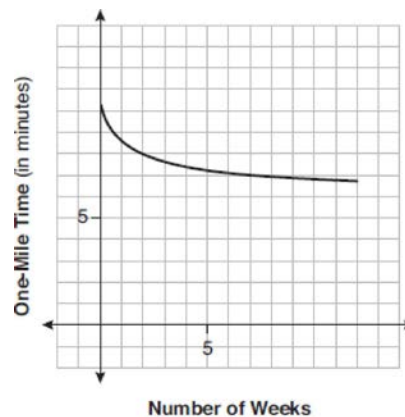

Which statement regarding Irma's one-mile training program is correct?
1) Her one-mile speed increased as the number of weeks increased.
2) Her one-mile speed decreased as the number of weeks increased.
3) If the trend continues, she will run under a six-minute mile by week thirteen.
4) She reduced her one-mile time the most between weeks ten and twelve.

76 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) $-\frac{\sqrt{8}}{3}$

13

77 The graph below represents national and New York State average gas prices.
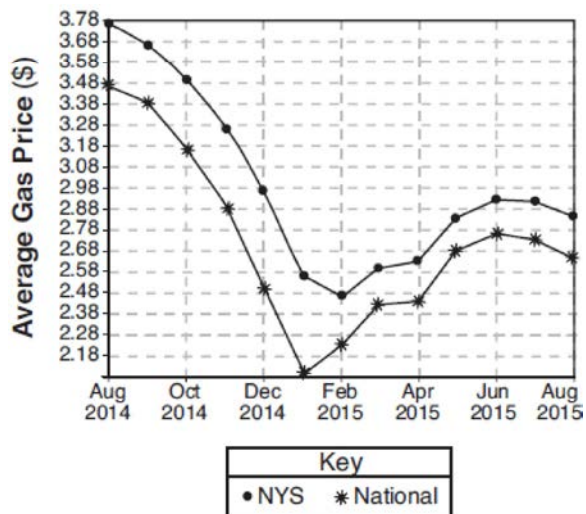
If New York State's gas prices are modeled by $G(x)$ and $C > 0$, which expression best approximates the national average x months from August 2014?
1) $G(x + C)$
2) $G(x) + C$
3) $G(x - C)$
4) $G(x) - C$

78 Mrs. Favata's statistics class wants to conduct a survey to see how students feel about changing the school mascot's name. Which plan is the best process for gathering an appropriate sample?
1) Survey students in a random sample of senior homerooms.
2) Survey every tenth student entering art classes in the school.
3) Survey every fourth student entering the cafeteria during each lunch period.
4) Survey all members of the school's varsity sports teams.

79 Data for the students enrolled in a local high school are shown in the Venn diagram below.
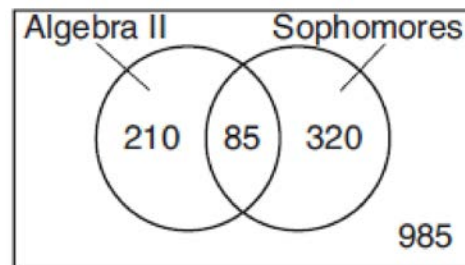
If a student from the high school is selected at random, what is the probability that the student is a sophomore given that the student is enrolled in Algebra II?
1) $\dfrac{85}{210}$
2) $\dfrac{85}{295}$
3) $\dfrac{85}{405}$
4) $\dfrac{85}{1600}$

80 The solution set for the equation $b = \sqrt{2b^2 - 64}$ is
1) $\{-8\}$
2) $\{8\}$
3) $\{\pm 8\}$
4) $\{\ \}$

81 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 $P(1) = 0$.

14

82 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?
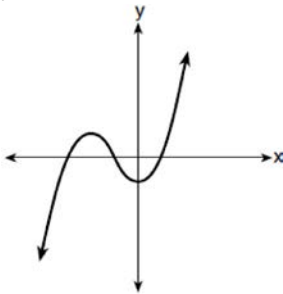
1) 7
2) 20
3) 68
4) 125

83 Consider the end behavior description below.
- as $x \to -\infty, f(x) \to \infty$
- as $x \to \infty, f(x) \to -\infty$

Which function satisfies the given conditions?

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

2)

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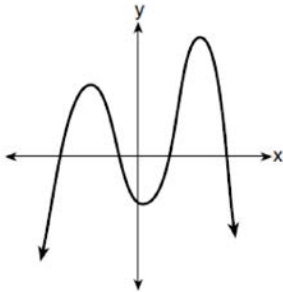
4)

84 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

85 Which expression is equivalent to $\dfrac{x^3 - 2}{x - 2}$?

1) x^2

2) $x^2 + 2x + 4 + \dfrac{6}{x - 2}$

3) $x^2 - 2$

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

86 Given that i is the imaginary unit, the expression $(x - 2i)^2$ is equivalent to

1) $x^2 + 4$

2) $x^2 - 4$

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

4) $x^2 - 4xi - 4$

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

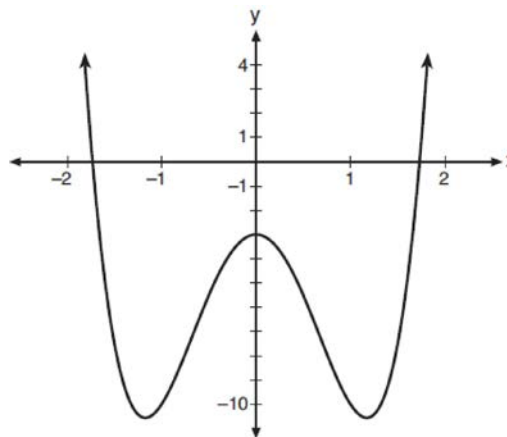$$M = \frac{P\left(\frac{r}{12}\right)\left(1 + \frac{r}{12}\right)^n}{\left(1 + \frac{r}{12}\right)^n - 1}$$

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

1) $1379.09

2) $1604.80

3) $1835.98

4) $9011.94

88 For all positive values of x, which expression is equivalent to $x^{\frac{3}{4}}$?

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

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

3) $\left(x^3\right)^4$

4) $3\left(x^4\right)$

89 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.

90 What is the solution set of the equation $\frac{4}{k^2 - 8k + 12} = \frac{k}{k - 2} + \frac{1}{k - 6}$?

1) $\{-1,6\}$

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

3) $\{-1\}$

4) $\{1\}$

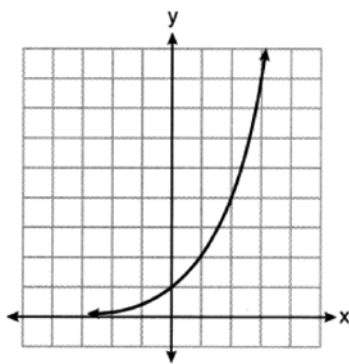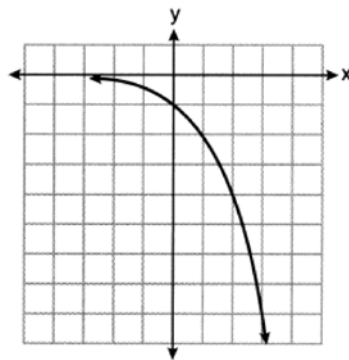91 Given the polynomial identity $x^6 + y^6 = (x^2 + y^2)(x^4 - x^2 y^2 + y^4)$, which equation must also be true for all values of x and y?

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

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

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

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

93 Written in simplest form, the fraction $\dfrac{x^3 - 9x}{9 - x^2}$, where $x \neq \pm 3$, is equivalent to

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

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

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

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

96 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) $\{(0,6),(5,21)\}$

97 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) $8x - 4i$

98 Consider the system of equations below?

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

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

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

What is the solution to the given system of equations?
1) $(1,1,2)$
2) $(3,-1,0)$
3) $(5,-1,2)$
4) $(3,5,8)$

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

100 Which statement below about the graph of
$f(x) = -\log(x + 4) + 2$ is true?
1) $f(x)$ has a y-intercept at $(0,2)$.
2) $-f(x)$ has a y-intercept at $(0,2)$.
3) As $x \to \infty, f(x) \to \infty$.
4) $x \to -4, f(x) \to \infty$.

101 What is the inverse of $f(x) = -6(x - 2)$?
1) $f^{-1}(x) = -2 - \dfrac{x}{6}$
2) $f^{-1}(x) = 2 - \dfrac{x}{6}$
3) $f^{-1}(x) = \dfrac{1}{-6(x - 2)}$
4) $f^{-1}(x) = 6(x + 2)$

102 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

103 The growth of a $500 investment can be modeled by the function $P(t) = 500(1.03)^t$, where t represents time in years. In terms of the monthly rate of growth, the value of the investment can be best approximated by
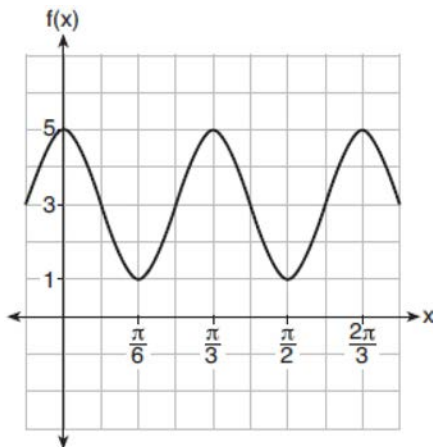1) $P(t) = 500(1.00247)^{12t}$
2) $P(t) = 500(1.00247)^t$
3) $P(t) = 500(1.03)^{12t}$
4) $P(t) = 500(1.03)^{\frac{t}{12}}$

18

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

Which equation is *not* equivalent?

1) $y = 2.5 - 2.5\left(2.7^{-.10x}\right)$

2) $y = 2.5 - 2.5\left(\left(2.7^2\right)^{-.05x}\right)$

3) $y = 2.5 - 2.5\left(\dfrac{1}{2.7^{.10x}}\right)$

4) $y = 2.5 - 2.5\left(2.7^{-2}\right)\left(2.7^{.05x}\right)$

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

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

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

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

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

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

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

Using this function, the amplitude of the tide is

1) $\dfrac{\pi}{6}$
2) 4.8
3) 3
4) 5.1

109 Which situation best describes conditional probability?

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

110 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) $y = -6$

111 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

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

113 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

114 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) $\pm 2i, 2$

115 At her job, Pat earns \$25,000 the first year and receives a raise of \$1000 each year. The explicit formula for the nth 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) $a_1 = 25,000, a_n = a_{n+1} + 1000$

116 The solutions to the equation $5x^2 - 2x + 13 = 9$ are
1) $\dfrac{1}{5} \pm \dfrac{\sqrt{21}}{5}$
2) $\dfrac{1}{5} \pm \dfrac{\sqrt{19}}{5} i$
3) $\dfrac{1}{5} \pm \dfrac{\sqrt{66}}{5} i$
4) $\dfrac{1}{5} \pm \dfrac{\sqrt{66}}{5}$

117 Which investigation technique is most often used to determine if a single variable has an impact on a given population?
1) observational study
2) random survey
3) controlled experiment
4) formal interview

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

1) $3x - 1 - \dfrac{1}{3x + 1}$

2) $3x - 1 + \dfrac{1}{3x + 1}$

3) $3x + 1 - \dfrac{1}{3x + 1}$

4) $3x + 1 + \dfrac{1}{3x + 1}$

119 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) $(-2, -1)$

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

121 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) $400(1.001121184)^{52t}$

122 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

123 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

124 Emmeline is working on one side of a polynomial identity proof used to form Pythagorean triples. Her work is shown below:

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

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

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

Step 3: $50x^2 + 25$

Step 4: $75x^2$

What statement is true regarding Emmeline's work?

1) Emmeline's work is entirely correct.
2) There is a mistake in step 2, only.
3) There are mistakes in step 2 and step 4.
4) There is a mistake in step 4, only.

125 Sodium iodide-131, used to treat certain medical conditions, has a half-life of 1.8 hours. The data table below shows the amount of sodium iodide-131, rounded to the nearest thousandth, as the dose fades over time.

Number of Half Lives	1	2	3	4	5
Amount of Sodium Iodide-131	139.000	69.500	34.750	17.375	8.688

What approximate amount of sodium iodide-131 will remain in the body after 18 hours?
1) 0.001
2) 0.136
3) 0.271
4) 0.543

126 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, $P(F \mid D)$ is
1) 0.344
2) 0.3648
3) 0.57
4) 0.8

127 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

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

129 Susan won $2,000 and invested it into an account with an annual interest rate of 3.2%. If her investment were compounded monthly, which expression best represents the value of her investment after t years?
1) $2000(1.003)^{12t}$
2) $2000(1.032)^{\frac{t}{12}}$
3) $2064^{\frac{t}{12}}$
4) $\dfrac{2000(1.032)^t}{12}$

130 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

131 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

132 The solution of $87e^{0.3x} = 5918$, to the *nearest thousandth*, is
1) 0.583
2) 1.945
3) 4.220
4) 14.066

133 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) $x(x + a) + b(x + a)$

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

1)

2)

3)

4)

23
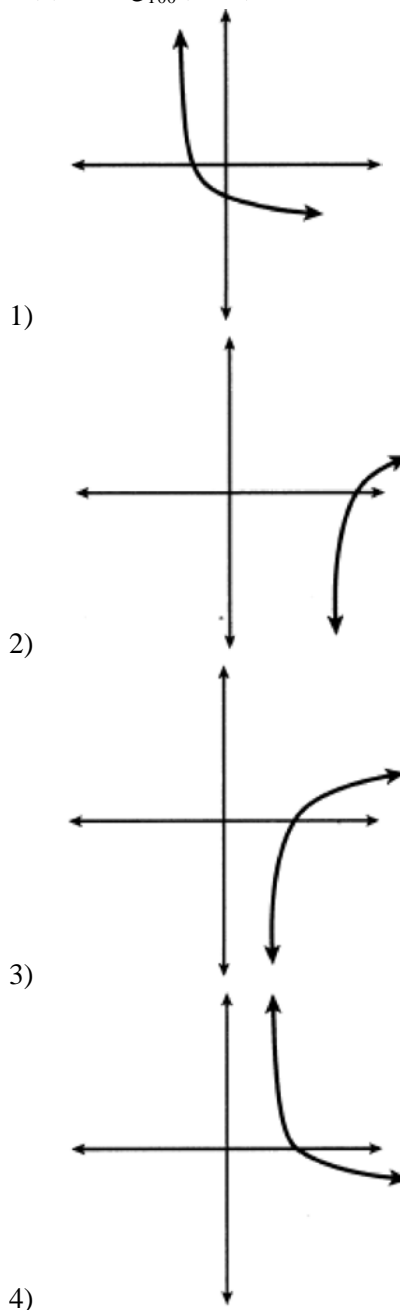
135 What is the solution when the equation $wx^2 + w = 0$ is solved for x, where w is a positive integer?
1) -1
2) 0
3) 6
4) $\pm i$

136 The function $N(x) = 90(0.86)^x + 69$ can be used to predict the temperature of a cup of hot chocolate in degrees Fahrenheit after x minutes. What is the approximate average rate of change of the temperature of the hot chocolate, in degrees per minute, over the interval $[0,6]$?
1) -8.93
2) -0.11
3) 0.11
4) 8.93

137 The half-life of iodine-131 is 8 days. The percent of the isotope left in the body d days after being introduced is $I = 100\left(\dfrac{1}{2}\right)^{\frac{d}{8}}$. 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

138 Expressed in simplest $a + bi$ form, $(7 - 3i) + (x - 2i)^2 - (4i + 2x^2)$ is
1) $(3 - x^2) - (4x + 7)i$
2) $(3 + 3x^2) - (4x + 7)i$
3) $(3 - x^2) - 7i$
4) $(3 + 3x^2) - 7i$

139 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) $\dfrac{(x - 1)(x^2 - 6x - 7)}{(x + 1)}$
4) $\dfrac{(x + 7)(x^2 + 4x + 3)}{(x + 3)}$

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

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

24

142 A group of students was trying to determine the proportion of candies in a bag that are blue. The company claims that 24% of candies in bags are blue. A simulation was run 100 times with a sample size of 50, based on the premise that 24% of the candies are blue. The approximately normal results of the simulation are shown in the dot plot below.
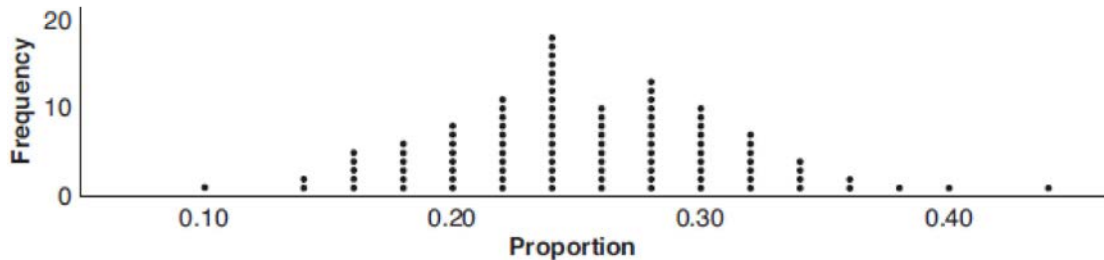
The simulation results in a mean of 0.254 and a standard deviation of 0.060. Based on this simulation, what is a plausible interval containing the middle 95% of the data?
1) (0.194, 0.314)   3) (−0.448, 0.568)
2) (0.134, 0.374)   4) (0.254, 0.374)

143 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

144 The expression $2 - \dfrac{x-1}{x+2}$ is equivalent to

1) $1 - \dfrac{3}{x+2}$

2) $1 + \dfrac{3}{x+2}$

3) $1 - \dfrac{1}{x+2}$

4) $1 + \dfrac{1}{x+2}$

145 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) $[1, 30]$

146 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

25

147 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, $x = 0$.

148 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

149 For positive values of x, which expression is equivalent to $\sqrt{16x^2} \cdot x^{\frac{2}{3}} + \sqrt[3]{8x^5}$

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

150 A function is defined as $a_n = a_{n-1} + \log_{n+1}(n-1)$, where $a_1 = 8$. What is the value of a_3?
1) 8
2) 8.5
3) 9.2
4) 10

151 A recursive formula for the sequence $64, 48, 36, \ldots$ is
1) $a_n = 64(0.75)^{n-1}$
2) $a_1 = 64$
   $a_n = a_{n-1} - 16$
3) $a_n = 64 + (n-1)(-16)$
4) $a_1 = 64$
   $a_n = 0.75a_{n-1}$

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

153 The amount of a substance, $A(t)$, in grams, remaining after t days is modeled by

$A(t) = 50(0.5)^{\frac{t}{3}}$. Which statement is false?
1) In 20 days, there is no substance remaining.
2) After two half-lives, there is 25% of the substance remaining.
3) The amount of the substance remaining can also be modeled by

$A(t) = 50(2)^{\frac{-t}{3}}$.
4) After one week, there is less than 10g of the substance remaining.

154 A rush-hour commuter train has arrived on time 64 of its first 80 days. As arrivals continue, which equation can be used to find x, the number of consecutive days that the train must arrive on schedule to raise its on-time performance rate to 90%?

1) $\dfrac{64}{80+x} = \dfrac{90}{100}$

2) $\dfrac{64+x}{80+x} = \dfrac{90}{100}$

3) $\dfrac{64+x}{80} = \dfrac{90}{100}$

4) $\dfrac{x}{80+x} = \dfrac{90}{100}$

155 In the diagram of a unit circle below, point A, $\left(-\dfrac{\sqrt{3}}{2}, \dfrac{1}{2}\right)$, represents the point where the terminal side of θ intersects the unit circle.
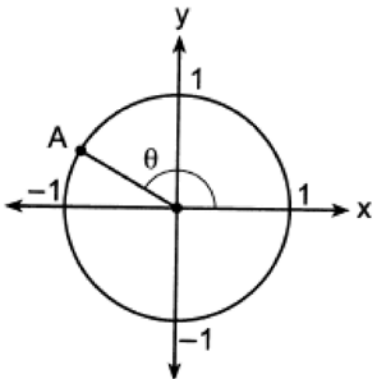
What is m$\angle\theta$?
1) 30°
2) 120°
3) 135°
4) 150°

156 Consider the probability statements regarding events A and B below.

$P(A \text{ or } B) = 0.3$;
$P(A \text{ and } B) = 0.2$; and
$P(A|B) = 0.8$

What is $P(B)$?
1) 0.1
2) 0.25
3) 0.375
4) 0.667

157 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

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

1) 3

2) $-\dfrac{17}{2}$

3) $\dfrac{x+3}{x}$

4) $\dfrac{x^2 - 9}{x(x-3)}$

159 In a group of 40 people, 20 have brown hair, 22 have blue eyes, and 15 have both brown hair and blue eyes. How many people have neither brown hair nor blue eyes?
1) 0
2) 13
3) 27
4) 32

160 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

161 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%

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

163 A 4th degree polynomial has zeros -5, 3, i, and $-i$. Which graph could represent the function defined by this polynomial?
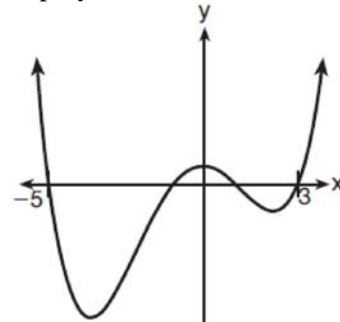
1)
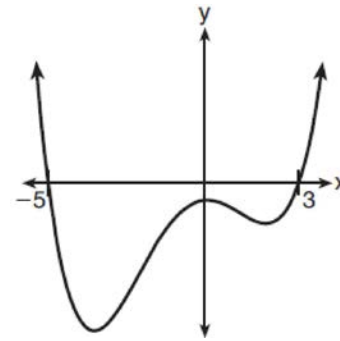
2)
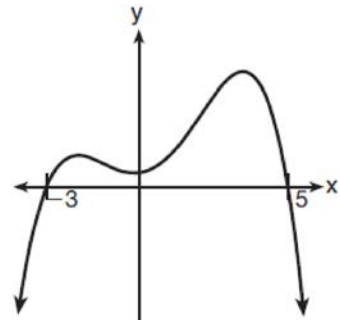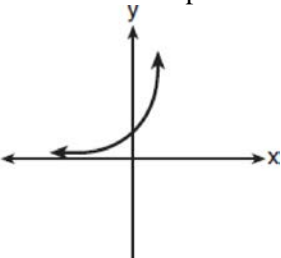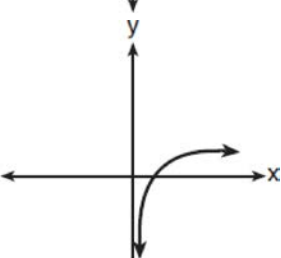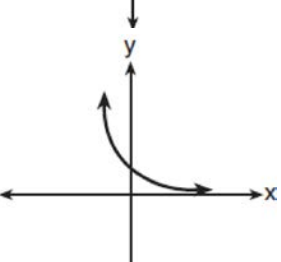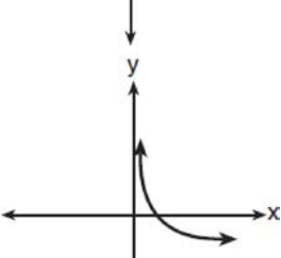

3)
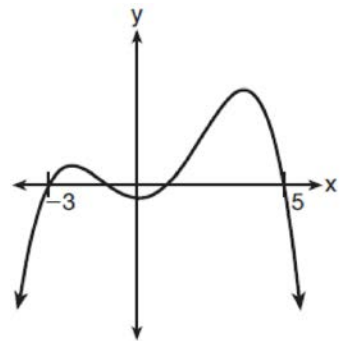
4)

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

1)

2)

3)

4)

165 What is the total number of points of intersection of the graphs of the equations $y = e^x$ and $xy = 20$?
1) 1
2) 2
3) 3
4) 0

166 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

167 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

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

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

29

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

g(x)

x	t(x)
−1	3
0	5
1	2
2	−5
3	−1
4	3
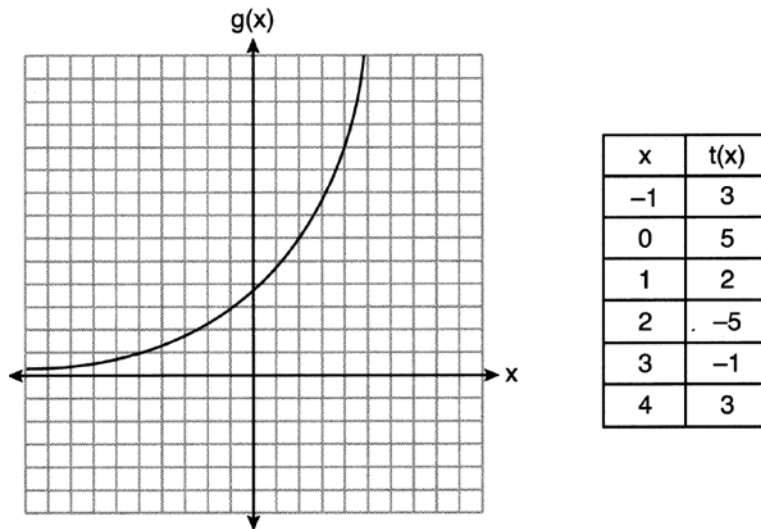
Over the interval [2,4], which statement regarding the average rate of change for g and t is true?

1) g has a greater average rate of change.

2) The average rates of change are equal.

3) The average rate of change for g is twice the average rate of change for t.

4) The average rate of change for g is half the average rate of change for t.

171 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.

172 How many solutions exist for

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

1) 1

2) 2

3) 3

4) 4

173 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

30

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

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

175 Which value, to the *nearest tenth*, is the *smallest* solution of $f(x) = g(x)$ if $f(x) = 3\sin\left(\dfrac{1}{2}x\right) - 1$ and $g(x) = x^3 - 2x + 1$?

1) -3.6
2) -2.1
3) -1.8
4) 1.4

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

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

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

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

178 For $x > 0$, which expression is equivalent to $\dfrac{\sqrt[3]{x^2} \cdot \sqrt{x^5}}{\sqrt[6]{x}}$?

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

179 A local university has a current enrollment of 12,000 students. The enrollment is increasing continuously at a rate of 2.5% each year. Which logarithm is equal to the number of years it will take for the population to increase to 15,000 students?

1) $\dfrac{\ln 1.25}{0.25}$
2) $\dfrac{\ln 3000}{0.025}$
3) $\dfrac{\ln 1.25}{2.5}$
4) $\dfrac{\ln 1.25}{0.025}$

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

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

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

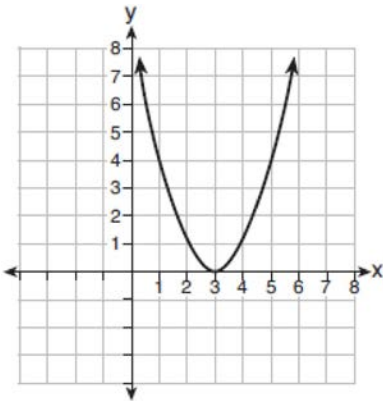| x	f(x)		x	g(x)
−3.12	−4.88		−2.01	−1.01
0	−6		0	0.58
1.23	−4.77		8.52	2.53
8.52	2.53		13.11	3.01
9.01	3.01		16.52	3.29

A solution to the equation $f(x) = g(x)$ is
1) 0
2) 2.53
3) 3.01
4) 8.52

182 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) $2x^2 + 32 = 0$

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

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

2) $3x^4 y^2$

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

4) $9x^4 y^2$

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

1) $f^{-1}(x)$ is a line with slope $\frac{5}{2}$.

2) $f^{-1}(x)$ is a line with slope $\frac{2}{5}$.

3) $f^{-1}(x)$ passes through the point $(6, -5)$.

4) $f^{-1}(x)$ has a y-intercept at $(0, -4)$.

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

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

2) $\log_2 \sqrt{10}$

3) $\log_4 10$

4) $\log_{10} 4$

186 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

187 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) $29,400\left(1.068^{\frac{1}{365}}\right)^{365t}$

188 The heights of the 3300 students at Oceanview High School are approximately normally distributed with a mean of 65.5 inches and a standard deviation of 2.9 inches. The number of students at Oceanview who are between 64 and 68 inches tall is closest to

1) 1660

2) 1070

3) 2244

4) 1640

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

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

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

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

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

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

191 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) $\dfrac{2 - 2(2.5^n)}{1 - 2.5}$

2) $\dfrac{2 - 2(2.5^{n-1})}{1 - 2.5}$

3) $\dfrac{1 - 2.5^n}{1 - 2.5}$

4) $\dfrac{1 - 2.5^{n-1}}{1 - 2.5}$

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

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

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

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

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

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

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

195 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 $0 \le t \le 10$.
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

196 Which statement regarding polynomials and their zeros is true?

1) $f(x) = (x^2 - 1)(x + a)$ has zeros of 1 and $-a$, only.

2) $f(x) = x^3 - ax^2 + 16x - 16a$ has zeros of 4 and a, only.

3) $f(x) = (x^2 + 25)(x + a)$ has zeros of ± 5 and $-a$.

4) $f(x) = x^3 - ax^2 - 9x + 9a$ has zeros of ± 3 and a.

197 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

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

199 A scatterplot showing the weight, w, in grams, of each crystal after growing t hours is shown below.
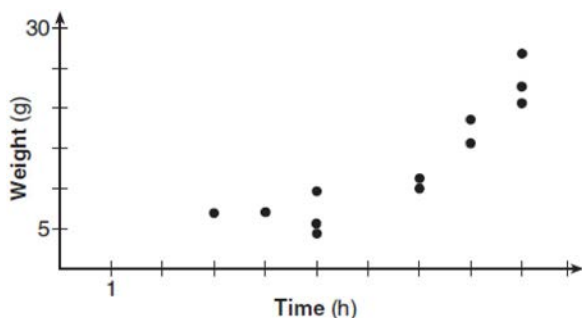
The relationship between weight, w, and time, t, is best modeled by

1) $w = 4^t + 5$
2) $w = (1.4)^t + 2$
3) $w = 5(2.1)^t$
4) $w = 8(.75)^t$

200 The graph of $y = f(x)$ is shown below.
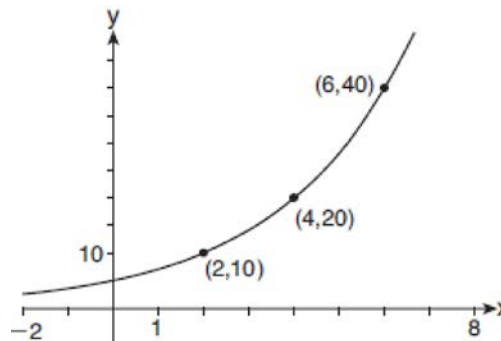
Which expression defines $f(x)$?

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

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

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

202 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%

35

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

204 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

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

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

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

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

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

205 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

207 A recursive formula for the sequence $40, 30, 22.5, \ldots$ is

1) $g_n = 40\left(\dfrac{3}{4}\right)^n$

2) $g_1 = 40$

$g_n = g_{n-1} - 10$

3) $g_n = 40\left(\dfrac{3}{4}\right)^{n-1}$

4) $g_1 = 40$

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

208 A sketch of $r(x)$ is shown below.
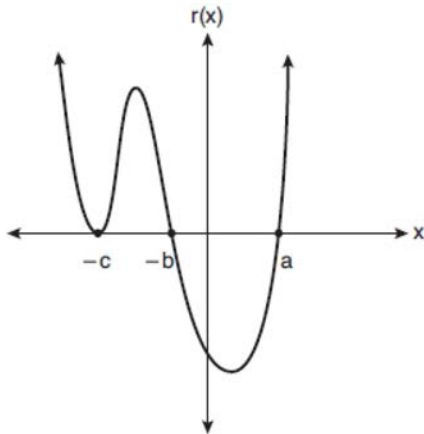
An equation for $r(x)$ could be
1) $r(x) = (x-a)(x+b)(x+c)$
2) $r(x) = (x+a)(x-b)(x-c)^2$
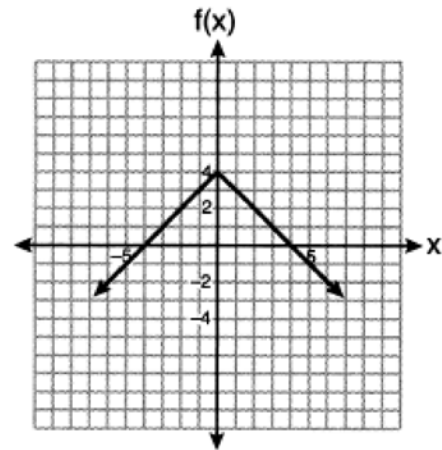3) $r(x) = (x+a)(x-b)(x-c)$
4) $r(x) = (x-a)(x+b)(x+c)^2$

209 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) $(x+6)(x+1)$

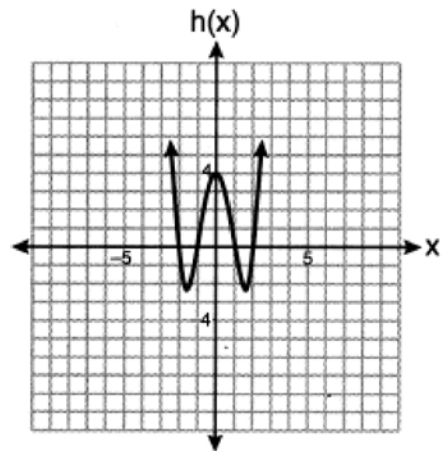210 If $A = -3+5i$, $B = 4-2i$, and $C = 1+6i$, where i is the imaginary unit, then $A - BC$ equals
1) $5 - 17i$
2) $5 + 27i$
3) $-19 - 17i$
4) $-19 + 27i$

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

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

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

212 What is the inverse of the function $y = 4x + 5$?
1) $x = \dfrac{1}{4}y - \dfrac{5}{4}$
2) $y = \dfrac{1}{4}x - \dfrac{5}{4}$
3) $y = 4x - 5$
4) $y = \dfrac{1}{4x+5}$

213 Which function is even?
1) $f(x) = \sin x$
2) $f(x) = x^2 - 4$
3) $f(x) = |x - 2| + 5$
4) $f(x) = x^4 + 3x^3 + 4$

216 Which equation has roots of $3 + i$ and $3 - i$?
1) $x^2 - 6x + 10 = 0$
2) $x^2 + 6x - 10 = 0$
3) $x^2 - 10x + 6 = 0$
4) $x^2 + 10x - 6 = 0$

214 The equation $t = \dfrac{1}{0.0105} \ln\left(\dfrac{A}{5000}\right)$ 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].

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

1)

2)

215 3Written in simplest form, $\dfrac{c^2 - d^2}{d^2 + cd - 2c^2}$ where
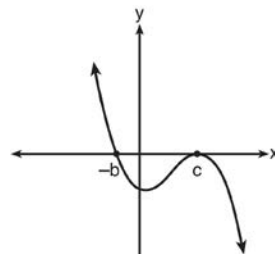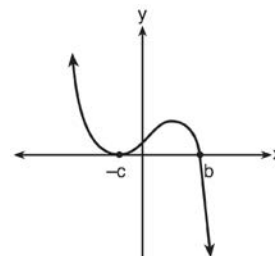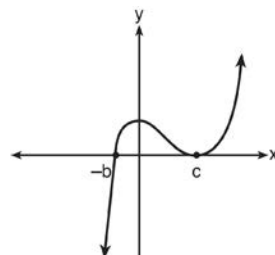
$c \neq d$, is equivalent to
1) $\dfrac{c + d}{d + 2c}$
2) $\dfrac{c - d}{d + 2c}$
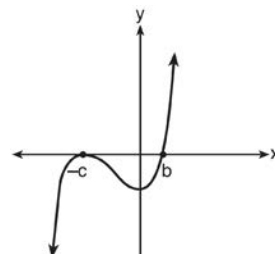3) $\dfrac{-c - d}{d + 2c}$
4) $\dfrac{-c + d}{d + 2c}$

3)

4)

38

Algebra II Multiple Choice Regents Exam Questions

218 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.

219 Which expression is equivalent to $\dfrac{4x^3 + 9x - 5}{2x - 1}$,
where $x \neq \dfrac{1}{2}$?
1) $2x^2 + x + 5$
2) $2x^2 + \dfrac{11}{2} + \dfrac{1}{2(2x - 1)}$
3) $2x^2 - x + 5$
4) $2x^2 - x + 4 + \dfrac{1}{2x - 1}$

220 The solution set for the equation
$\sqrt{x + 14} - \sqrt{2x + 5} = 1$ is
1) $\{-6\}$
2) $\{2\}$
3) $\{18\}$
4) $\{2, 22\}$

221 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

222 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

223 Which expression has been rewritten correctly to form a true statement?
1) $(x + 2)^2 + 2(x + 2) - 8 = (x + 6)x$
2) $x^4 + 4x^2 + 9x^2 y^2 - 36y^2 = (x + 3y)^2 (x - 2)^2$
3) $x^3 + 3x^2 - 4xy^2 - 12y^2 = (x - 2y)(x + 3)^2$
4) $(x^2 - 4)^2 - 5(x^2 - 4) - 6 = (x^2 - 7)(x^2 - 6)$

224 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) $t = 11$

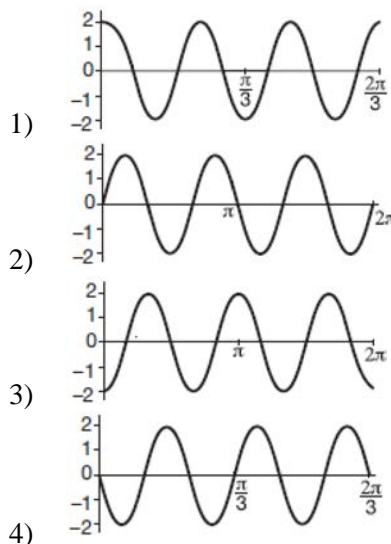225 Functions f, g, and h are given below.

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

$$g(x) = f(x) + 1$$
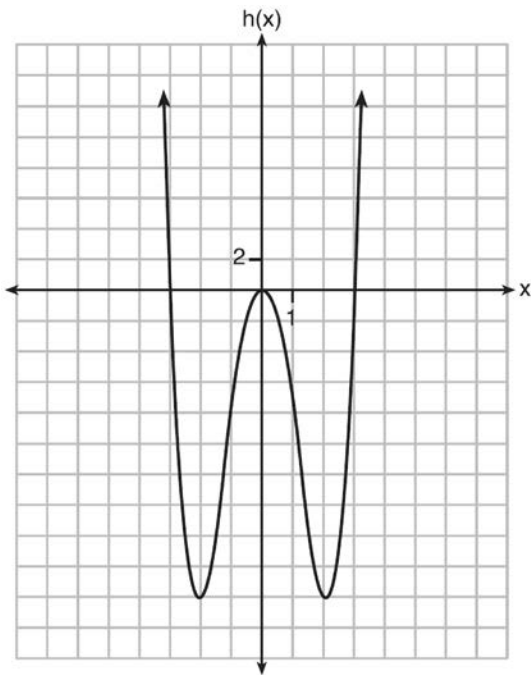
Which statement is true about functions f, g, and h?
1) $f(x)$ and $g(x)$ are odd, $h(x)$ is even.
2) $f(x)$ and $g(x)$ are even, $h(x)$ is odd.
3) $f(x)$ is odd, $g(x)$ is neither, $h(x)$ is even.
4) $f(x)$ is even, $g(x)$ is neither, $h(x)$ is odd.

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

227 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

228 Which binomial is a factor of $x^4 - 4x^2 - 4x + 8$?
1) $x - 2$
2) $x + 2$
3) $x - 4$
4) $x + 4$

229 When $b > 0$ and d is a positive integer, the expression $(3b)^{\frac{2}{d}}$ is equivalent to

1) $\dfrac{1}{\left(\sqrt[d]{3b}\right)^2}$

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

3) $\dfrac{1}{\sqrt{3b^d}}$

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

230 To solve $\dfrac{2x}{x-2} - \dfrac{11}{x} = \dfrac{8}{x^2-2x}$, Ren multiplied both sides by the least common denominator. Which statement is true?
1) 2 is an extraneous solution.
2) $\dfrac{7}{2}$ is an extraneous solution.
3) 0 and 2 are extraneous solutions.
4) This equation does not contain any extraneous solutions.

231 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 $-1 - 4i$

232 A game spinner is divided into 6 equally sized regions, as shown in the diagram below.
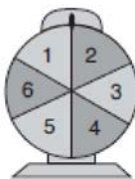
For Miles to win, the spinner must land on the number 6. After spinning the spinner 10 times, and losing all 10 times, Miles complained that the spinner is unfair. At home, his dad ran 100 simulations of spinning the spinner 10 times, assuming the probability of winning each spin is $\dfrac{1}{6}$.

The output of the simulation is shown in the diagram below.
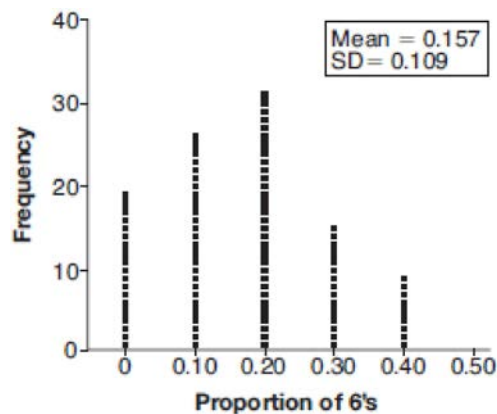
Which explanation is appropriate for Miles and his dad to make?
1) The spinner was likely unfair, since the number 6 failed to occur in about 20% of the simulations.
2) The spinner was likely unfair, since the spinner should have landed on the number 6 by the sixth spin.
3) The spinner was likely not 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.

233 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 $d = 10 \log \dfrac{I}{I_0}$. The threshold sound audible to the average person is 1.0×10^{-12} W/m^2 (watts per square meter). Consider the following sound level classifications:

Moderate	45-69 dB
Loud	70-89 dB
Very loud	90-109 dB
Deafening	>110 dB

How would a sound with intensity 6.3×10^{-3} W/m^2 be classified?
1) moderate
2) loud
3) very loud
4) deafening

234 Given $f^{-1}(x) = -\dfrac{3}{4}x + 2$, which equation represents $f(x)$?

1) $f(x) = \dfrac{4}{3}x - \dfrac{8}{3}$

2) $f(x) = -\dfrac{4}{3}x + \dfrac{8}{3}$

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

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

235 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

236 Which statement is *incorrect* for the graph of the function $y = -3 \cos\left[\dfrac{\pi}{3}(x-4)\right] + 7$?

1) The period is 6.
2) The amplitude is 3.
3) The range is [4,10].
4) The midline is $y = -4$.

237 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) $9k^2 - 12ki + 4$
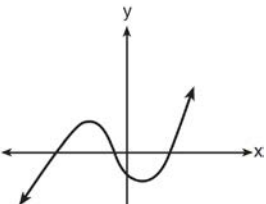
238 Which graph has the following characteristics?
- three real zeros
- as $x \to -\infty$, $f(x) \to -\infty$
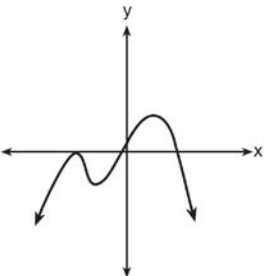- as $x \to \infty$, $f(x) \to \infty$
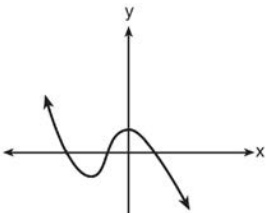
1)
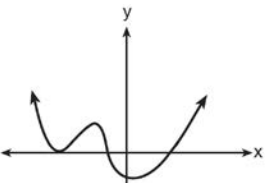
2)

3)

4)

239 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

240 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 $g(x)$.

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

242 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) $300e^{-0.42}$

243 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.
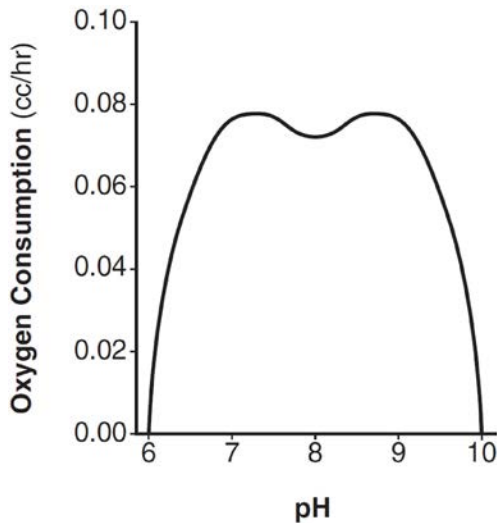
Which statement about this function is *incorrect*?
1) The degree of the polynomial is even.
2) There is a positive leading coefficient.
3) At two pH values, there is a relative maximum value.
4) There are two intervals where the function is decreasing.

244 When $g(x) = \dfrac{2}{x+2}$ 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) $(1.4, 3.4)$

245 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.

246 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

$H(t) = 70\sin\left(\dfrac{2\pi}{7}(t - 1.75)\right) + 80$, where t is time, in minutes. Using $H(t)$ for one full rotation, this car's minimum height, in feet, is
1) 150
2) 70
3) 10
4) 0

247 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) $4(x-3)^2 + 4(y+9)^2 = 436$

248 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

249 The expression $\dfrac{6x^3 + 17x^2 + 10x + 2}{2x + 3}$ equals

1) $3x^2 + 4x - 1 + \dfrac{5}{2x + 3}$

2) $6x^2 + 8x - 2 + \dfrac{5}{2x + 3}$

3) $6x^2 - x + 13 - \dfrac{37}{2x + 3}$

4) $3x^2 + 13x + \dfrac{49}{2} + \dfrac{151}{2x + 3}$

250 The expression $\dfrac{-3x^2 - 5x + 2}{x^3 + 2x^2}$ can be rewritten as

1) $\dfrac{-3x - 3}{x^2 + 2x}$

2) $\dfrac{-3x - 1}{x^2}$

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

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

251 The solution set for the equation $\sqrt{56 - x} = x$ is
1) $\{-8, 7\}$
2) $\{-7, 8\}$
3) $\{7\}$
4) $\{\ \}$

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

1) $ac(b + d)^x$

2) $ac(b + d)^{2x}$

3) $ac(bd)^x$

4) $ac(bd)^{x^2}$

253 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

254 The expression $\dfrac{x^3 + 2x^2 + x + 6}{x + 2}$ is equivalent to

1) $x^2 + 3$

2) $x^2 + 1 + \dfrac{4}{x + 2}$

3) $2x^2 + x + 6$

4) $2x^2 + 1 + \dfrac{4}{x + 2}$

255 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

256 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) $C(n) = \dfrac{329.99 + 108.78n}{n}$
4) $C(n) = \dfrac{329.99 + 326.34n}{n}$

257 What is the solution set of the equation $\dfrac{3x + 25}{x + 7} - 5 = \dfrac{3}{x}$?
1) $\left\{ \dfrac{3}{2}, 7 \right\}$
2) $\left\{ \dfrac{7}{2}, -3 \right\}$
3) $\left\{ -\dfrac{3}{2}, 7 \right\}$
4) $\left\{ -\dfrac{7}{2}, -3 \right\}$

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

259 What is the solution to $8(2^{x+3}) = 48$?
1) $x = \dfrac{\ln 6}{\ln 2} - 3$
2) $x = 0$
3) $x = \dfrac{\ln 48}{\ln 16} - 3$
4) $x = \ln 4 - 3$

260 A recursive formula for the sequence $18, 9, 4.5, \ldots$ is
1) $g_1 = 18$
   $g_n = \dfrac{1}{2} g_{n-1}$
2) $g_n = 18 \left(\dfrac{1}{2} \right)^{n-1}$
3) $g_1 = 18$
   $g_n = 2g_{n-1}$
4) $g_n = 18(2)^{n-1}$

261 The completely factored form of $2d^4 + 6d^3 - 18d^2 - 54d$ is
1) $2d(d^2 - 9)(d + 3)$
2) $2d(d^2 + 9)(d + 3)$
3) $2d(d + 3)^2(d - 3)$
4) $2d(d - 3)^2(d + 3)$

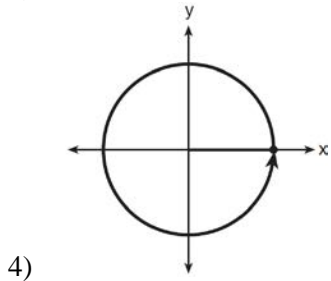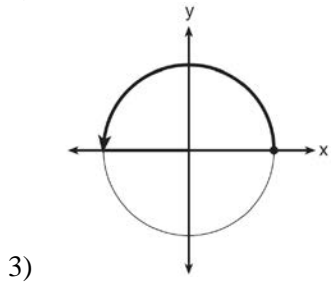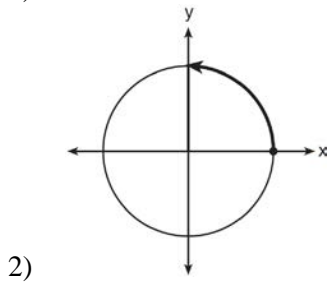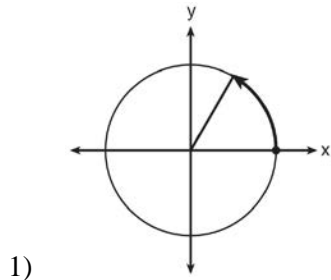262 What are the zeros of $P(m) = (m^2 - 4)(m^2 + 1)$?
1) 2 and -2, only
2) $2, -2$, and -4
3) $-4, i$, and $-i$
4) $2, -2, i$, and $-i$

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

1)

2)

3)

4)

264 Which function represents exponential decay?
1) $y = 2^{0.3t}$
2) $y = 1.2^{3t}$
3) $y = \left(\dfrac{1}{2}\right)^{-t}$
4) $y = 5^{-t}$

265 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

266 Which equation represents the set of points equidistant from line ℓ and point R shown on the graph below?
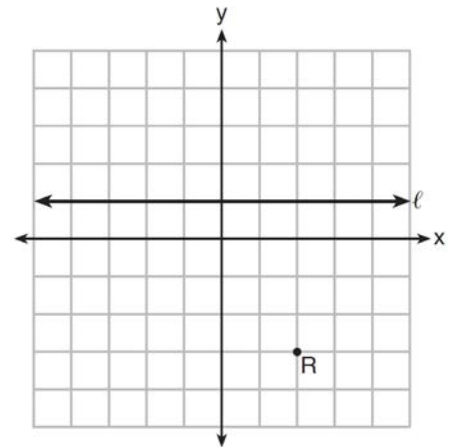
1) $y = -\dfrac{1}{8}(x+2)^2 + 1$
2) $y = -\dfrac{1}{8}(x+2)^2 - 1$
3) $y = -\dfrac{1}{8}(x-2)^2 + 1$
4) $y = -\dfrac{1}{8}(x-2)^2 - 1$

47

267 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) $x = 3^y$

268 The function $f(x) = 2^{-0.25x} \bullet \sin\left(\dfrac{\pi}{2} x\right)$ 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*?
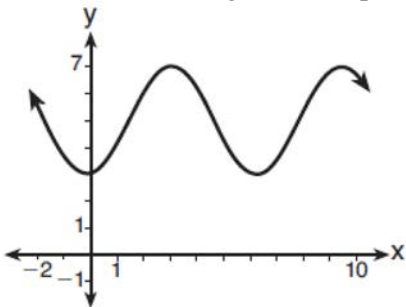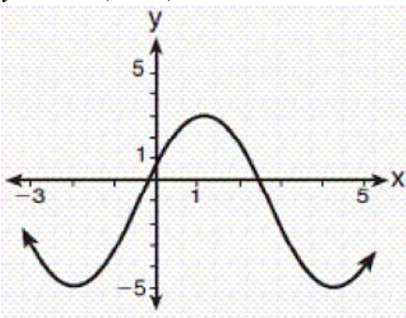
    1) -3.66
    2) -0.30
    3) -0.26
    4) 3.36

269 Which sinusoid has the greatest amplitude?

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

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

270 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 $x \to -\infty$.
    4) $g(x)$, $h(x)$, and $j(x)$ have rational zeros.

271 Which equation represents an odd function?

    1) $y = \sin x$
    2) $y = \cos x$
    3) $y = (x + 1)^3$
    4) $y = e^{5x}$

272 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.

273 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.

Differences in Mean Weight (oz.)
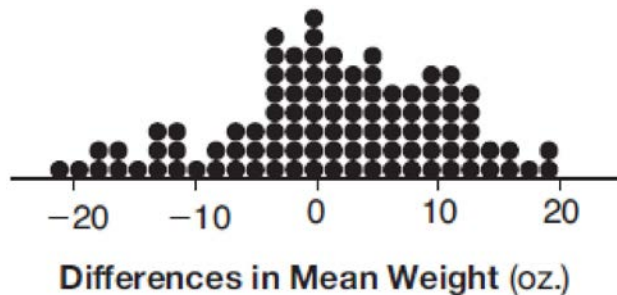
Given these results, what is an appropriate inference that can be drawn?

1) There was no effect observed between the two groups.

2) There was an effect observed that could be due to the random assignment of plants to the groups.

3) There is strong evidence to support the hypothesis that tomatoes from plants planted in black plastic mulch are larger than those planted without mulch.

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.

274 Given that $\sin^2 \theta + \cos^2 \theta = 1$ and $\sin \theta = -\dfrac{\sqrt{2}}{5}$, what is a possible value of $\cos \theta$?

1) $\dfrac{5 + \sqrt{2}}{5}$

2) $\dfrac{\sqrt{23}}{5}$

3) $\dfrac{3\sqrt{3}}{5}$

4) $\dfrac{\sqrt{35}}{5}$

275 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

49

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

277 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) $S = \dfrac{100 - 100(1.0025)^{12}}{1 - 1.0025}$

3) $S = 100(1.0025)^{12}$

4) $S = \dfrac{100 - 100(1.03)^{12}}{1 - 1.03}$

278 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.

279 The function $f(x) = \dfrac{x - 3}{x^2 + 2x - 8}$ is undefined when x equals

1) 2 or -4

2) 4 or -2

3) 3, only

4) 2, only

280 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) $(300, 400)$

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

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

2) $\dfrac{9ix^6 \sqrt[3]{4}}{y^2 \sqrt[3]{y^2}}$

3) $\dfrac{9x^6 \sqrt[3]{4}}{y \sqrt[3]{y}}$

4) $\dfrac{9x^6 \sqrt[3]{4}}{y^2 \sqrt[3]{y^2}}$

282 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) $x - 7$

283 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) $300(1.30)^{\frac{365}{14}}$

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

285 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

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

1) $-\sqrt[6]{m^5}$

2) $\dfrac{1}{\sqrt[6]{m^5}}$

3) $-m\sqrt[5]{m}$

4) $\dfrac{1}{m\sqrt[5]{m}}$

287 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) $-0.15x^3 - 0.02x^2 + 28x - 120$
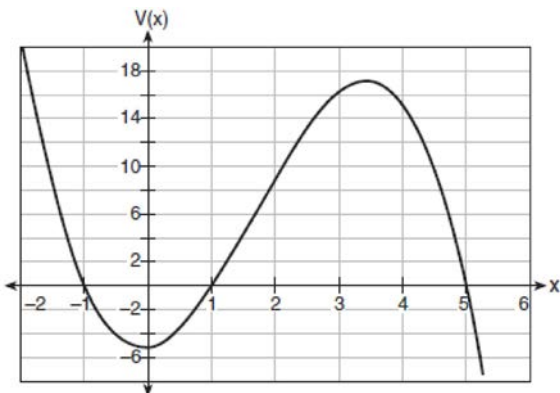3) $-0.15x^3 + 0.01x^2 - 2.01x - 120$
4) $-0.15x^3 + 32x + 120$

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

289 The solutions to the equation $-\dfrac{1}{2}x^2 = -6x + 20$ are

1) $-6 \pm 2i$
2) $-6 \pm 2\sqrt{19}$
3) $6 \pm 2i$
4) $6 \pm 2\sqrt{19}$

290 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) $[0,3.5]$

291 For $x \ne 0$, which expressions are equivalent to one divided by the sixth root of x?

I. $\dfrac{\sqrt[6]{x}}{\sqrt[3]{x}}$ II. $\dfrac{x^{\frac{1}{6}}}{x^{\frac{1}{3}}}$ 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

292 Given $f(9) = -2$, which function can be used to generate the sequence $-8, -7.25, -6.5, -5.75, \ldots$?
1) $f(n) = -8 + 0.75n$
2) $f(n) = -8 - 0.75(n - 1)$
3) $f(n) = -8.75 + 0.75n$
4) $f(n) = -0.75 + 8(n - 1)$

293 The inverse of the function $f(x) = \dfrac{x + 1}{x - 2}$ is

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

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

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

4) $f^{-1}(x) = \dfrac{x - 1}{x + 1}$

294 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) $a_0 = 1000$

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

295 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

296 Which diagram represents an angle, α, measuring $\frac{13\pi}{20}$ radians drawn in standard position, and its reference angle, θ?
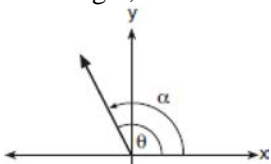
1)

2)
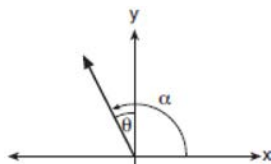
3)
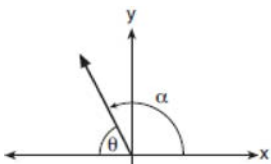
4)

297 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) $\{0, 3, -4\}$

298 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

299 The solution to the equation $4x^2 + 98 = 0$ is
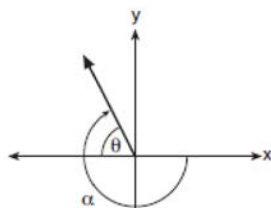1) ± 7
2) $\pm 7i$
3) $\pm \dfrac{7\sqrt{2}}{2}$
4) $\pm \dfrac{7i\sqrt{2}}{2}$

300 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 $\log_{0.8}\left(\dfrac{V}{17000}\right) = t$. 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

301 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) $y^2 + 4$

302 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) $y = \dfrac{x^2}{2} + 3$

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

303 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) $-\dfrac{3}{5}$

2) $-\dfrac{3}{4}$

3) $\dfrac{3}{5}$

4) $\dfrac{4}{5}$

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

305 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

306 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

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

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

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

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

308 The set of data in the table below shows the results of a survey on the number of messages that people of different ages text on their cell phones each month.

	Text Messages per Month		
Age Group	0-10	11-50	Over 50
15-18	4	37	68
19-22	6	25	87
23-60	25	47	157

If a person from this survey is selected at random, what is the probability that the person texts over 50 messages per month given that the person is between the ages of 23 and 60?

1) $\dfrac{157}{229}$

2) $\dfrac{157}{312}$

3) $\dfrac{157}{384}$

4) $\dfrac{157}{456}$

309 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

310 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.

311 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) $\dfrac{m(c)}{g(c)} = \dfrac{-1}{1-c}$

312 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) $x^2 = 4y$

313 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

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

315 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.

316 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.

Samples = 200
Mean = 0.497
SD = 0.050
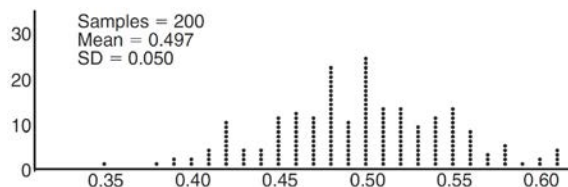
Given the results of her coin flips and of her computer simulation, which statement is most accurate?
1) 73 of the computer's next 100 coin flips will be heads.
2) 50 of her next 100 coin flips will be heads.
3) Her coin is not fair.
4) Her coin is fair.

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

318 A solution of the equation $2x^2 + 3x + 2 = 0$ is
1) $-\dfrac{3}{4} + \dfrac{1}{4} i\sqrt{7}$
2) $-\dfrac{3}{4} + \dfrac{1}{4} i$
3) $-\dfrac{3}{4} + \dfrac{1}{4} \sqrt{7}$
4) $\dfrac{1}{2}$

56

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

1) $\dfrac{\pi}{3}$ right

2) $\dfrac{\pi}{3}$ left

3) $\dfrac{\pi}{3}$ up

4) $\dfrac{\pi}{3}$ down

320 The graph of $p(x)$ is shown below.
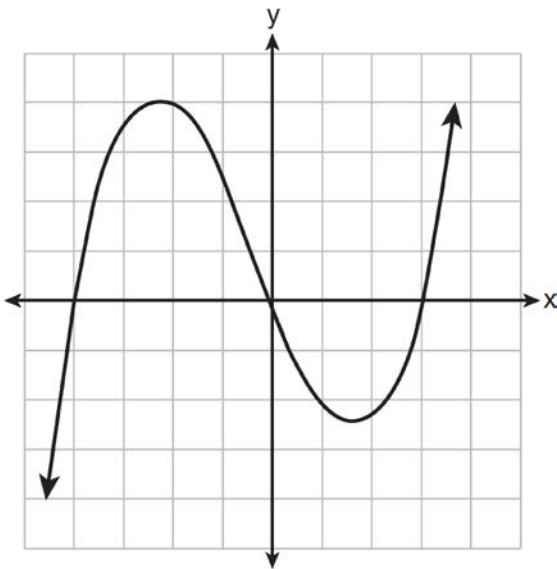
What is the remainder when $p(x)$ is divided by $x + 4$?

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

321 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

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

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

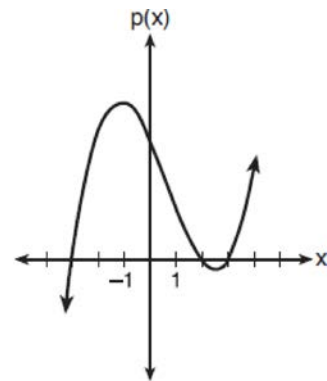| m	B
0	100.00
10	1172.00
19	1352.00
36	1770.80
60	2591.90
69	2990.00
72	3135.80
73	3186.00

Over which interval of time is her average rate of change for the balance on her credit card account the greatest?
1) month 10 to month 60
2) month 19 to month 69
3) month 36 to month 72
4) month 60 to month 73

324 lridium-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 $A = 100\left(\dfrac{1}{2}\right)^{\frac{t}{73.83}}$. Which equation approximates the amount of Iridium-192 present after t days?

1) $A = 100\left(\dfrac{73.83}{2}\right)^{t}$

2) $A = 100\left(\dfrac{1}{147.66}\right)^{t}$

3) $A = 100(0.990656)^{t}$

4) $A = 100(0.116381)^{t}$

325 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

326 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

327 If $\sin^2(32°) + \cos^2(M) = 1$, then M equals
1) 32°
2) 58°
3) 68°
4) 72°

328 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

329 The expression $6xi^3(-4xi + 5)$ is equivalent to
1) $2x - 5i$
2) $-24x^2 - 30xi$
3) $-24x^2 + 30x - i$
4) $26x - 24x^2 i - 5i$

330 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) $(1.00427)^{\frac{m}{12}}$

331 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.

Proportion of Successes
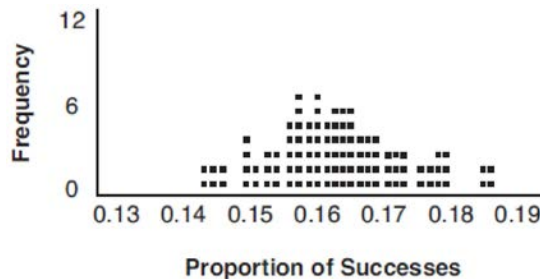
At a 95% confidence level, the proportion of New York City residents with hypertension and the margin of error are closest to
1) proportion $\approx .16$; margin of error $\approx .01$
2) proportion $\approx .16$; margin of error $\approx .02$
3) proportion $\approx .01$; margin of error $\approx .16$
4) proportion $\approx .02$; margin of error $\approx .16$

332 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) $\dfrac{FW}{F - W}$
3) $\dfrac{FW}{W - F}$
4) $\dfrac{1}{F} - \dfrac{1}{W}$

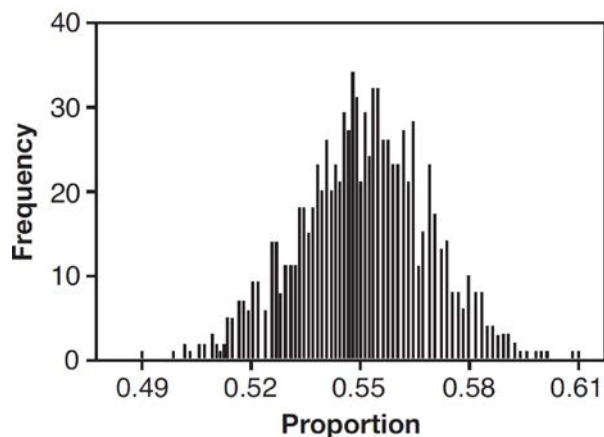333 A candidate for political office commissioned a poll. His staff received responses from 900 likely voters and 55% of them said they would vote for the candidate. The staff then conducted a simulation of 1000 more polls of 900 voters, assuming that 55% of voters would vote for their candidate. The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

334 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) $j_1 = 250,000$

$j_n = j_{n-1} + 937$

335 The price of a postage stamp in the years since the end of World War I is shown in the scatterplot below.
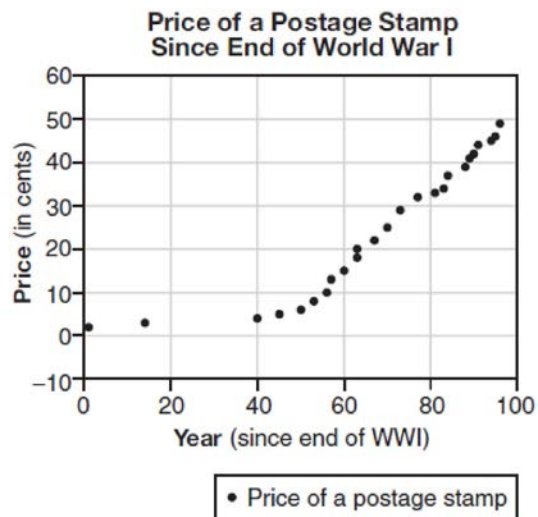
The equation that best models the price, in cents, of a postage stamp based on these data is
1) $y = 0.59x - 14.82$
2) $y = 1.04(1.43)^x$
3) $y = 1.43(1.04)^x$
4) $y = 24\sin(14x) + 25$

336 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.

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

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

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

3) $\dfrac{2}{3} \pm 6i\sqrt{158}$

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

338 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) $\displaystyle\sum_{n=1}^{6} 8(1.10)^{n-1}$

2) $\displaystyle\sum_{n=1}^{6} 8(1.10)^{n}$

3) $\dfrac{8 - 8(1.10)^6}{0.90}$

4) $\dfrac{8 - 8(0.10)^n}{1.10}$

339 As x increases from 0 to $\dfrac{\pi}{2}$, 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

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

1) $2x^2 + 3x - 7 + \dfrac{31}{2x+3}$

2) $2x^2 - 3x + 7 - \dfrac{11}{2x+3}$

3) $2x^2 + 2.5x + 5 + \dfrac{15}{2x+3}$

4) $2x^2 - 2.5x - 5 - \dfrac{20}{2x+3}$

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

342 If the terminal side of angle θ, in standard position, passes through point $(-4, 3)$, what is the numerical value of $\sin\theta$?

1) $\dfrac{3}{5}$

2) $\dfrac{4}{5}$

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

4) $-\dfrac{4}{5}$

343 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) $(11.29, 32.87)$

344 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?
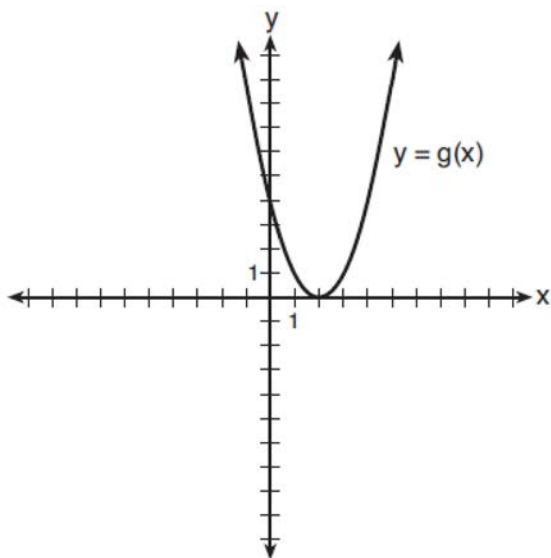
1) $\{(0, -2)\}$
2) $\{(0, -2), (1, 6)\}$
3) $\{(1, 6)\}$
4) $\{(1, 1), (6, 16)\}$

345 Which equation is represented by the graph shown below?
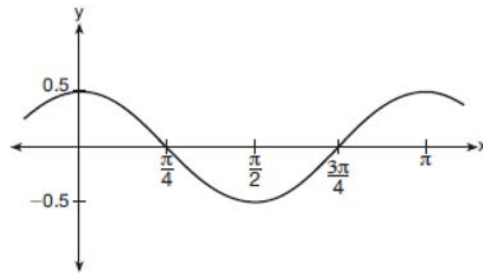
1) $y = \dfrac{1}{2} \cos 2x$
2) $y = \cos x$
3) $y = \dfrac{1}{2} \cos x$
4) $y = 2\cos \dfrac{1}{2} x$

346 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) $P_0 = 19,378,000$

$P_t = 1.015P_{t-1}$

Algebra II 2 Point Regents Exam Questions

347 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.

348 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*.

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

350 Verify the following Pythagorean identity for all values of x and y:
$$(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$$

351 Given $f(x) = 3x^2 + 7x - 20$ and $g(x) = x - 2$, state the quotient and remainder of $\dfrac{f(x)}{g(x)}$, in the form $q(x) + \dfrac{r(x)}{g(x)}$.

352 A formula for work problems involving two people is shown below.
$$\frac{1}{t_1} + \frac{1}{t_2} = \frac{1}{t_b}$$
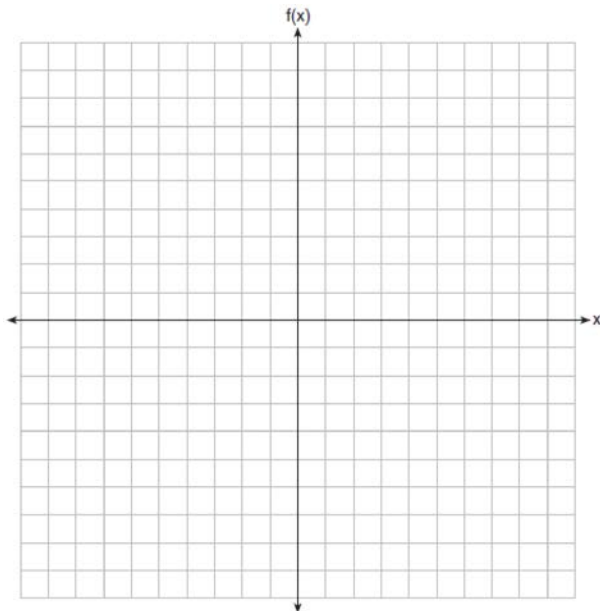t_1 = the time taken by the first person to complete the job
t_2 = the time taken by the second person to complete the job
t_b = the time it takes for them working together to complete the job
Fred and Barney are carpenters who build the same model desk. It takes Fred eight hours to build the desk while 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.

353 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.

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

63

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

356 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.

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

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

358 On the grid below, sketch a cubic polynomial whose zeros are 1, 3, and -2.
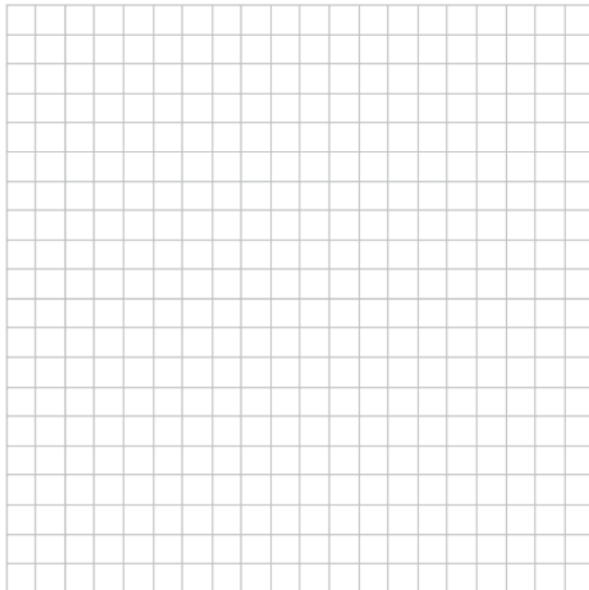
359 Graph $y = x^3 - 4x^2 + 2x + 7$ on the set of axes below.
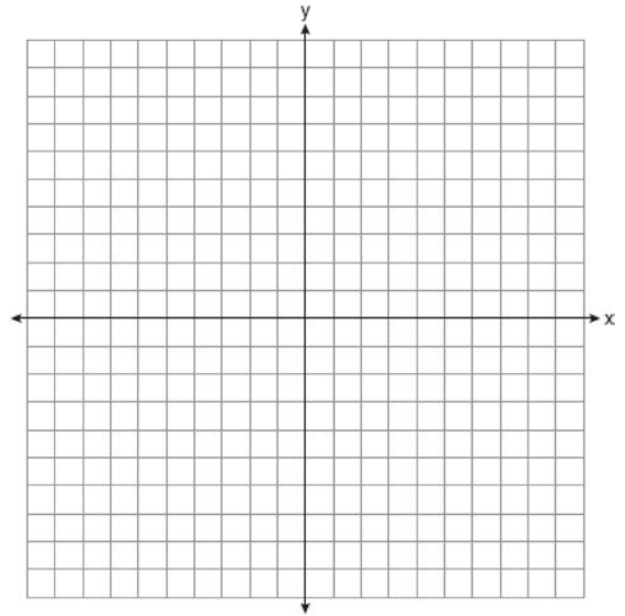
360 Does the equation $x^2 - 4x + 13 = 0$ have imaginary solutions? Justify your answer.

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

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

363 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*.

364 Visible light can be represented by sinusoidal waves. Three visible light waves are shown in the graph below. The midline of each wave is labeled ℓ.
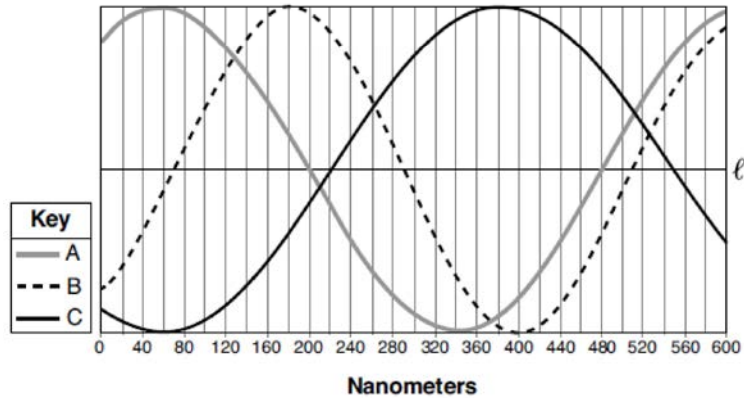
Based on the graph, which light wave has the longest period? Justify your answer.

365 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.

366 Given the geometric series $300 + 360 + 432 + 518.4 + \dots$, write a geometric series formula, S_n, for the sum of the first n terms. Use the formula to find the sum of the first 10 terms, to the *nearest tenth*.

367 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.

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

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

370 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.

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

65

372 Justify why $\dfrac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}}$ is equivalent to $x^{\frac{-1}{12}} y^{\frac{2}{3}}$ using properties of rational exponents, where $x \neq 0$ and $y \neq 0$.

373 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.
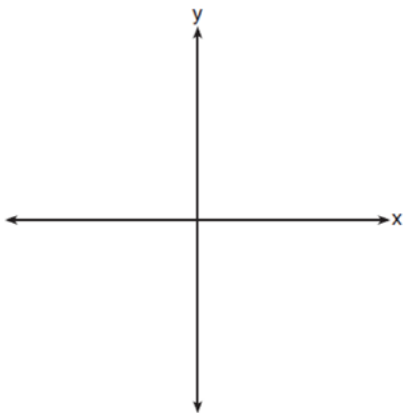
374 Algebraically solve for x: $\dfrac{-3}{x+3} + \dfrac{1}{2} = \dfrac{x}{6} - \dfrac{1}{2}$

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

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

377 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.
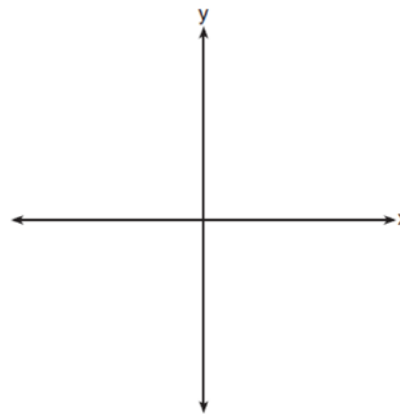
378 The zeros of a quartic polynomial function h are -1, ± 2, and 3. Sketch a graph of $y = h(x)$ on the grid below.
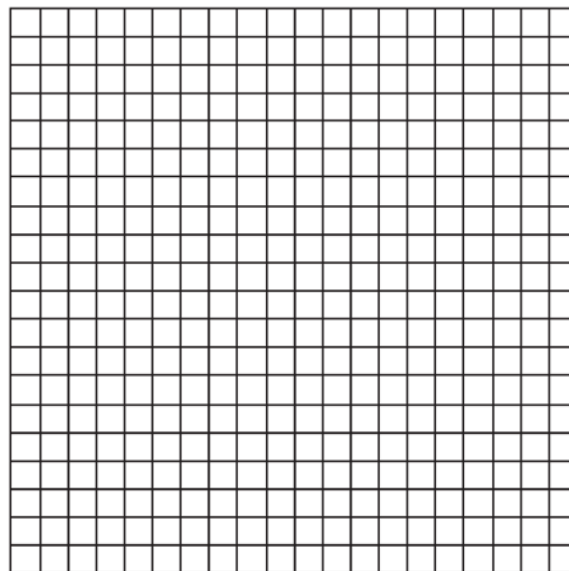
379 Determine if $x - 5$ is a factor of $2x^3 - 4x^2 - 7x - 10$. Explain your answer.

66

380 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

381 Using the unit circle below, explain why $\csc \theta = \dfrac{1}{y}$.
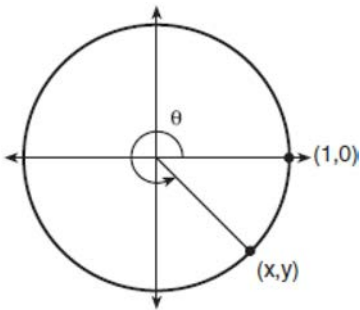
382 According to a study done at a hospital, the average weight of a newborn baby is 3.39 kg, with a standard deviation of 0.55 kg. The weights of all the newborns in this hospital closely follow a normal distribution. Last year, 9256 babies were born at this hospital. Determine, to the *nearest integer*, approximately how many babies weighed more than 4 kg.

383 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*.

384 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.

385 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.

386 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.

387 Solve for *x*: $\dfrac{1}{x} - \dfrac{1}{3} = -\dfrac{1}{3x}$

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

389 The parabola $y = -\dfrac{1}{20}(x-3)^2 + 6$ has its focus at $(3,1)$. Determine and state the equation of the directrix. (The use of the grid below is optional.)
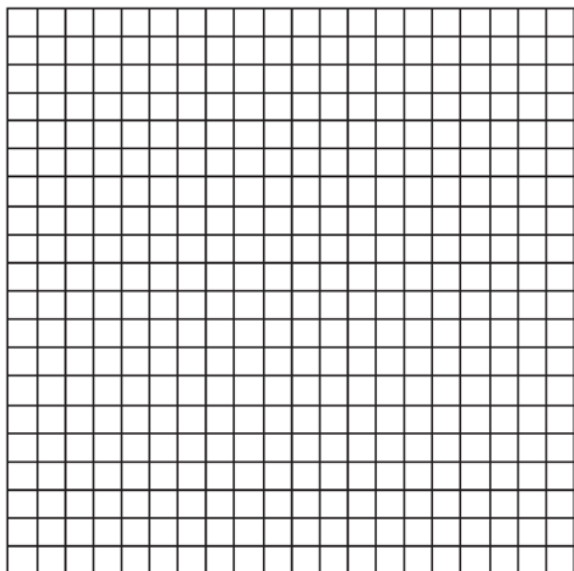
390 Determine the quotient and remainder when $(6a^3 + 11a^2 - 4a - 9)$ is divided by $(3a - 2)$. Express your answer in the form $q(a) + \dfrac{r(a)}{d(a)}$.

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

392 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*.

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

M = monthly payment
P = amount borrowed
r = annual interest rate
n = total number of monthly payments

393 Graph $t(x) = 3\sin(2x) + 2$ over the domain $[0, 2\pi]$ on the set of axes below.
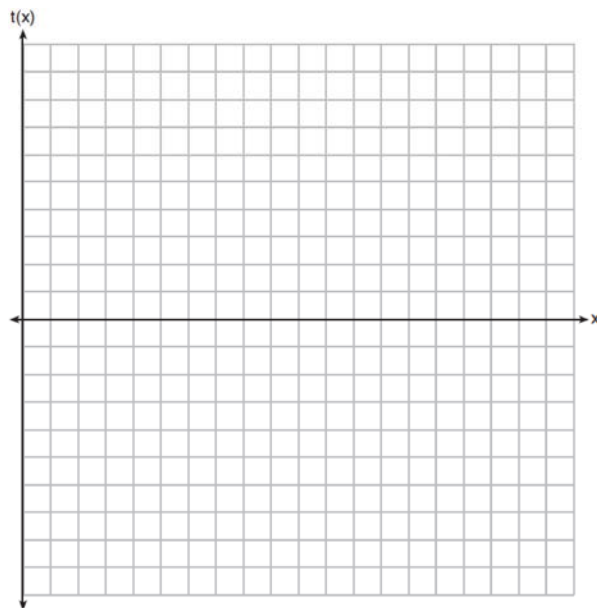
394 The table below shows the number of hours of daylight on the first day of each month in Rochester, NY.

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

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

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

$$y = x - 28$$

396 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.

397 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.

398 Write $\sqrt[3]{x} \bullet \sqrt{x}$ as a single term with a rational exponent.

399 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?

400 Biologists are studying a new bacterium. They create a culture with 100 of the bacteria and anticipate that the number of bacteria will double every 30 hours. Write an equation for the number of bacteria, B, in terms of the number of hours, t, since the experiment began.

401 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.

402 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.
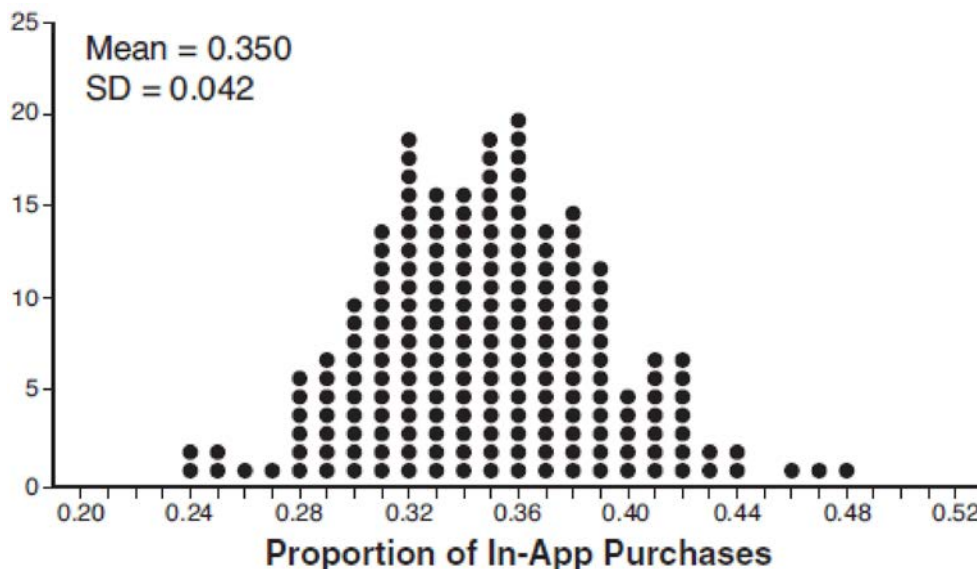
Considering the middle 95% of the data, determine the margin of error, to the *nearest hundredth*, for the simulated results. In the given context, explain what this value represents.

403 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.

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

405 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?

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

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

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

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

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

$$= 6 + 10i - 4$$

$$= 2 + 10i$$

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

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

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

408 For n and $p > 0$, is the expression

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

Justify your answer.

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

410 Graph $y = 400(.85)^{2x} - 6$ on the set of axes below.
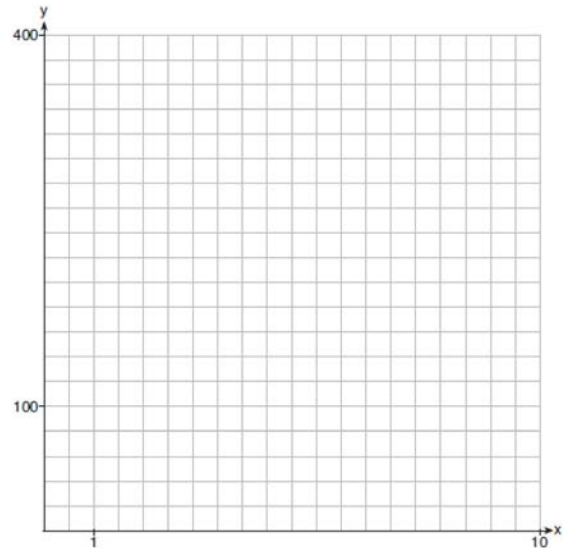
411 Researchers in a local area found that the population of rabbits with an initial population of 20 grew continuously at the rate of 5% per month. The fox population had an initial value of 30 and grew continuously at the rate of 3% per month. Find, to the *nearest tenth of a month*, how long it takes for these populations to be equal.

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

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

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

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

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

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

416 When the function $p(x)$ is divided by $x - 1$ the quotient is $x^2 + 7 + \dfrac{5}{x-1}$. State $p(x)$ in standard form.
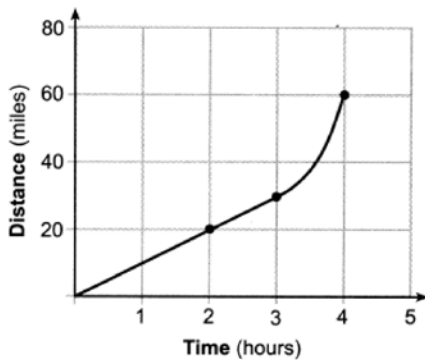
417 Describe the transformation applied to the graph of $p(x) = 2^x$ that forms the new function $q(x) = 2^{x-3} + 4$.

418 Given: $h(x) = \dfrac{2}{9}x^3 + \dfrac{8}{9}x^2 - \dfrac{16}{13}x + 2$

$k(x) = -|0.7x| + 5$

State the solutions to the equation $h(x) = k(x)$, rounded to the *nearest hundredth*.

419 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.

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

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

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

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

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

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

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

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

425 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.

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

427 Algebraically determine the values of x that satisfy the system of equations below.
$$y = -2x + 1$$
$$y = -2x^2 + 3x + 1$$

428 Write a recursive formula, a_n, to describe the sequence graphed below.
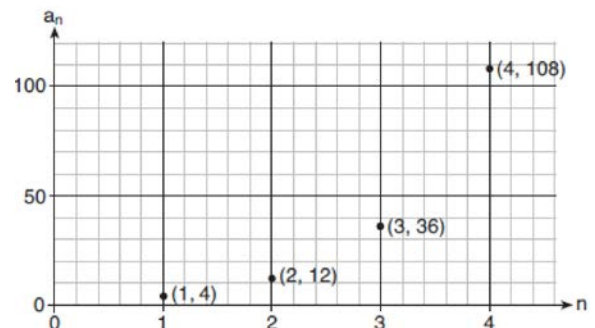
429 Explain why $81^{\frac{3}{4}}$ equals 27.

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

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

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

431 On the grid below, graph the function $y = \log_2(x - 3) + 1$
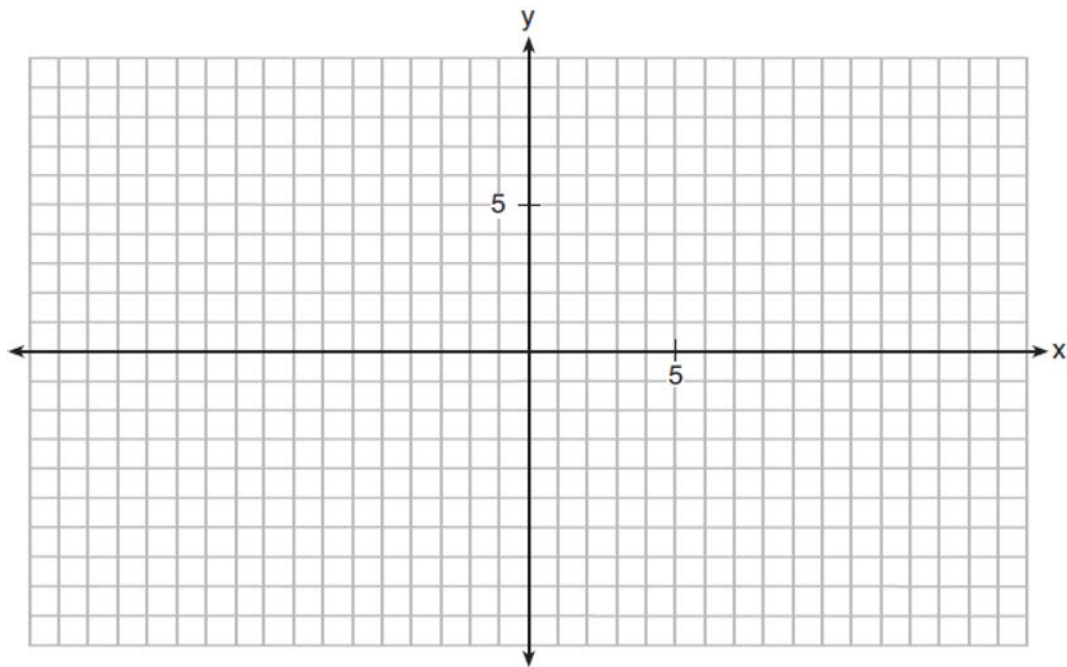
432 The distance needed to stop a car after applying the brakes varies directly with the square of the car's speed. The table below shows stopping distances for various speeds.

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.

433 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.

434 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.

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

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

436 Rewrite the expression
$\left(4x^2 + 5x\right)^2 - 5\left(4x^2 + 5x\right) - 6$ as a product of four linear factors.

439 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.

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

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

441 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.

442 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.

443 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.

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

445 Write $-\dfrac{1}{2}i^3\left(\sqrt{-9} - 4\right) - 3i^2$ in simplest $a + bi$ form.

446 Solve algebraically for n: $\dfrac{2}{n^2} + \dfrac{3}{n} = \dfrac{4}{n^2}$

447 Write a recursive formula for the sequence $6, 9, 13.5, 20.25, \ldots$

448 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.

How's My Driving?
Call 1-555-DRIVING
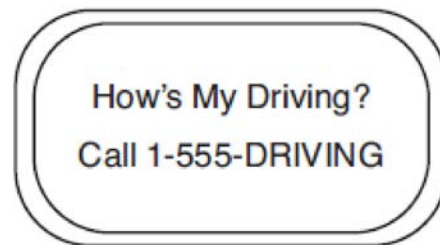
The driver who receives the highest number of positive comments will win the recognition. Explain *one* statistical bias in this data collection method.

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

450 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.
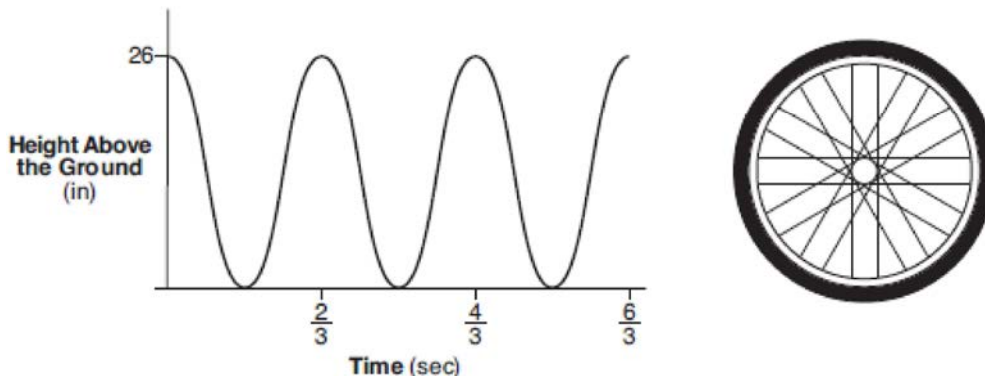
Identify the period of the graph and describe what the period represents in this context.

451 On the grid below, graph the function $f(x) = x^3 - 6x^2 + 9x + 6$ on the domain $-1 \le x \le 4$.
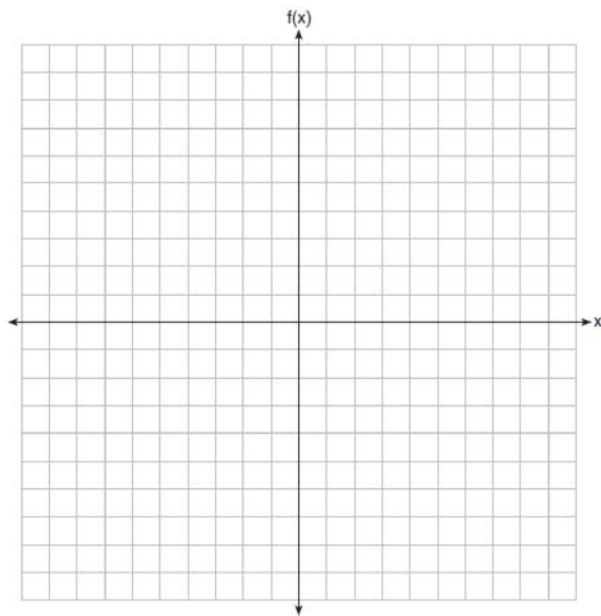
453 Graph $y = 2\cos\left(\dfrac{1}{2}x\right) + 5$ on the interval $[0, 2\pi]$, using the axes below.
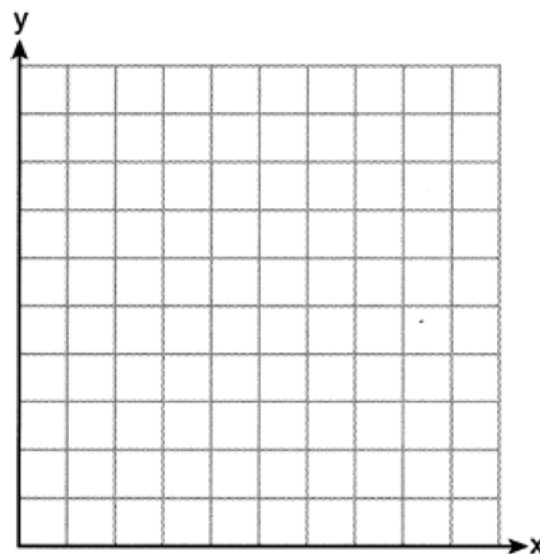
452 Solve algebraically for all values of x:
$\sqrt{4x+1} = 11 - x$

454 Solve algebraically for all values of x:
$\sqrt{x-5} + x = 7$

455 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.

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

457 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.

458 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.

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

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

461 Factor completely over the set of integers:
$$-2x^4 + x^3 + 18x^2 - 9x$$

462 Solve algebraically for all values of x:
$$\sqrt{x-4} + x = 6$$

463 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*.

464 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.

465 Sketch the graphs of $r(x) = \dfrac{1}{x}$ and $a(x) = |x| - 3$ on the set of axes below. Determine, to the *nearest tenth*, the positive solution of $r(x) = a(x)$.
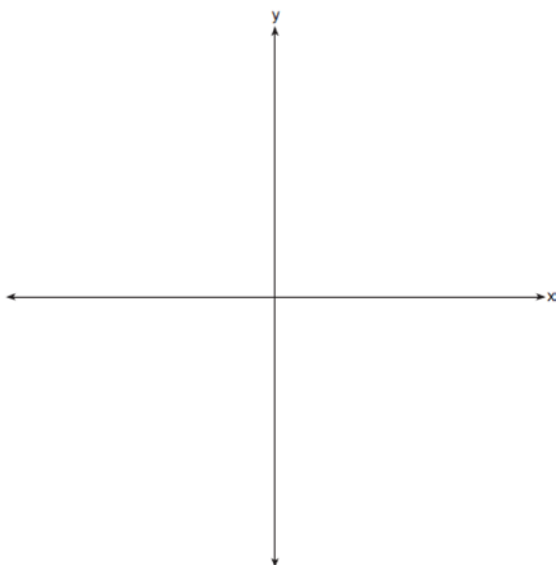
467 Robin flips a coin 100 times. It lands heads up 43 times, and she wonders if the coin is unfair. She runs a computer simulation of 750 samples of 100 fair coin flips. The output of the proportion of heads is shown below.
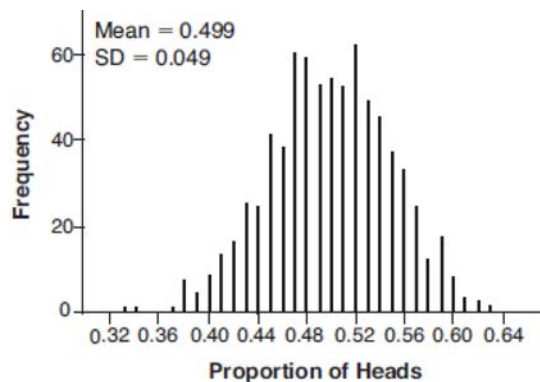
Do the results of the simulation provide strong evidence that Robin's coin is unfair? Explain your answer.

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

$$y = 2x^2 - 7x + 4$$
$$y = 11 - 2x$$

468   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 $(0, 2)$.
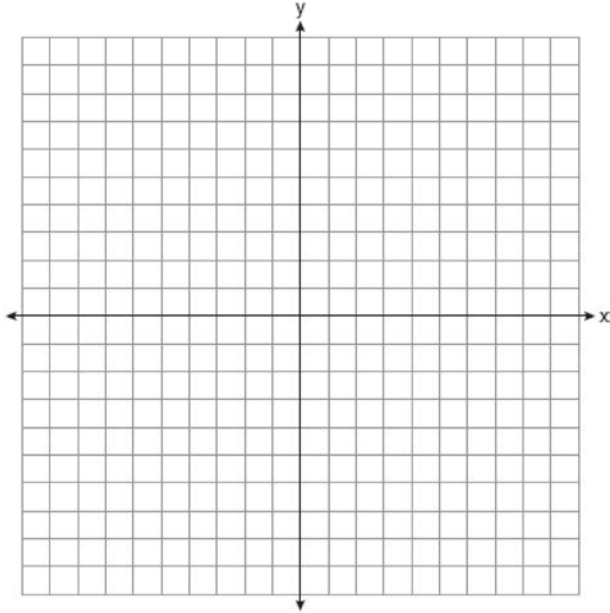
Algebra II 4 Point Regents Exam Questions

469   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.
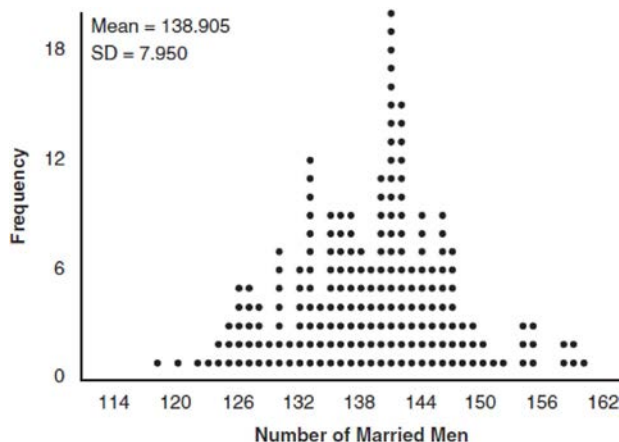
a) Based on the simulation, create an interval in which the middle 95% of the number of married men may fall. Round your answer to the *nearest integer*.
b) A study claims "50 percent of men 21 and older in the United States are married." Do your results from part a contradict this claim? Explain.

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

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

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

471   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 $j(x)$.

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

473 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.

Simulated Differences

Differences (Group 1 – Group 2)
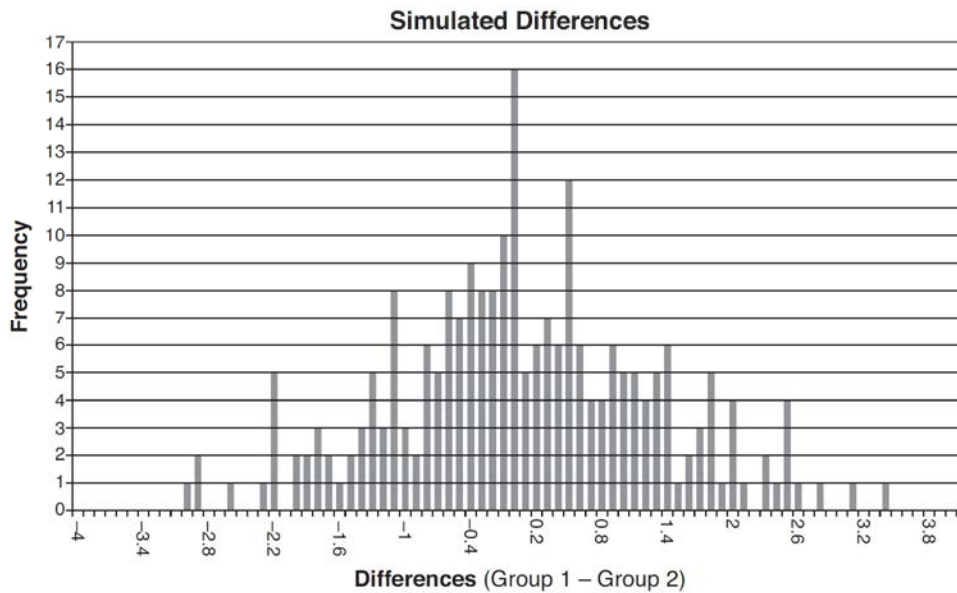
Ayva has decided that the difference in mean reading times is not an unusual occurrence. Support her decision using the results of the simulation. Explain your reasoning.

474 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.
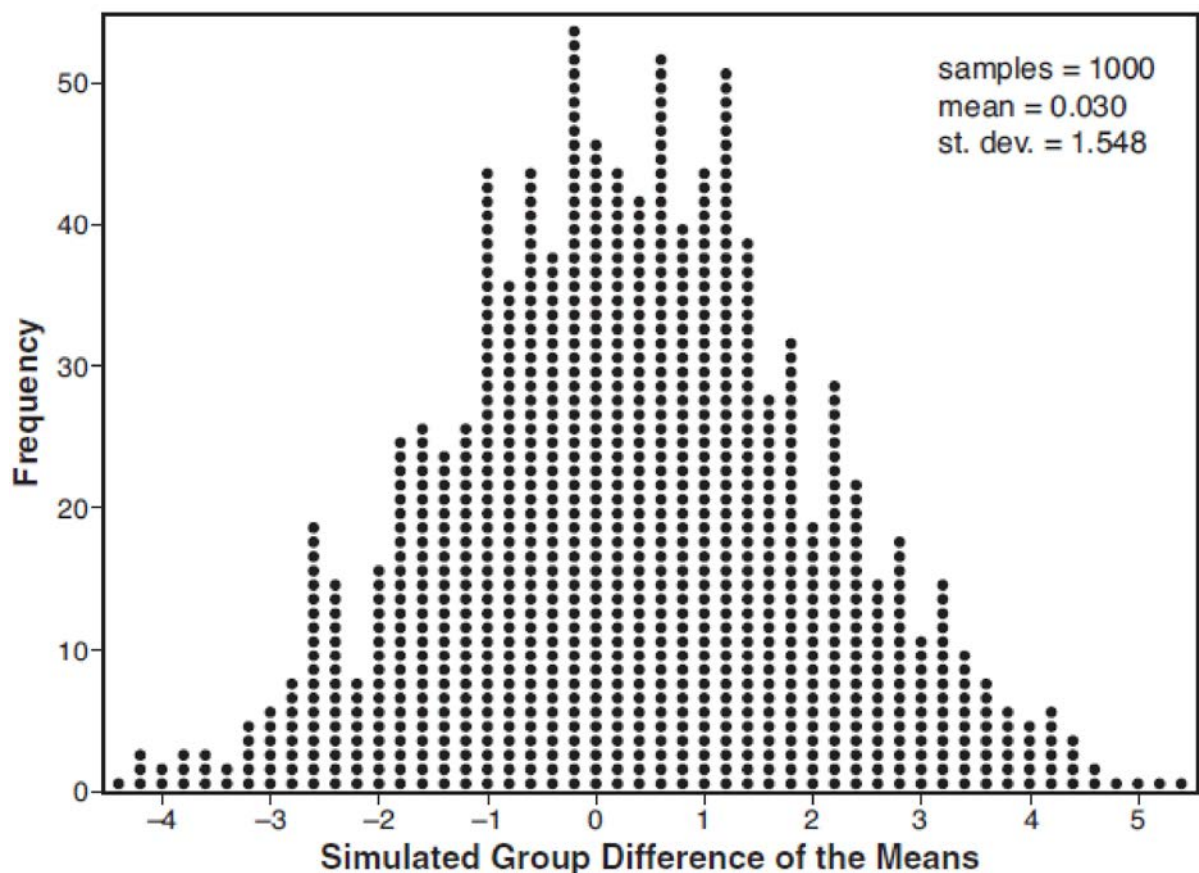
Use the simulation results to determine the interval representing the middle 95% of the difference in means, to the *nearest hundredth*. Is the difference in means in Joseph's experiment statistically significant based on the simulation? Explain.

475 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.

476 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.

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

478 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.

479 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.

480 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.
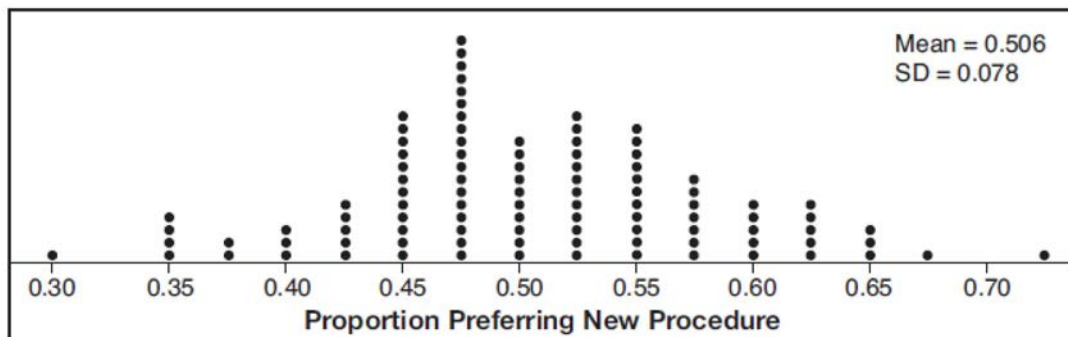
Assume the set of data is approximately normal and the dealership wants to be 95% confident of its results. Determine an interval containing the plausible sample values for which the dealership will launch the new procedure. Round your answer to the *nearest hundredth*. Forty customers are selected randomly 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.

481 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.
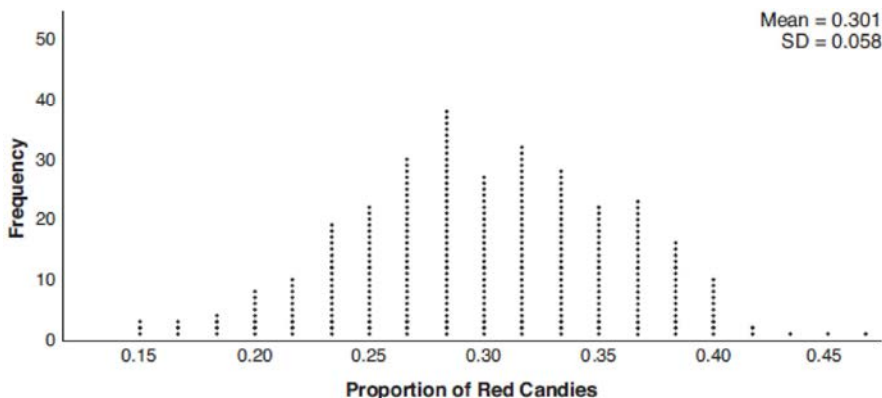
Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within. Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

482 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.

483 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.

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

485 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 $1 \le t \le 2$. At what value(s) of t, to the *nearest tenth of a second*, does $h(t) = 0$ in the interval $1 \le t \le 5$? Justify your answer.

486 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 nth 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.

487 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.
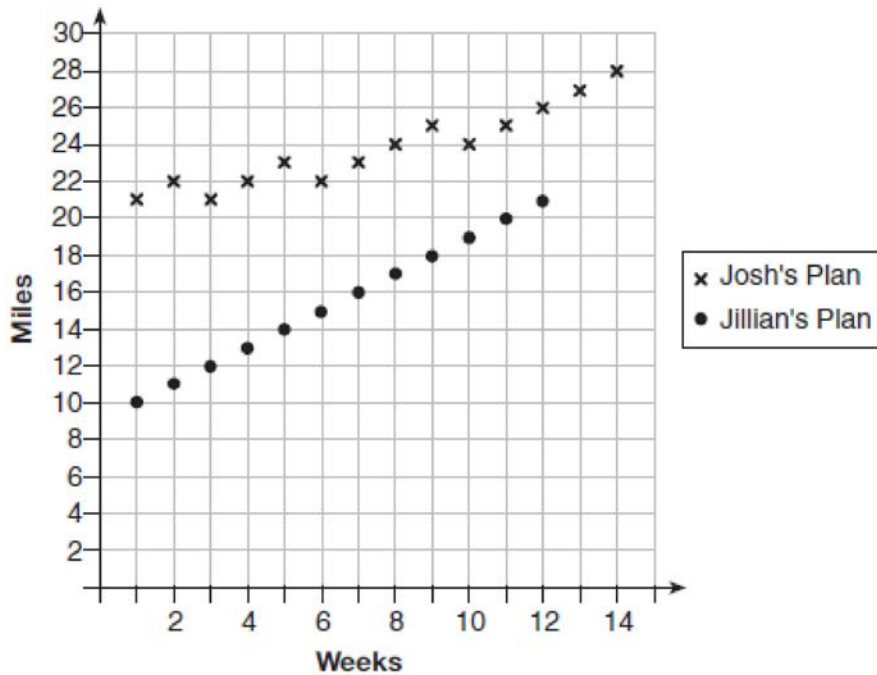
Which one of the plans follows an arithmetic pattern? Explain how you arrived at your answer. Write a recursive definition to represent the number of miles run each week for the duration of the plan you chose. Jillian's plan has an alternative if Elaina wanted to train instead for a full 26-mile marathon. 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.

488 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 $M = P \bullet \dfrac{r(1+r)^N}{(1+r)^N - 1}$ 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.

489 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.
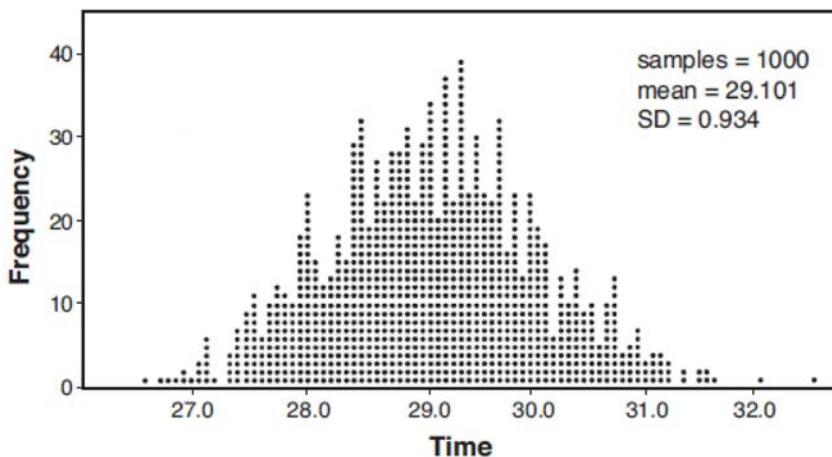
Based on the simulation results, is the claim that commuters listen to the station on average 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

490 Write an explicit formula for a_n, the nth 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 $n > 1$?

491 Solve the following system of equations algebraically for all values of x, y, and z:
$$x + y + z = 1$$
$$2x + 4y + 6z = 2$$
$$-x + 3y - 5z = 11$$

492 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.

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

494 Graph the following function on the axes below.
$$f(x) = \log_3(2 - x)$$
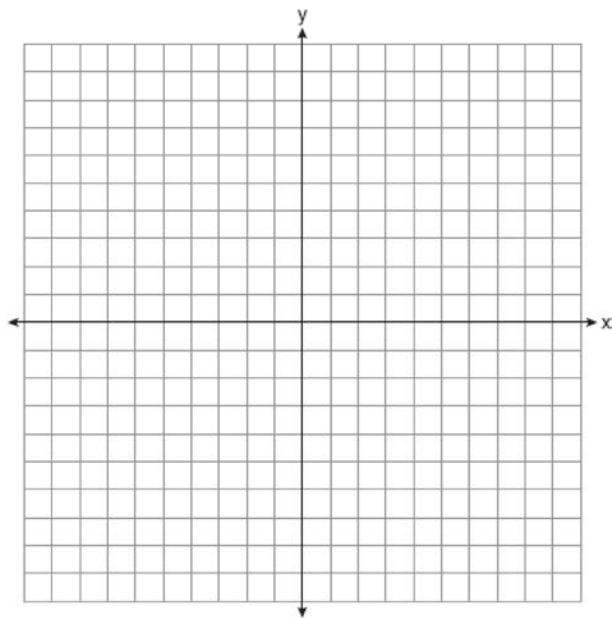
State the domain of f. State the equation of the asymptote.

495 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*.

496 On the set of axes below, graph $y = f(x)$ and $y = g(x)$ for the given functions.
$$f(x) = x^3 - 3x^2$$
$$g(x) = 2x - 5$$
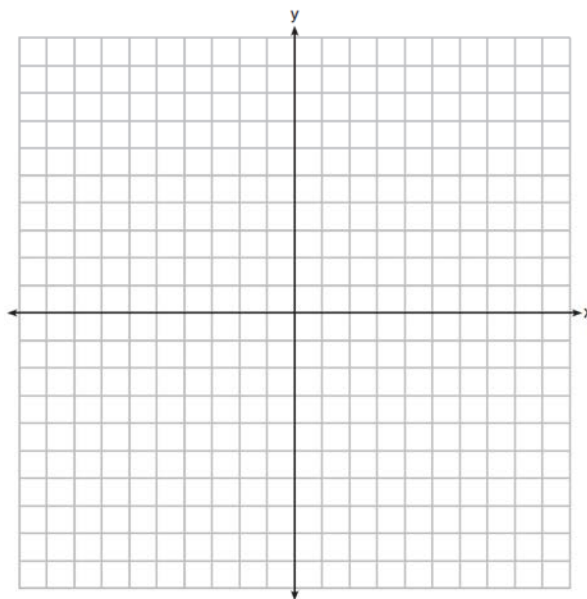
State the number of solutions to the equation $f(x) = g(x)$.

497 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.

498 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.

Classical vs. Rap

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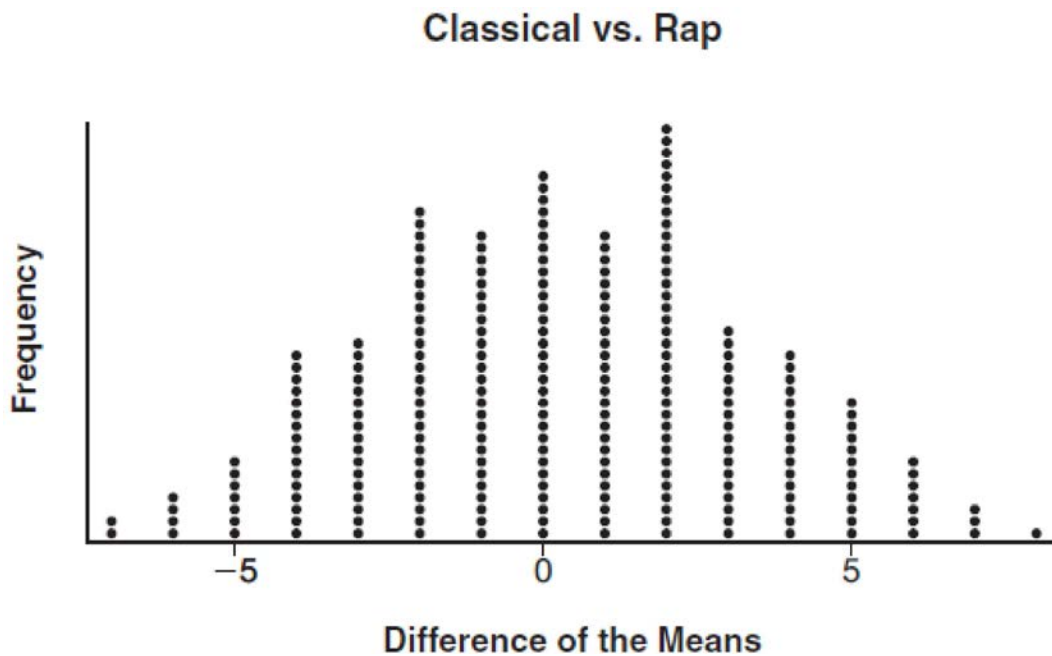
Does the simulation support the theory that there may be a significant difference in quiz scores? Explain.

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

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

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

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

500 Algebraically determine the values of h and k to
correctly complete the identity stated below.

$$2x^3 - 10x^2 + 11x - 7 = (x - 4)(2x^2 + hx + 3) + k$$

501 `Solve the system of equations shown below algebraically.
$$(x-3)^2 + (y+2)^2 = 16$$
$$2x + 2y = 10$$

502 Solve the following system of equations algebraically for all values of x, y, and z:
$$2x + 3y - 4z = -1$$
$$x - 2y + 5z = 3$$
$$-4x + y + z = 16$$

503 Graph $y = \log_2(x+3) - 5$ on the set of axes below. Use an appropriate scale to include *both* intercepts.
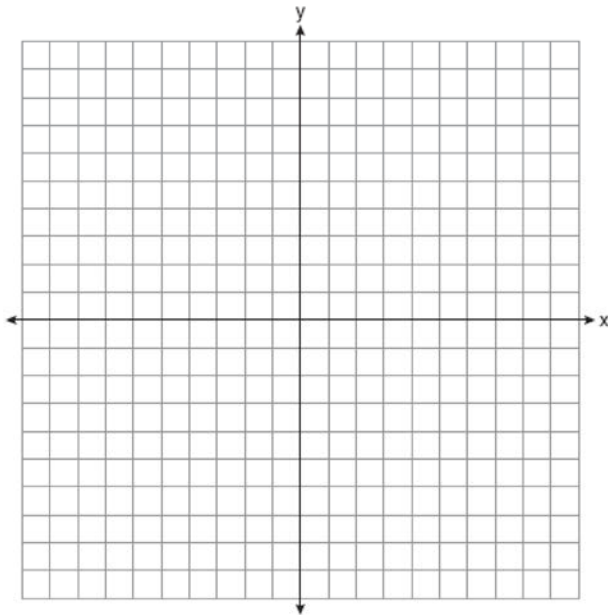
Describe the behavior of the given function as x approaches -3 and as x approaches positive infinity.

504 The graph of $y = f(x)$ is shown below. The function has a leading coefficient of 1.
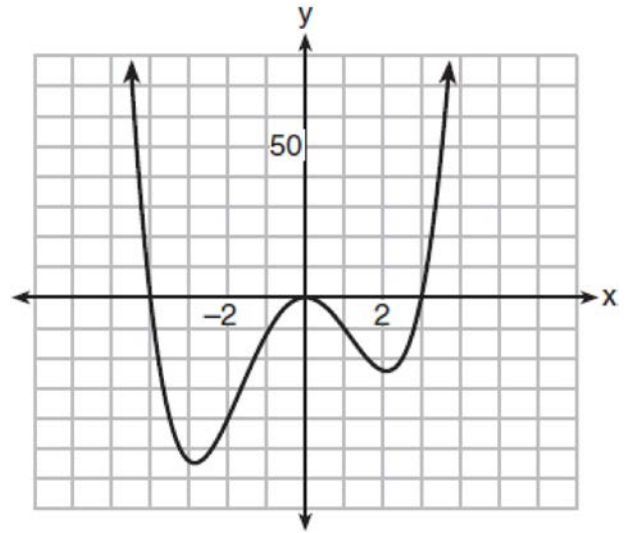
Write an equation for $f(x)$. The function g is formed by translating function f left 2 units. Write an equation for $g(x)$.

505 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?

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

507 Find algebraically the zeros for
$p(x) = x^3 + x^2 - 4x - 4$. On the set of axes below, graph $y = p(x)$.
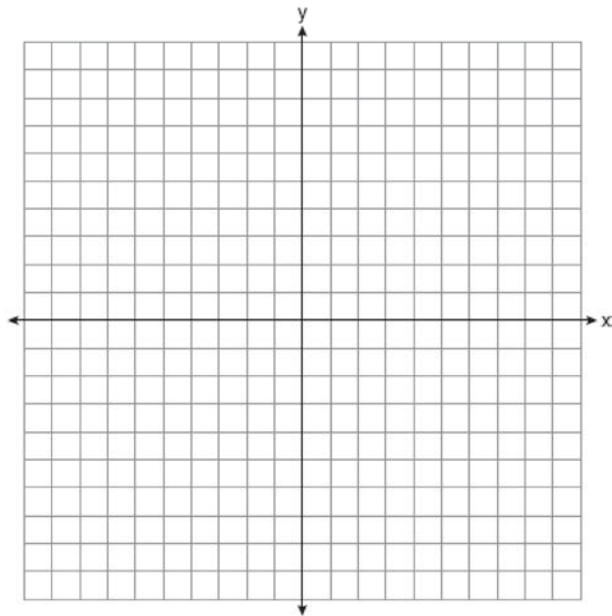
508 Carla wants to start a college fund for her daughter Lila. She puts $63,000 into an account that grows at a rate of 2.55% per year, compounded monthly. Write a function, $C(t)$, that represents the amount of money in the account t years after the account is opened, given that no more money is deposited 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*.

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

510 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.

511 a) On the axes below, sketch *at least one* cycle of a sine curve with an amplitude of 2, a midline at $y = -\dfrac{3}{2}$, and a period of 2π.
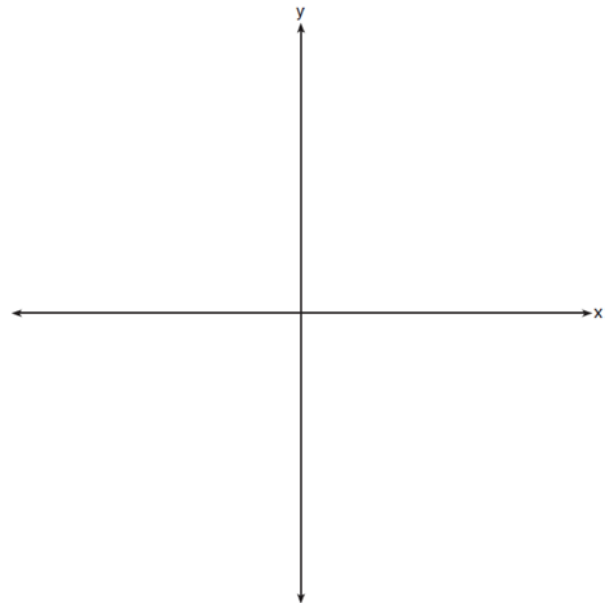
b) Explain any differences between a sketch of $y = 2\sin\left(x - \dfrac{\pi}{3}\right) - \dfrac{3}{2}$ and the sketch from part a.

512 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.

Simulated Group Mean Differences
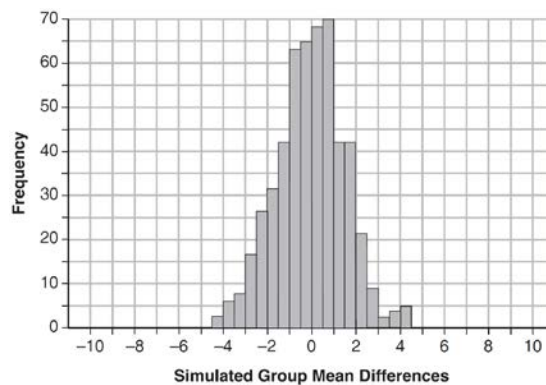
Use the simulation to determine if there is a significant difference in the final grades. Explain your answer.

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

514 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.

515 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*.

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

93

517 Determine an equation for the parabola with focus $(4, -1)$ and directrix $y = -5$. (Use of the grid below is optional.)
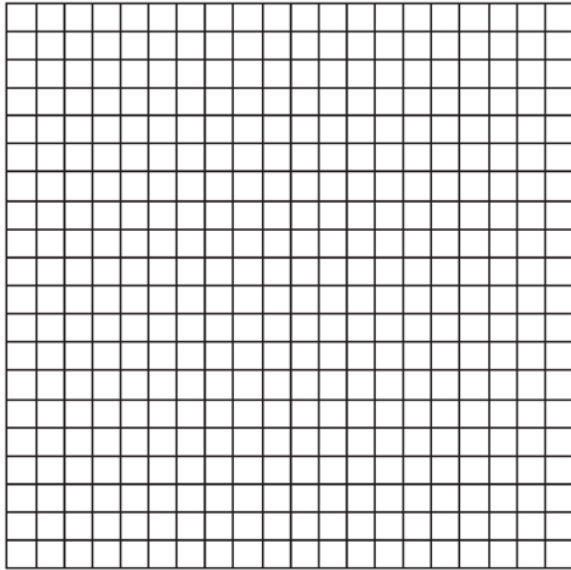
518 Solve the equation $\sqrt{2x - 7} + x = 5$ algebraically, and justify the solution set.

519 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.

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

521 Algebraically solve the following system of equations.
$$(x - 2)^2 + (y - 3)^2 = 16$$
$$x + y - 1 = 0$$

522 The function $v(x) = x(3 - x)(x + 4)$ models the volume, in cubic inches, of a rectangular solid for $0 \le x \le 3$. Graph $y = v(x)$ over the domain $0 \le x \le 3$.
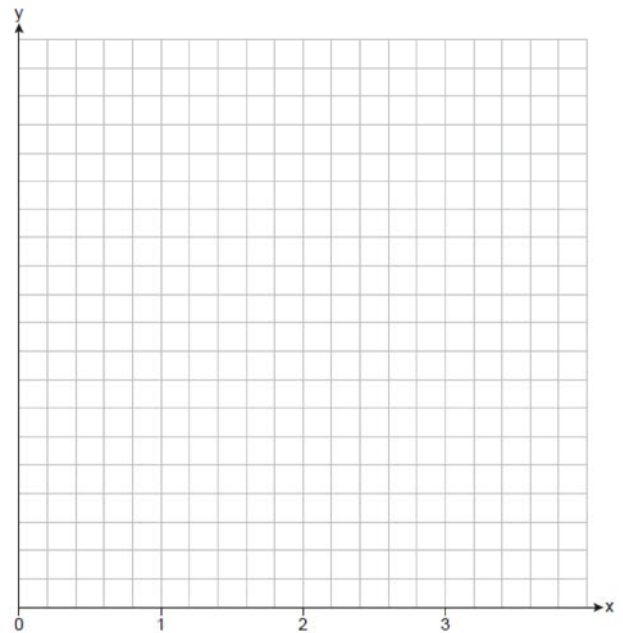
To the *nearest tenth of a cubic inch*, what is the maximum volume of the rectangular solid?

523 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.

524 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.

525 When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.
a) Assuming an initial value of 11,000 bacteria, write a function, $p(t)$, that can be used to model the population of bacteria, p, on a smartphone screen, where t represents the time in minutes after it is first observed under a microscope.
b) Using $p(t)$ from part a, determine algebraically, to the *nearest hundredth of a minute*, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

526 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.

Mean = 0.247
S. D. = 0.062
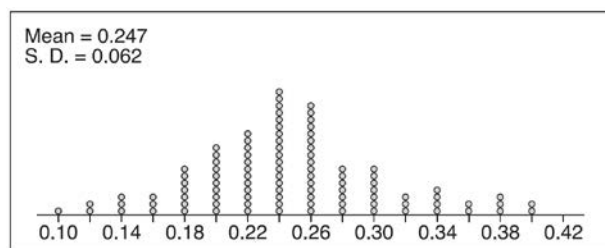
Proportion Preferring Stephen's Product

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.

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

Mean = 0.651
SD = 0.034

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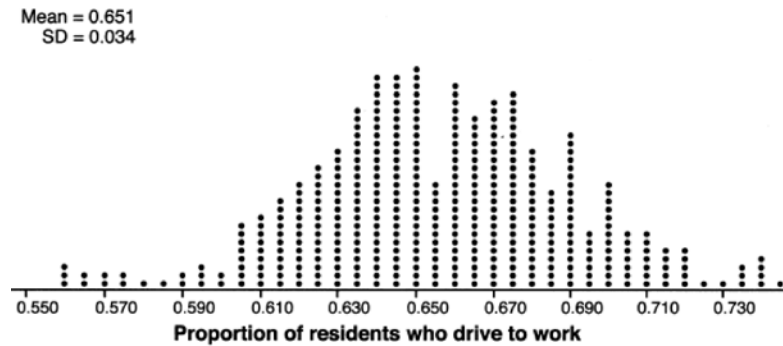
Use the simulation results to construct a plausible interval containing the middle 95% of the data. Round your answer to the *nearest hundredth*. One year after launching the campaign, the Department of Transportation conducts a survey of 200 randomly selected city residents and finds that 122 of them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

528 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

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

529 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.
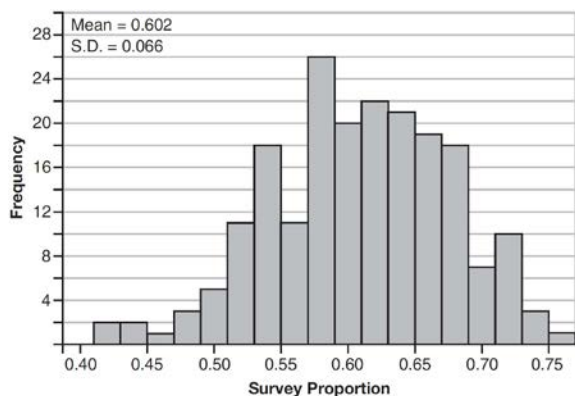
Using the results of the simulation, determine a plausible interval containing the middle 95% of the data. Round all values to the *nearest hundredth*. Members of the prom committee are concerned that a vote of all students attending the prom may produce a 50% − 50% split. Explain what statistical evidence supports this concern.

530 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*.

531 Write an equation for a sine function with an amplitude of 2 and a period of $\dfrac{\pi}{2}$. On the grid below, sketch the graph of the equation in the interval 0 to 2π.
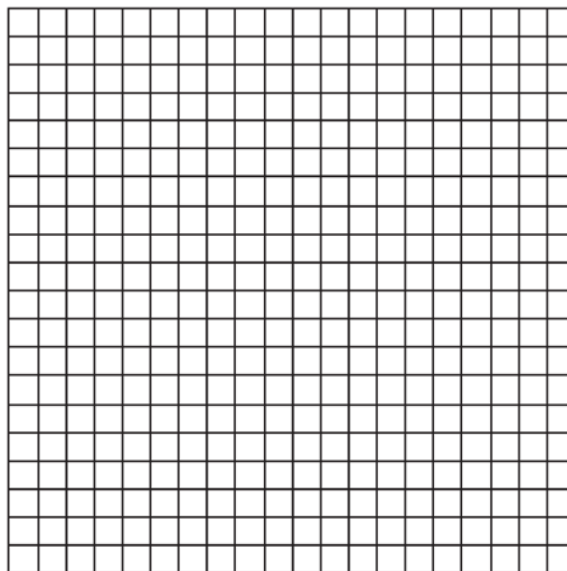
532 A Foucault pendulum can be used to demonstrate that the Earth rotates. The time, t, in seconds, that it takes for one swing or period of the pendulum can be modeled by the equation $t = 2\pi\sqrt{\dfrac{L}{g}}$ where L is the length of the pendulum in meters and g is a constant of 9.81 m/s². The first Foucault pendulum was constructed in 1851 and has a pendulum length of 67 m. Determine, to the *nearest tenth of a second*, the time it takes this pendulum to complete one swing. Another Foucault pendulum at the United Nations building takes 9.6 seconds to complete one swing. Determine, to the *nearest tenth of a meter*, the length of this pendulum.

533 State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.
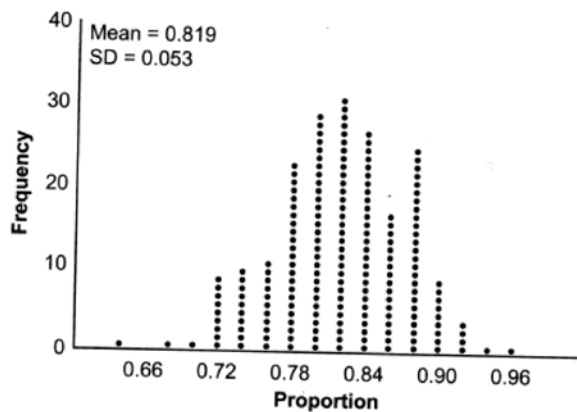
Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the *nearest thousandth*. The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials' claim.

Algebra II 6 Point Regents Exam Questions

534 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 $0 \le t \le 5$, on the set of axes below.
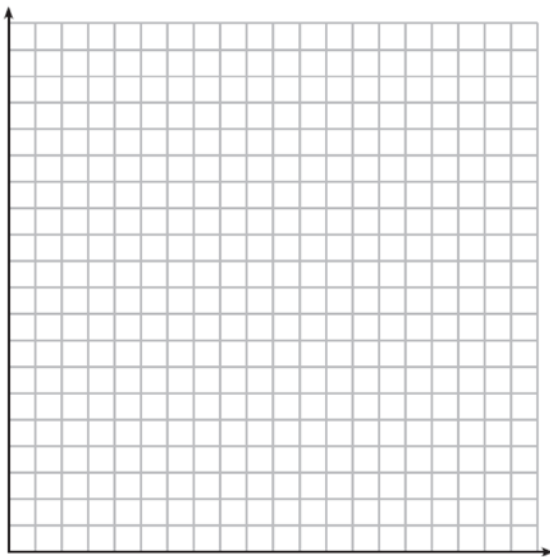
State when $V(t) = Z(t)$, to the *nearest hundredth*, and interpret its meaning in the context of the problem. Zach takes out an insurance policy that requires him to pay a $3000 deductible in case of a collision. Zach will cancel the collision policy when the value of his car equals his deductible. To the *nearest year*, how long will it take Zach to cancel this policy? Justify your answer.

535 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 $0 \le t \le 2$.
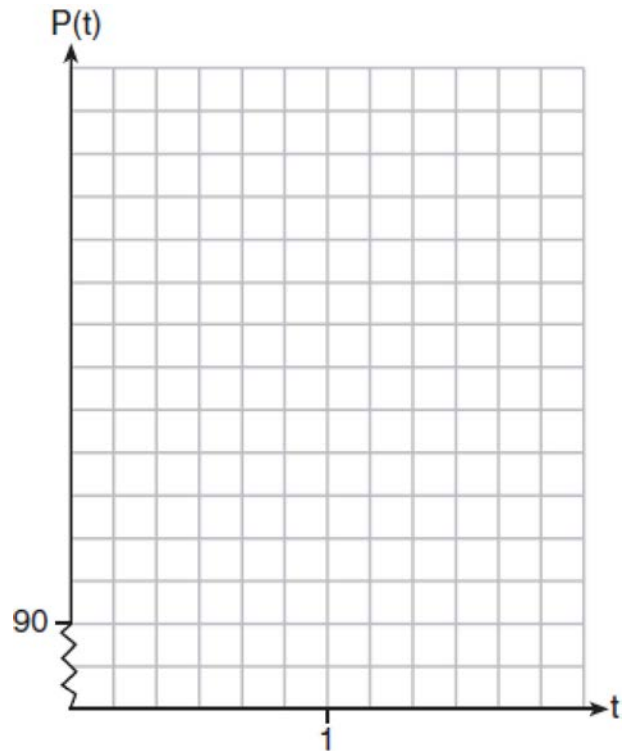
Determine the period of P. Explain what this value represents in the given context. Normal resting blood pressure for an adult is 120 over 80. This means that the blood pressure oscillates between a maximum of 120 and a minimum of 80. Adults with high blood pressure (above 140 over 90) and adults with 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.

99

536 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.
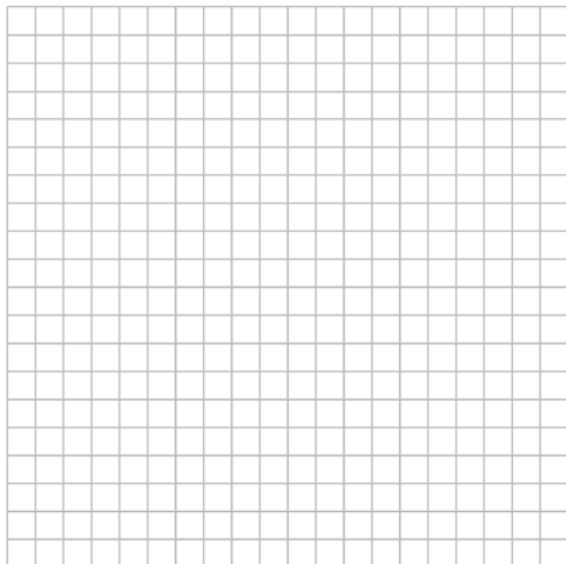
People who fish in Carter Beach know that a certain species of fish is most plentiful when the water level is increasing. Explain whether you would recommend fishing for this species at 7:30 p.m. or 10:30 p.m. using evidence from the given context.

537 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.
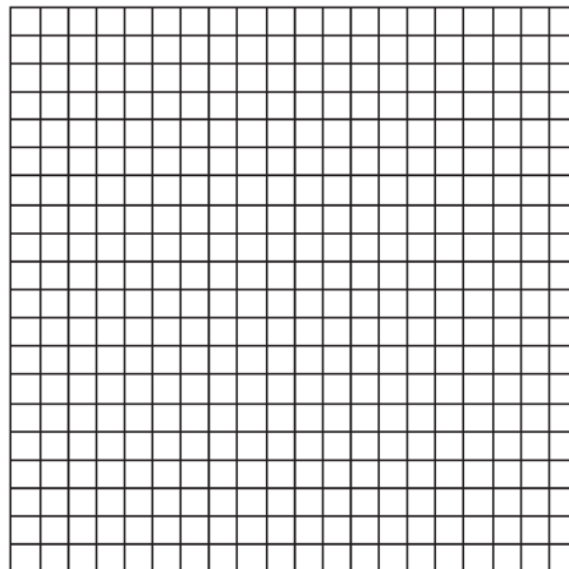
Does the height of the nail ever reach 30 inches above the ground? Justify your answer.

538 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.

539 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.

540 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.

541 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 $A = A_0 \left(\dfrac{1}{2}\right)^{\frac{t}{h}}$ 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.

542 A technology company is comparing two plans for speeding up its technical support time. Plan *A* can be modeled by the function $A(x) = 15.7(0.98)^x$ and plan *B* can be modeled by the function $B(x) = 11(0.99)^x$ where *x* is the number of customer service representatives employed by the company and $A(x)$ and $B(x)$ represent the average wait time, in minutes, of each customer. Graph $A(x)$ and $B(x)$ in the interval $0 \le x \le 100$ on the set of axes below.
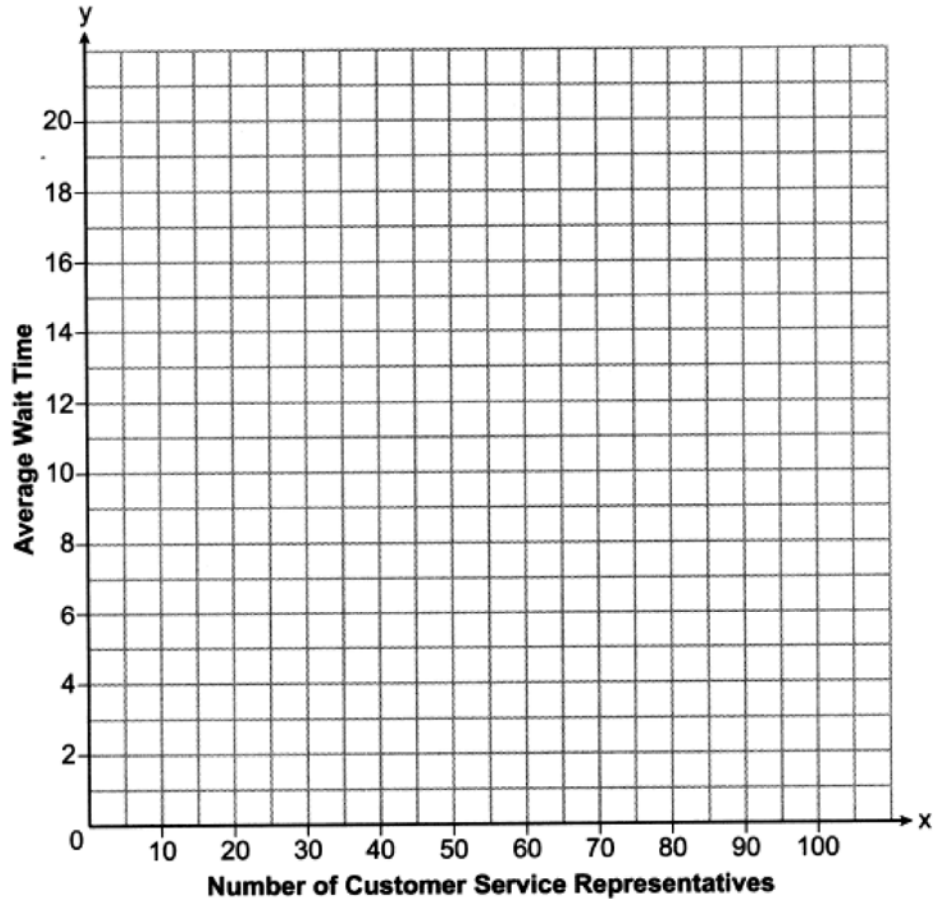
To the *nearest integer*, solve the equation $A(x) = B(x)$. Determine, to the *nearest minute*, $B(100) - A(100)$. Explain what this value represents in the given context.

543 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.
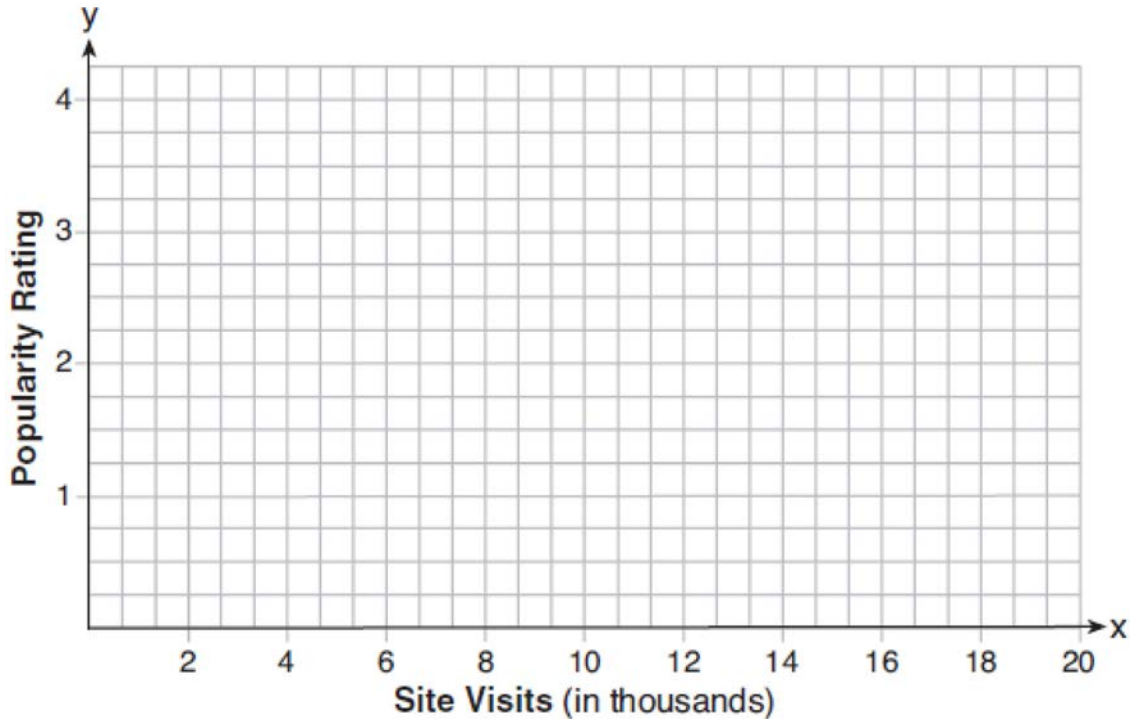
An alternative rating model is represented by $R(x) = \dfrac{1}{2}x - 6$, where x is the number of visits per week in thousands. Graph $R(x)$ on the same set of axes. For what number of weekly visits will the two models provide the same rating?

544 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.

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

$$a_0 = 92.2$$

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

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

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

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

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

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

547 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.

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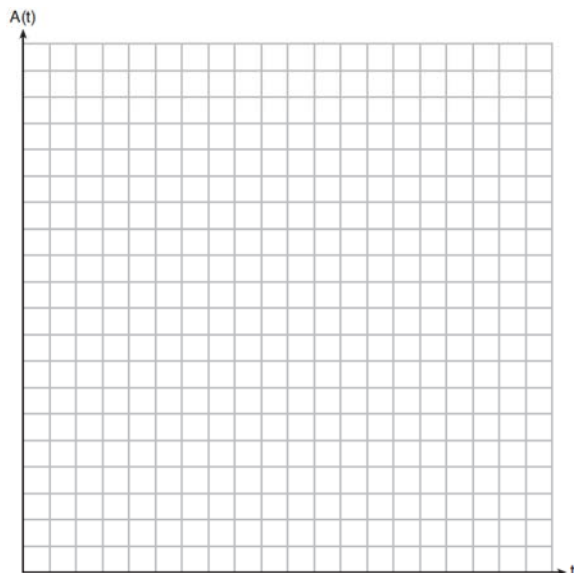
Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal. Explain how your graph of $A(t)$ confirms your answer.

548 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 $2 \leq x \leq 16$.

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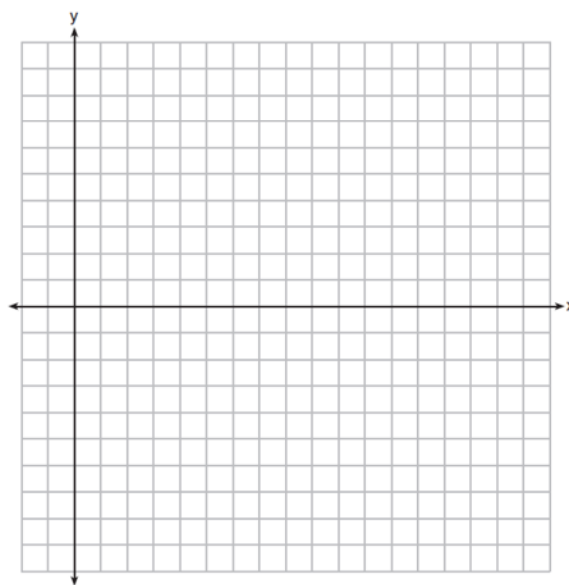
Over the given domain, state when the company was the least profitable and the most profitable, to the *nearest year*. Explain how you determined your answer.

105

549 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.
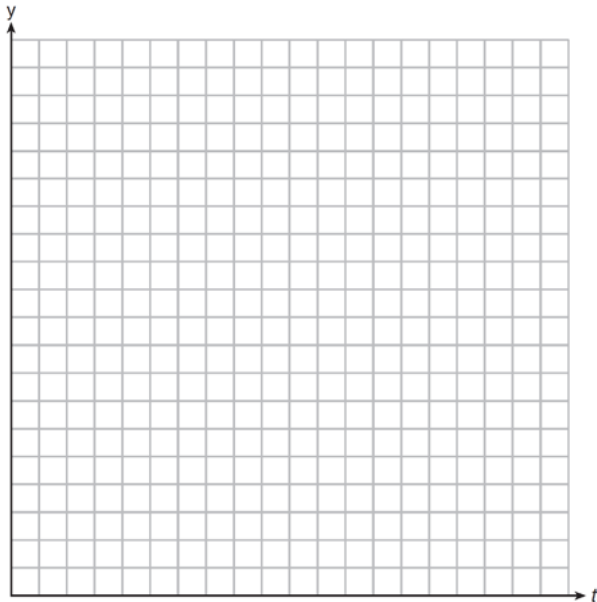
To the *nearest hour*, t, when does the amount of the given drug remaining in patient B begin to exceed the amount of the given drug remaining in patient A? The doctor will allow patient A to take another 800 milligram dose of the drug once only 15% of the original dose is left in the body. Determine, to the *nearest tenth of an hour*, how long patient A will have to wait to take another 800 milligram dose of the drug.

Algebra II Multiple Choice Regents Exam Questions
Answer Section

1   ANS: 4

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

REF: 012011aii   NAT: S.CP.A.4   TOP: Conditional Probability

2   ANS: 1
The vertical distance from the directrix to the vertex, *p*, is 2. The vertical distance from the vertex to the focus must also be 2.

REF: 062213aii   NAT: G.GPE.A.2   TOP: Graphing Quadratic Functions

3   ANS: 1

$$x^3 + 2x^2 - 9x - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0$$

$$x^2(x+2) - 9(x+2) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0$$

$$(x+2)(x^2 - 9) = 0$$

REF: 011903aii   NAT: A.APR.B.3   TOP: Solving Polynomial Equations

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

5   ANS: 3   REF: 082201aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: type

6   ANS: 4

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

REF: 081917aii   NAT: F.LE.A.2   TOP: Modeling Exponential Functions

7   ANS: 3

$$
\require{enclose}
\begin{array}{r}
2x^3 - 4x^2 - x + \dfrac{14}{x+6} \\[4pt]
x+6 \enclose{longdiv}{2x^4 + 8x^3 - 25x^2 - 6x + 14} \\
\underline{2x^4 + 12x^3} \\
-4x^3 - 25x^2 \\
\underline{-4x^3 - 24x^2} \\
-x^2 - 6x \\
\underline{-x^2 - 6x}
\end{array}
$$

REF: 081805aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

8   ANS: 1
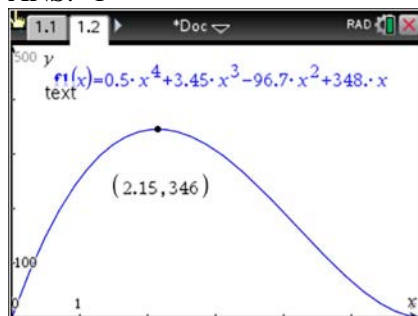
    REF: 011908aii   NAT: F.IF.B.4   TOP: Graphing Polynomial Functions

9   ANS: 4

There is no *x*-intercept.

    REF: 011823aii   NAT: F.IF.C.7   TOP: Graphing Exponential Functions

10   ANS: 4   REF: 062216aii   NAT: S.IC.B.3   TOP: Analysis of Data

    KEY: type

11   ANS: 3

$$e^{bt} = \frac{c}{a}$$

$$\ln e^{bt} = \ln \frac{c}{a}$$

$$bt \ln e = \ln \frac{c}{a}$$

$$t = \frac{\ln \frac{c}{a}}{b}$$

    REF: 011813aii   NAT: F.LE.A.4   TOP: Exponential Equations

    KEY: without common base

12   ANS: 2

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

    REF: 081811aii   NAT: F.TF.C.8   TOP: Determining Trigonometric Functions

13   ANS: 4   REF: 082220aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions

14 ANS: 4

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

REF: 011811aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
KEY: variables

15 ANS: 3   REF: 061910aii   NAT: F.BF.A.2   TOP: Sequences

16 ANS: 2   REF: 081908aii   NAT: F.IF.B.4   TOP: Graphing Polynomial Functions

17 ANS: 4

$$\frac{5+9}{2} = 7, \text{ vertex: } (-2,7); \ p = 7 - 9 = -2, \ y = \frac{1}{4(-2)}(x+2)^2 + 7$$

$$y - 7 = \frac{1}{-8}(x+2)^2$$

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

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

18 ANS: 4   REF: 081803aii   NAT: F.BF.A.1   TOP: Operations with Functions

19 ANS: 1

$84.1\% \times 750 \approx 631$

REF: 011923aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: predict

20 ANS: 1

2) linear, 3) quadratic, 4) cubic

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

21 ANS: 3   REF: 081819aii   NAT: A.REI.D.11   TOP: Other Systems

22 ANS: 1

$$
\begin{array}{lll}
x + y + z = 9 & 4 - y - z = -1 & 4 - 6 + z = 9 \\
\underline{x - y - z = -1} & 4 - y + z = 21 & z = 11 \\
\quad 2x = 8 & -y - z = -5 & \\
\quad\ \ x = 4 & \underline{-y + z = 17} & \\
& -2y = 12 & \\
& y = -6 &
\end{array}
$$

REF: 012018aii   NAT: A.REI.C.6   TOP: Solving Linear Systems
KEY: three variables

23 ANS: 3   REF: 061824aii   NAT: A.CED.A.1   TOP: Modeling Rationals

24 ANS: 1   REF: 082221aii   NAT: F.BF.B.6   TOP: Sigma Notation
KEY: represent

25 ANS: 4

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

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

REF: 011922aii   NAT: F.IF.C.9   TOP: Comparing Functions

26 ANS: 4

$$\dfrac{2}{x} = \dfrac{4x}{x+3}$$

$$2x + 6 = 4x^2$$

$$4x^2 - 2x - 6 = 0$$

$$2\left(2x^2 - x - 3\right) = 0$$

$$(2x - 3)(x + 1) = 0$$

$$x = \dfrac{3}{2}, -1$$

REF: 061809aii   NAT: A.REI.A.2   TOP: Solving Rationals

27 ANS: 4

$0.48 \cdot 0.25 = 0.12$

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

28 ANS: 3

$(x + 3i)^2 - (2x - 3i)^2 = x^2 + 6xi + 9i^2 - \left(4x^2 - 12xi + 9i^2\right) = -3x^2 + 18xi$

REF: 061805aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

29 ANS: 1

$$p(x) = r(x) - c(x)$$

$$-0.5x^2 + 250x - 300 = -0.3x^2 + 150x - c(x)$$

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

REF: 061813aii   NAT: F.BF.A.1   TOP: Operations with Functions

30 ANS: 3

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

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

31 ANS: 3

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

$$x+1 = x^2 + 2x + 1$$

$$0 = x^2 + x$$

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

$$x = -1, 0$$

REF: 011802aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions

32 ANS: 2

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

$$2x = y + 16$$

$$y = 2x - 16$$

REF: 081806aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: linear

33 ANS: 2   REF: 011820aii   NAT: S.IC.A.2   TOP: Analysis of Data

34 ANS: 3

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

REF: 062210aii   NAT: F.BF.A.1   TOP: Operations with Functions

35 ANS: 3   REF: 012002aii   NAT: F.BF.A.1   TOP: Operations with Functions

36 ANS: 2   REF: 011901aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: mean and standard deviation

37 ANS: 4

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

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

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

$$2 = x$$

REF: 081915aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

38 ANS: 3

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

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

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

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

$$x = 5, 7$$

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

39 ANS: 1

$$\ln e^{x+2} = \ln \frac{7}{5}$$

$$(x + 2) \ln e = \ln \frac{7}{5}$$

$$x = -2 + \ln \frac{7}{5}$$

REF: 062207aii   NAT: F.LE.A.4   TOP: Exponential Equations
KEY: without common base

40 ANS: 4

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

REF: 061810aii   NAT: F.TF.B.5   TOP: Modeling Trigonometric Functions

41 ANS: 4
$$a_1 = 2.5 + 0.5(1) = 3$$

REF: 011916aii   NAT: F.BF.A.2   TOP: Sequences

42 ANS: 1

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

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

43 ANS: 1
The time of the next high tide will be the midpoint of consecutive low tides.

REF: 011907aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: mixed

44 ANS: 2   REF: 082204aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: type

45 ANS: 3   REF: 082214aii   NAT: F.IF.C.7   TOP: Graphing Exponential Functions

46 ANS: 2
The mass of the carbon-14 is decreasing by half every 5715 years.

REF: 062211aii   NAT: F.LE.B.5   TOP: Modeling Exponential Functions

47 ANS: 3

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

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

48 ANS: 3

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

$k = 3$

REF: 061812aii   NAT: A.APR.B.2   TOP: Remainder Theorem

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

REF: 081823aii   NAT: G.GPE.A.2   TOP: Graphing Quadratic Functions

50 ANS: 2

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

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

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

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

REF: 082206aii   NAT: A.APR.B.2   TOP: Remainder Theorem

51 ANS: 1

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

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

52 ANS: 4
1) $d(2) = 2$; 2) $d(1) = 12$; 3) $d(9) \approx 11$; 4) $d(-1) = 2$

REF: 062220aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions

53 ANS: 4   REF: 012016aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions
KEY: increasing/decreasing

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

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

55 ANS: 1
$0.5^{\frac{1}{0.0803}} \approx 0.000178$

REF: 082224aii   NAT: A.SSE.B.3   TOP: Modeling Exponential Functions

56 ANS: 4
$\dfrac{x^2 - 4x}{2x} = \dfrac{x(x-4)}{2x} = \dfrac{x-4}{2} = \dfrac{x}{2} - 2 \quad \dfrac{x-1}{2} - \dfrac{3}{2} = \dfrac{x-1-3}{2} = \dfrac{x-4}{2}$

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

57 ANS: 1
$1.025^{\frac{1}{12}} \approx 1.00206$

REF: 081924aii   NAT: A.SSE.B.3   TOP: Modeling Exponential Functions

58 ANS: 2   REF: 062219aii   NAT: F.TF.A.1   TOP: Unit Circle

59 ANS: 2   REF: 081904aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: higher power

60 ANS: 4   REF: 081912aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: mixed

61 ANS: 2

$x + y - z = 6$ $2x + 2y - 2z = 12$ $5y - 4z = 31$ $5y - 2(-4) = 23$ $x + 3 - (-4) = 6$

$\underline{-x + 4y - z = 17}$ $\underline{2x - 3y + 2z = -19}$ $\underline{5y - 2z = 23}$ $5y = 15$ $x = -1$

$5y - 2z = 23$ $5y - 4z = 31$ $-2z = 8$ $y = 3$

$z = -4$

REF: 061923aii   NAT: A.REI.C.6   TOP: Solving Linear Systems
KEY: three variables

62 ANS: 2   REF: 062206aii   NAT: A.APR.B.2   TOP: Remainder Theorem

63 ANS: 4

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

REF: 011809aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

64 ANS: 4

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

$\log_2(x - 1) = 1$

$x - 1 = 2^1$

$x = 3$

REF: 061819aii   NAT: F.IF.C.7   TOP: Graphing Logarithmic Functions

65 ANS: 1

$\dfrac{-12}{16} = \dfrac{9}{-12} = \dfrac{-6.75}{9}$

REF: 012017aii   NAT: F.IF.A.3   TOP: Sequences   KEY: difference or ratio

66 ANS: 2

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

REF: 081822aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: period

67 ANS: 2

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

$$xy + 2x = y$$

$$xy - y = -2x$$

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

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

REF: 081924aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: other

68 ANS: 4

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

REF: 081921aii   NAT: A.APR.B.3   TOP: Graphing Polynomial Functions

69 ANS: 1

$$\left(a\sqrt[3]{2b^2}\right)\left(\sqrt[3]{4a^2 b}\right) = a\sqrt[3]{8a^2 b^3} = 2ab\sqrt[3]{a^2}$$

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

70 ANS: 4

$$(a+b+c)^2 = a^2 + ab + ac + ab + b^2 + bc + ac + ab + c^2$$

$$x = a^2 + b^2 + c^2 + 2(ab + bc + ac)$$

$$x = y + 2z$$

REF: 061822aii   NAT: A.APR.C.4   TOP: Polynomial Identities

71 ANS: 2   REF: 011910aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: bias

72 ANS: 1

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

REF: 011919aii   NAT: A.APR.B.3   TOP: Graphing Polynomial Functions

73 ANS: 4   REF: 012014aii   NAT: S.IC.B.5   TOP: Analysis of Data

74 ANS: 4

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

REF: 081914aii   NAT: N.RN.A.2   TOP: Operations with Radicals
KEY: with variables, index > 2

75 ANS: 1   REF: 061904aii   NAT: F.IF.B.6   TOP: Rate of Change

76 ANS: 1   REF: 011815aii   NAT: F.TF.A.2   TOP: Unit Circle

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

78 ANS: 3
To determine student opinion, survey the widest range of students.

REF: 062202aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: bias

79 ANS: 2

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

REF: 081818aii   NAT: S.CP.A.1   TOP: Venn Diagrams

80 ANS: 2

$b^2 = 2b^2 - 64$ -8 is extraneous.

$-b^2 = -64$

$b = \pm 8$

REF: 061919aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions

81 ANS: 4   REF: 061907aii   NAT: A.APR.B.2   TOP: Remainder Theorem

82 ANS: 1

$1240(1.06)^x = 890(1.11)^x$

$x \approx 7$

REF: 061814aii   NAT: A.REI.D.11   TOP: Other Systems

83 ANS: 3   REF: 012005aii   NAT: F.IF.B.4   TOP: Graphing Polynomial Functions

84 ANS: 4   REF: 081906aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: type

85 ANS: 2

$$\require{enclose}
\begin{array}{r}
x^2 + 2x + 4 \\
x-2 \enclose{longdiv}{x^3 - 0x^2 + 0x - 2} \\
\underline{x^3 - 2x^2} \\
2x^2 + 0x \\
\underline{2x^2 - 4x} \\
4x - 2 \\
\underline{4x - 8} \\
6
\end{array}$$

REF: 082217aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

86 ANS: 4

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

REF: 082202aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

87 ANS: 3

$$M = \frac{240000\left(\frac{4.5\%}{12}\right)\left(1 + \frac{4.5\%}{12}\right)^{15 \times 12}}{\left(1 + \frac{4.5\%}{12}\right)^{15 \times 12} - 1} \approx 1835.98$$

REF: 062209aii   NAT: F.IF.B.4   TOP: Evaluating Exponential Expressions

88 ANS: 1   REF: 062201aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents

89 ANS: 1   REF: 081804aii   NAT: F.IF.C.9   TOP: Comparing Functions

90 ANS: 3

$$\frac{4}{k^2 - 8k + 12} = \frac{k(k - 6) + (k - 2)}{k^2 - 8k + 12} \quad k = 6 \text{ is extraneous}$$

$$4 = k^2 - 6k + k - 2$$

$$0 = k^2 - 5k - 6$$

$$0 = (k - 6)(k + 1)$$

$$k = 6, -1$$

REF: 082218aii   NAT: A.REI.A.2   TOP: Solving Rationals

91 ANS: 1

2) $(x^4 - x^2 y^2 + y^4) \neq (x^2 - y^2)(x^2 - y^2)$; 3) $x^6 + y^6 \neq (x^3 + y^3)^2$; 4) $\dfrac{x^6 + y^6}{x^2 + y^2} \neq x^6 + y^6 - (x^2 + y^2)$

REF: 082219aii   NAT: A.APR.C.4   TOP: Polynomial Identities

92 ANS: 3   REF: 062205aii   NAT: F.BF.B.3   TOP: Transformations with Functions

93 ANS: 1

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

REF: 012023aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: factoring

94 ANS: 3

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

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

95 ANS: 3

$(x + a)^2 + 5(x + a) + 4$ let $u = x + a$

$$u^2 + 5u + 4$$

$$(u + 4)(u + 1)$$

$$(x + a + 4)(x + a + 1)$$

REF: 012006aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: multivariable

96 ANS: 3

$(x + 4)^2 - 10 = 3x + 6$ $y = 3(-5) + 6 = -9$

$x^2 + 8x + 16 - 10 = 3x + 6$ $y = 3(0) + 6 = 6$

$$x^2 + 5x = 0$$

$$x(x + 5) = 0$$

$$x = -5, 0$$

REF: 061903aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

97 ANS: 1

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

$(2x - i)[(2x - i) - (2x + 3i)]$

$$(2x - i)(-4i)$$

$$-8xi + 4i^2$$

$$-8xi - 4$$

REF: 011911aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

98 ANS: 2

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

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

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

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

                           $-2y = 2$

                           $y = -1$

REF: 062208aii   NAT: A.REI.C.6   TOP: Solving Linear Systems
KEY: three variables

99 ANS: 3

between 000 and 449, inclusive→ $\dfrac{450}{1000} = 45\%$

REF: 012024aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: type

100 ANS: 4   REF: 062215aii   NAT: F.IF.C.7   TOP: Graphing Logarithmic Functions

101 ANS: 2

$x = -6(y - 2)$

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

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

REF: 011821aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: linear

102 ANS: 1   REF: 081903aii   NAT: F.LE.A.2   TOP: Families of Functions

103 ANS: 1

$\left(1.03^{\frac{1}{12}} \right)^{12t} \approx 1.00247^{12t}$

REF: 062224aii   NAT: A.SSE.B.3   TOP: Modeling Exponential Functions

104 ANS: 4   REF: 011808aii   NAT: A.SSE.B.3   TOP: Modeling Exponential Functions

105 ANS: 1

The cosine function has been translated +3. Since the maximum is 5 and the minimum is 1, the amplitude is 2.
$\dfrac{\pi}{3} = \dfrac{2\pi}{b}$.

$b = 6$

REF: 011913aii   NAT: F.TF.B.5   TOP: Modeling Trigonometric Functions

106 ANS: 2

$x^2 = 3x + 40.$ $x = -5$ is an extraneous solution.

$x^2 - 3x - 40 = 0$

$(x - 8)(x + 5) = 0$

$x = 8, -5$

REF: 012010aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions

107 ANS: 1

$6 - (3x - 2i)(3x - 2i) = 6 - \left(9x^2 - 12xi + 4i^2 \right) = 6 - 9x^2 + 12xi + 4 = -9x^2 + 12xi + 10$

REF: 061915aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

108 ANS: 2   REF: 082203aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: amplitude
109 ANS: 4   REF: 012008aii   NAT: S.CP.A.3   TOP: Conditional Probability
110 ANS: 1

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

REF: 011816aii   NAT: G.GPE.A.2   TOP: Graphing Quadratic Functions
111 ANS: 3
$T(19) = 8\sin(0.3(19) - 3) + 74 \approx 77$

REF: 061922aii   NAT: F.TF.A.2   TOP: Determining Trigonometric Functions
KEY: radians
112 ANS: 2
$$n^2\left(n^2 - 9\right) + 4n\left(n^2 - 9\right) - 12\left(n^2 - 9\right)$$

$$\left(n^2 + 4n - 12\right)\left(n^2 - 9\right)$$

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

REF: 061911aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: factoring by grouping
113 ANS: 4
$3x - (-2x + 14) = 16 \quad 3(6) - 4z = 2$

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

$\qquad\qquad x = 6 \qquad\qquad z = 4$

REF: 011803aii   NAT: A.REI.C.6   TOP: Solving Linear Systems
KEY: three variables
114 ANS: 4
$$m^3 - 2m^2 + 4m - 8 = 0$$

$$m^2(m - 2) + 4(m - 2) = 0$$

$$\left(m^2 + 4\right)(m - 2) = 0$$

REF: 081821aii   NAT: A.APR.B.3   TOP: Solving Polynomial Equations
115 ANS: 3   REF: 011824aii   NAT: F.BF.A.2   TOP: Sequences
116 ANS: 2

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

REF: 011905aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

117 ANS: 3   REF: 012015aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: type

118 ANS: 1

$$3x + 1 \overline{\smash{\big)}\ 9x^2 + 0x - 2}$$ with quotient $3x - 1$

$$\underline{9x^2 + 3x}$$
$$-3x - 2$$
$$\underline{-3x - 1}$$
$$-1$$

REF: 081910aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

119 ANS: 2

$$x^2 + 4x - 1 = x - 3 \quad y + 3 = -1$$
$$x^2 + 3x + 2 = 0 \quad\quad y = -4$$
$$(x + 2)(x + 1) = 0$$
$$x = -2, -1$$

REF: 061801aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

120 ANS: 3   REF: 011917aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: other

121 ANS: 4

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

REF: 061924aii   NAT: F.BF.A.1   TOP: Modeling Exponential Functions

122 ANS: 3   REF: 061901aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: type

123 ANS: 3
$$440 \times 2.3\% \approx 10$$

REF: 011807aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: predict

124 ANS: 3   REF: 012003aii   NAT: A.APR.C.4   TOP: Polynomial Identities

125 ANS: 3

$$y = 278(0.5)^{\frac{18}{1.8}} \approx 0.271$$

REF: 011920aii   NAT: F.LE.A.2   TOP: Modeling Exponential Functions

126 ANS: 4   REF: 081824aii   NAT: S.CP.A.3   TOP: Conditional Probability

127 ANS: 4

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

REF: 061905aii   NAT: A.SSE.B.4   TOP: Series

128 ANS: 3

$$\frac{2}{3x+1} = \frac{1}{x} - \frac{6x}{3x+1} \quad -\frac{1}{3} \text{ is extraneous.}$$

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

$$6x^2 + 2x = 3x + 1$$

$$6x^2 - x - 1 = 0$$

$$(2x-1)(3x+1) = 0$$

$$x = \frac{1}{2}, -\frac{1}{3}$$

REF: 011915aii   NAT: A.REI.A.2   TOP: Solving Rationals

129 ANS: 1

$$2000\left(1 + \frac{.032}{12}\right)^{12t} \approx 2000(1.003)^{12t}$$

REF: 012004aii   NAT: F.BF.A.1   TOP: Modeling Exponential Functions

130 ANS: 2

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

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

REF: 011904aii   NAT: F.IF.A.3   TOP: Sequences   KEY: explicit

131 ANS: 4   REF: 011801aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: bias

132 ANS: 4

$$\ln e^{0.3x} = \ln\frac{5918}{87}$$

$$x = \frac{\ln\frac{5918}{87}}{0.3}$$

REF: 081801aii   NAT: F.LE.A.4   TOP: Exponential Equations
KEY: without common base

133 ANS: 2   REF: 011806aii   NAT: A.APR.C.4   TOP: Polynomial Identities

134 ANS: 4
Translate the parent log function 2 to the right and reflect over the *x*-axis.

REF: 082207aii   NAT: F.IF.C.7   TOP: Graphing Logarithmic Functions

135 ANS: 4

$$wx^2 + w = 0$$

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

$$x^2 = -1$$

$$x = \pm i$$

REF: 061912aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | taking square roots

136 ANS: 1

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

REF: 012012aii   NAT: F.IF.B.6   TOP: Rate of Change

137 ANS: 1

$$100\left(\frac{1}{2}\right)^{\frac{d}{8}} = 100e^{kd}$$

$$\left(\frac{1}{2}\right)^{\frac{1}{8}} = e^k$$

$$k \approx -0.087$$

REF: 061818aii   NAT: F.LE.A.4   TOP: Exponential Decay

138 ANS: 1

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

REF: 012022aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

139 ANS: 1

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

REF: 061808aii   NAT: A.APR.C.4   TOP: Polynomial Identities

140 ANS: 2   REF: 061917aii   NAT: F.LE.B.5   TOP: Modeling Exponential Functions

141 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) $0.2 \neq 0.15 \cdot 0.05$

$$0.2 \neq 0.2 \cdot 0.2$$

REF: 011912aii   NAT: S.CP.A.3   TOP: Conditional Probability

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

REF: 061913aii   NAT: S.IC.B.5   TOP: Analysis of Data

143 ANS: 1
$$x - \frac{20}{x} = 8$$
$$x^2 - 8x - 20 = 0$$
$$(x - 10)(x + 2) = 0$$
$$x = 10, -2$$

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

144 ANS: 2
$$2 - \frac{x-1}{x+2}$$
$$1 + \frac{x+2}{x+2} - \frac{x-1}{x+2}$$
$$1 + \frac{x+2-(x-1)}{x+2}$$
$$1 + \frac{3}{x+2}$$

REF: 081907aii   NAT: A.APR.D.7   TOP: Addition and Subtraction of Rationals

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

REF: 061807aii   NAT: F.IF.B.6   TOP: Rate of Change

146 ANS: 3
$x^2 + (2x)^2 = 5$ $y = 2x = \pm 2$
$$x^2 + 4x^2 = 5$$
$$5x^2 = 5$$
$$x = \pm 1$$

REF: 081916aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

147 ANS: 2   REF: 061802aii   NAT: F.IF.C.7   TOP: Graphing Exponential Functions

148 ANS: 4
$400 \cdot .95^4 \approx 380$

REF: 061918aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: predict

149 ANS: 2

$$4x \bullet x^{\frac{2}{3}} + 2x^{\frac{5}{3}} = 4x^{\frac{5}{3}} + 2x^{\frac{5}{3}} = 6x^{\frac{5}{3}} = 6\sqrt[3]{x^5}$$

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

150 ANS: 2

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

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

REF: 062221aii   NAT: F.IF.A.3   TOP: Sequences

151 ANS: 4

1) is a correct formula, but not recursive

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

152 ANS: 1   REF: 011902aii   NAT: F.IF.C.7   TOP: Graphing Logarithmic Functions

153 ANS: 1

1) $A(20) > 0$; 2) $.5 \times .5 = .25$; 3) true; 4) $A(7) \approx 9.9$

REF: 082211aii   NAT: F.LE.B.5   TOP: Modeling Exponential Functions

154 ANS: 2   REF: 082222aii   NAT: A.CED.A.1   TOP: Modeling Rationals

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

156 ANS: 2

$$P(B) \cdot P(A|B) = P(A \text{ and } B)$$

$$P(B) \cdot 0.8 = 0.2$$

$$P(B) = 0.25$$

REF: 081913aii   NAT: S.CP.A.3   TOP: Conditional Probability

157 ANS: 4

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

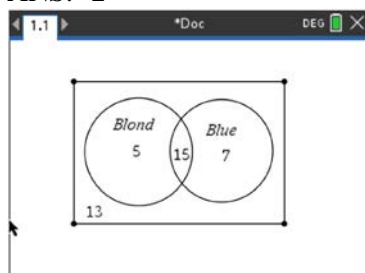REF: 061902aii   NAT: A.APR.C.4   TOP: Polynomial Identities

158 ANS: 3

$$\frac{x^2(x+2) - 9(x+2)}{x\left(x^2 - x - 6\right)} = \frac{\left(x^2 - 9\right)(x+2)}{x(x-3)(x+2)} = \frac{(x+3)(x-3)}{x(x-3)} = \frac{x+3}{x}$$

REF: 061803aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: factoring

159 ANS: 2

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

REF: 062204aii   NAT: S.CP.A.1   TOP: Venn Diagrams

160 ANS: 2

$$S_{20} = \frac{.01 - .01(3)^{20}}{1 - 3} = 17,433,922$$

REF: 011822aii   NAT: A.SSE.B.4   TOP: Series

161 ANS: 1

REF: 081919aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: percent

162 ANS: 4

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

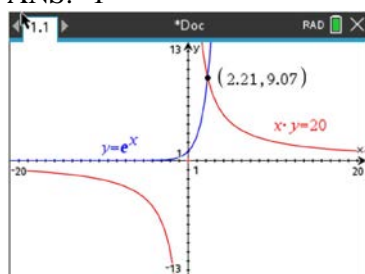REF: 011918aii   NAT: A.SSE.B.3   TOP: Modeling Exponential Functions

163 ANS: 2   REF: 061816aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions
KEY: bimodalgraph

164 ANS: 2   REF: 081816aii   NAT: F.IF.C.7   TOP: Graphing Logarithmic Functions
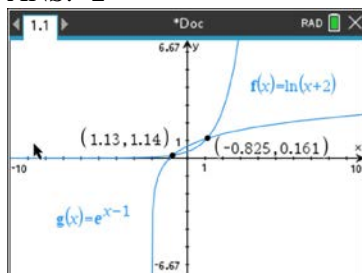KEY: bimodalgraph

165 ANS: 1

REF: 082210aii   NAT: A.REI.D.11   TOP: Other Systems

166 ANS: 2

REF: 081920aii   NAT: A.REI.D.11   TOP: Other Systems

167 ANS: 2   REF: 011804aii   NAT: F.TF.A.2   TOP: Determining Trigonometric Functions
KEY: radians

168 ANS: 1

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

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

169 ANS: 1

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

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

REF: 081820aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions
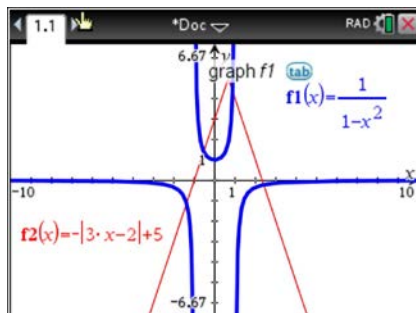KEY: maximum/minimum

170 ANS: 4

$$g(x): \frac{10-6}{4-2} = 2 \quad t(x): \frac{3--5}{4-2} = 4$$

REF: 062212ai   NAT: F.IF.C.9   TOP: Comparing Functions

171 ANS: 4   REF: 011805aii   NAT: F.LE.B.5   TOP: Modeling Exponential Functions

172 ANS: 4

REF: 011924aii   NAT: A.REI.D.11   TOP: Other Systems

173 ANS: 3

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

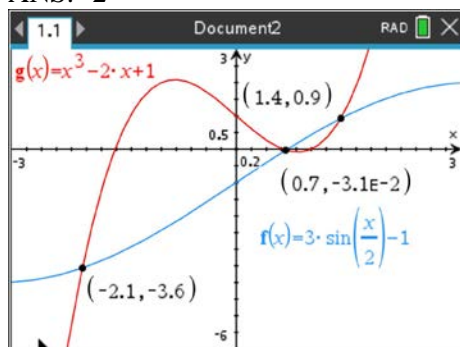$\quad r^3 = 27$

$\quad\ r = 3$

REF: 081902aii   NAT: A.SSE.B.4   TOP: Series

174 ANS: 4

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

REF: 062223aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

175 ANS: 2

REF: 012021aii   NAT: A.REI.D.11   TOP: Other Systems

176 ANS: 3

$x = \dfrac{-2 \pm \sqrt{2^2 - 4(3)(7)}}{2(3)} = \dfrac{-2 \pm \sqrt{-80}}{6} = \dfrac{-2 \pm i\sqrt{16}\sqrt{5}}{6} = -\dfrac{1}{3} \pm \dfrac{2i\sqrt{5}}{3}$

REF: 081809aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

177 ANS: 2

$$
\begin{array}{r}
1 \\
x^2 + 3 \overline{\smash{\big)}\, x^2 + 0x + 12} \\
\underline{x^2 + 0x + 3} \\
9
\end{array}
$$

REF: 062218aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

178 ANS: 3

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

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

179 ANS: 4

$$\frac{15000}{12000} = \frac{12000e^{.025t}}{12000}$$

$$1.25 = e^{.025t}$$

$$\ln 1.25 = \ln e^{.025t}$$

$$\ln 1.25 = .025t$$

$$\frac{\ln 1.25}{.025} = t$$

REF: 082209aii   NAT: F.LE.A.4   TOP: Exponential Growth

180 ANS: 3
The distance from the vertex to the focus, p, is 4. Since the focus is below the vertex, p is negative.

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

REF: 082212aii   NAT: G.GPE.A.2   TOP: Graphing Quadratic Functions

181 ANS: 4   REF: 061914aii   NAT: A.REI.D.11   TOP: Other Systems

182 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) $x = \pm 4i$

REF: 011909aii   NAT: A.REI.B.4   TOP: Using the Discriminant
KEY: determine nature of roots given equation, graph, table

183 ANS: 1

$$\sqrt[4]{81x^8y^6} = 81^{\frac{1}{4}} x^{\frac{8}{4}} y^{\frac{6}{4}} = 3x^2 y^{\frac{3}{2}}$$

REF: 012001aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
KEY: variables

184 ANS: 3

$$x = -\frac{2y}{5} + 4 \quad y = -\frac{5}{2}(6) + 10 = -5$$

$$5x = -2y + 20$$

$$2y = -5x + 20$$

$$y = -\frac{5}{2}x + 10$$

REF: 082223aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: linear

185 ANS: 4

$$\log 2^t = \log \sqrt{10} \quad 2) \frac{\log \sqrt{10}}{\log 2} = \log_2 \sqrt{10}, \ 1) \log_2 \sqrt{10} = \log_2 10^{\frac{1}{2}} = \frac{1}{2}\log_2 10, \ 3) \log_4 10 = \frac{\log_2 10}{\log_2 4} = \frac{1}{2}\log_2 10$$

$$t \log 2 = \log \sqrt{10}$$

$$t = \frac{\log \sqrt{10}}{\log 2}$$

REF: 012009aii   NAT: F.LE.A.4   TOP: Exponential Equations
KEY: without common base

186 ANS: 2

REF: 061817aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: probability

187 ANS: 4
1 year = 365 days

REF: 061823aii   NAT: A.SSE.B.3   TOP: Modeling Exponential Functions

188 ANS: 1   REF: 062214aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: predict

189 ANS: 3

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

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

$$x - \frac{1}{2} = -6y$$

$$-\frac{1}{6}\left(x - \frac{1}{2}\right) = y$$

REF: 062217aii NAT: F.BF.B.4 TOP: Inverse of Functions
KEY: linear

190 ANS: 2

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

REF: 081808aii NAT: A.SSE.B.3 TOP: Modeling Exponential Functions

191 ANS: 1 REF: 081813aii NAT: A.SSE.B.4 TOP: Series

192 ANS: 3

$$y = x^3 - 2$$

$$x = y^3 - 2$$

$$x + 2 = y^3$$

$$\sqrt[3]{x + 2} = y$$

REF: 061815aii NAT: F.BF.B.4 TOP: Inverse of Functions
KEY: other

193 ANS: 2

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

REF: 012020aii NAT: A.REI.B.4 TOP: Solving Quadratics
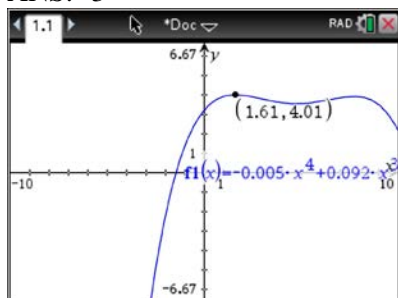KEY: complex solutions | quadratic formula

194 ANS: 4

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

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

REF: 081814aii NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

195 ANS: 3

REF: 011817aii   NAT: F.IF.B.4   TOP: Graphing Polynomial Functions

196 ANS: 4

1) -1 is also a zero. 2) $x^2(x-a)+16(x-a)=(x^2+16)(x-a)$ a is the only zero. 3) $-a$ is the only zero. 4) $x^2(x-a)-9(x-a)=(x^2-9)(x-a)$.

REF: 012019aii   NAT: A.APR.B.3   TOP: Solving Polynomial Equations
197 ANS: 1   REF: 011814aii   NAT: A.REI.D.11   TOP: Other Systems
198 ANS: 4   REF: 081810aii   NAT: F.BF.A.2   TOP: Sequences
199 ANS: 2   REF: 061804aii   NAT: S.ID.B.6   TOP: Regression
KEY: choose model
200 ANS: 3   REF: 061906aii   NAT: F.LE.A.2   TOP: Families of Functions
201 ANS: 1

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

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

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

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

REF: 011812aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions
202 ANS: 1

$$9110=5000e^{30r}$$

$$\ln\frac{911}{500}=\ln e^{30r}$$

$$\frac{\ln\frac{911}{500}}{30}=r$$

$$r\approx.02$$

REF: 011810aii   NAT: F.LE.A.4   TOP: Exponential Growth
203 ANS: 3   REF: 081909aii   NAT: F.BF.A.2   TOP: Sequences
KEY: recursive

204 ANS: 2   REF: 081802aii   NAT: S.IC.B.3   TOP: Analysis of Data
    KEY: type

205 ANS: 4

$$120 = 68 + (195 - 68)e^{-0.05t}$$

$$52 = 127e^{-0.05t}$$

$$\ln \frac{52}{127} = \ln e^{-0.05t}$$

$$\ln \frac{52}{127} = -0.05t$$

$$\frac{\ln \frac{52}{127}}{-0.05} = t$$

$$18 \approx t$$

    REF: 081918aii   NAT: F.LE.A.4   TOP: Exponential Decay

206 ANS: 2

$$\frac{x^2 + 3x}{x^2 + 5x + 6} = \frac{x(x + 3)}{(x + 2)(x + 3)}$$

    REF: 082215aii   NAT: A.APR.D.6   TOP: Rational Expressions
    KEY: factoring

207 ANS: 4
    (1) and (3) are not recursive

    REF: 012013aii   NAT: F.LE.A.2   TOP: Sequences   KEY: recursive

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

209 ANS: 2

$$u = x + 2 \qquad u^2 + 4u + 3$$

$$(u + 3)(u + 1)$$

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

$$(x + 5)(x + 3)$$

    REF: 081901aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
    KEY: higher power

210 ANS: 3

$$-3 + 5i - \left(4 + 24i - 2i - 12i^2\right) = -3 + 5i - (16 + 22i) = -19 - 17i$$

    REF: 081815aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

211 ANS: 2   REF: 062222aii   NAT: F.IF.C.9   TOP: Comparing Functions

212 ANS: 2

$x = 4y + 5$

$x - 5 = 4y$

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

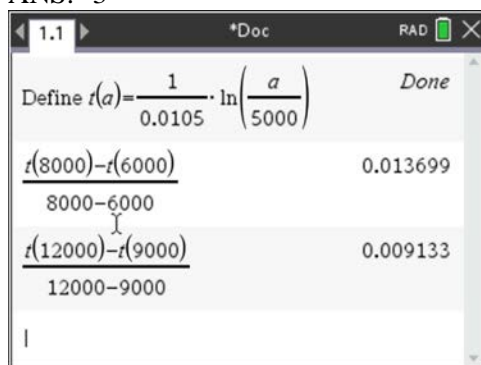REF: 061909aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: linear

213 ANS: 2

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

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

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

REF: 061806aii   NAT: F.BF.B.3   TOP: Even and Odd Functions

214 ANS: 3

REF: 081922aii   NAT: F.IF.B.6   TOP: Rate of Change

215 ANS: 3

$$\frac{c^2 - d^2}{d^2 + cd - 2c^2} = \frac{(c + d)(c - d)}{(d + 2c)(d - c)} = \frac{-(c + d)}{d + 2c} = \frac{-c - d}{d + 2c}$$

REF: 011818aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: factoring

216 ANS: 1

The product of the roots equals $(3 + i)(3 - i) = 9 - i^2 = 10 = \dfrac{c}{a}$. OR

$(x - (3 + i))(x - (3 - i)) = 0$

$(x - 3 - i)(x - 3 + i) = 0$

$((x - 3) - i)((x - 3) + i) = 0$

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

$x^2 - 6x + 9 + 1 = 0$

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

REF: 082208aii   NAT: A.REI.B.4   TOP: Complex Conjugate Root Theorem

217 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.

REF: spr1501aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions
KEY: bimodalgraph

Algebra II Multiple Choice Regents Exam Questions
Answer Section

218 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

REF: 061715aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions
KEY: maximum/minimum

219 ANS: 1

$$2x - 1 \overline{)\, 4x^3 + 0x^2 + 9x - 5}$$

quotient $2x^2 + x + 5$

$$\underline{4x^3 - 2x^2}$$
$$2x^2 + 9x$$
$$\underline{2x^2 - x}$$
$$10x - 5$$
$$\underline{10x - 5}$$

REF: 081713aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

220 ANS: 2

$$\sqrt{x + 14} = \sqrt{2x + 5} + 1 \qquad \sqrt{22 + 14} - \sqrt{2(22) + 5} = 1$$
$$x + 14 = 2x + 5 + 2\sqrt{2x + 5} + 1 \qquad\qquad 6 - 7 \neq 1$$
$$-x + 8 = 2\sqrt{2x + 5}$$
$$x^2 - 16x + 64 = 8x + 20$$
$$x^2 - 24x + 44 = 0$$
$$(x - 22)(x - 2) = 0$$
$$x = 2, 22$$

REF: 081704aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: advanced

221 ANS: 4   REF: 061706aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions

222 ANS: 1
The probability of rain equals the probability of rain, given that Sean pitches.

REF: 061611aii   NAT: S.CP.A.3   TOP: Conditional Probability

223 ANS: 1

1) let $y = x + 2$, then $y^2 + 2y - 8$

$$(y + 4)(y - 2)$$

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

$$(x + 6)x$$

REF: 081715aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: multivariable

224 ANS: 3

$$-33t^2 + 360t = 700 + 5t$$

$$-33t^2 + 355t - 700 = 0$$

$$t = \frac{-355 \pm \sqrt{355^2 - 4(-33)(-700)}}{2(-33)} \approx 3, 8$$

REF: 081606aii   NAT: A.REI.D.11   TOP: Quadratic-Linear Systems

225 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.

REF: fall1502aii   NAT: F.BF.B.3   TOP: Even and Odd Functions

226 ANS: 3

(3) repeats 3 times over 2π.

REF: 011722aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: recognize | bimodalgraph

227 ANS: 4

The maximum volume of $p(x) = -(x + 2)(x - 10)(x - 14)$ is about 56, at $x = 12.1$

REF: 081712aii   NAT: F.IF.B.4   TOP: Graphing Polynomial Functions

228 ANS: 1

```
2 | 1   0   -4   -4    8
  |     2    4    0   -8
  ‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾
    1   2    0   -4    0
```

Since there is no remainder when the quartic is divided by $x - 2$, this binomial is a factor.

REF: 061711aii   NAT: A.APR.B.2   TOP: Remainder Theorem

229 ANS: 4   REF: 061601aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
KEY: variables

230 ANS: 1

$$\frac{2x}{x-2}\left(\frac{x}{x}\right) - \frac{11}{x}\left(\frac{x-2}{x-2}\right) = \frac{8}{x^2-2x}$$

$$2x^2 - 11x + 22 = 8$$

$$2x^2 - 11x + 14 = 0$$

$$(2x-7)(x-2) = 0$$

$$x = \frac{7}{2}, 2$$

REF: 061719aii   NAT: A.REI.A.2   TOP: Solving Rationals

231 ANS: 3

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

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

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

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

REF: 081703aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | completing the square

232 ANS: 3   REF: 061710aii   NAT: S.IC.A.2   TOP: Analysis of Data

233 ANS: 3

$$d = 10\log\frac{6.3\times10^{-3}}{1.0\times10^{-12}} \approx 98$$

REF: 011715aii   NAT: F.IF.B.4   TOP: Evaluating Logarithmic Expressions

234 ANS: 2

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

$$-4x = 3y - 8$$

$$-4x + 8 = 3y$$

$$-\frac{4}{3}x + \frac{8}{3} = y$$

REF: 061616aii   NAT: F.BF.B.4   TOP: Inverse of Functions
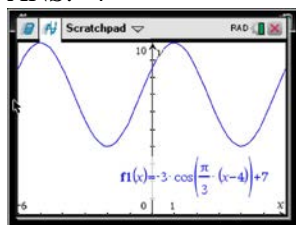KEY: linear

235 ANS: 1

$$(x+3)^2 + (2x-4)^2 = 8 \qquad b^2 - 4ac$$

$$x^2 + 6x + 9 + 4x^2 - 16x + 16 = 8 \quad 100 - 4(5)(17) < 0$$

$$5x^2 - 10x + 17 = 0$$

REF: 081719aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

236 ANS: 4

 As the range is [4,10], the midline is $y = \dfrac{4+10}{2} = 7$.

REF: fall1506aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: mixed

237 ANS: 3

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

REF: 081702aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

238 ANS: 3

The graph shows three real zeros, and has end behavior matching the given end behavior.

REF: 061604aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions
KEY: bimodalgraph

239 ANS: 1

$P(28) = 5(2)^{\frac{98}{28}} \approx 56$

REF: 011702aii   NAT: F.LE.A.2   TOP: Modeling Exponential Functions

240 ANS: 2   REF: 011720aii   NAT: A.APR.B.2   TOP: Remainder Theorem

241 ANS: 4

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

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

242 ANS: 1

$$\frac{A}{P} = e^{rt}$$
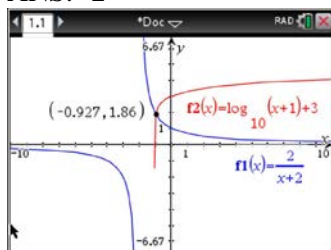
$$0.42 = e^{rt}$$

$$\ln 0.42 = \ln e^{rt}$$

$$-0.87 \approx rt$$

REF: 011723aii   NAT: F.BF.A.1   TOP: Modeling Exponential Functions
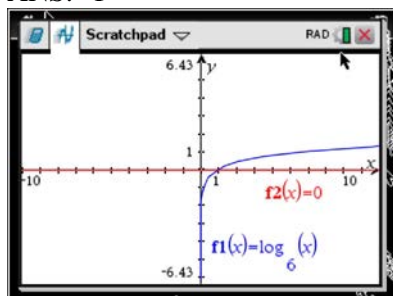
243 ANS: 2   REF: 061620aii   NAT: F.IF.B.4   TOP: Graphing Polynomial Functions
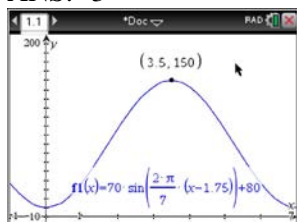
244 ANS: 2

REF: 011712aii   NAT: A.REI.D.11   TOP: Other Systems

245 ANS: 1

REF: 061618aii   NAT: F.IF.C.7   TOP: Graphing Logarithmic Functions

246 ANS: 3

  $H(t)$ is at a minimum at $70(-1) + 80 = 10$

REF: 061613aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions
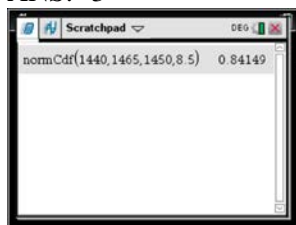KEY: maximum/minimum

247 ANS: 4

$4(x^2 - 6x + 9) + 4(y^2 + 18y + 81) = 76 + 36 + 324$

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

REF: 061619aii   NAT: G.GPE.A.1   TOP: Equations of Circles
KEY: completing the square

248 ANS: 3

REF: 081604aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: probability

249 ANS: 1

REF: fall1503aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

250 ANS: 4

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

REF: 061723aii   NAT: A.APR.D.6   TOP: Expressions with Negative Exponents
KEY: variables

251 ANS: 3

$\sqrt{56 - x} = x$ -8 is extraneous.

$56 - x = x^2$

$0 = x^2 + x - 56$

$0 = (x+8)(x-7)$

$x = 7$

REF: 061605aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions
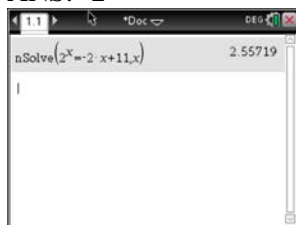
252 ANS: 3   REF: 011710aii   NAT: F.BF.A.1   TOP: Operations with Functions

253 ANS: 2

REF: 081603aii   NAT: A.REI.D.11   TOP: Other Systems

254 ANS: 2

$$\begin{array}{r} x^2 + 0x + 1 \\ x + 2 \overline{\smash{\big)}\ x^3 + 2x^2 + x + 6} \\ \underline{x^3 + 2x^2} \\ 0x^2 + x \\ \underline{0x^2 + 0x} \\ x + 6 \\ \underline{x + 2} \\ 4 \end{array}$$

REF: 081611aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

255 ANS: 1

II. Ninth graders drive to school less often; III.Students know little about adults; IV. Calculus students love math!

REF: 081602aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: bias

256 ANS: 3   REF: 061722aii   NAT: A.CED.A.1   TOP: Modeling Rationals

257 ANS: 4

$$x(x+7) \left[\frac{3x+25}{x+7} - 5 = \frac{3}{x} \right]$$

$$x(3x+25) - 5x(x+7) = 3(x+7)$$

$$3x^2 + 25x - 5x^2 - 35x = 3x + 21$$

$$2x^2 + 13x + 21 = 0$$

$$(2x+7)(x+3) = 0$$

$$x = -\frac{7}{2}, -3$$

REF: fall1501aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

258 ANS: 3
$(m-2)^2(m+3) = (m^2-4m+4)(m+3) = m^3+3m^2-4m^2-12m+4m+12 = m^3-m^2-8m+12$

REF: 081605aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: factoring by grouping

259 ANS: 1
$8(2^{x+3}) = 48$

$2^{x+3} = 6$

$(x+3)\ln 2 = \ln 6$

$x+3 = \dfrac{\ln 6}{\ln 2}$

$x = \dfrac{\ln 6}{\ln 2} - 3$

REF: 061702aii   NAT: F.LE.A.4   TOP: Exponential Equations
KEY: without common base

260 ANS: 1
(2) is not recursive

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

261 ANS: 3
$2d(d^3+3d^2-9d-27)$

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

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

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

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

REF: 081615aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
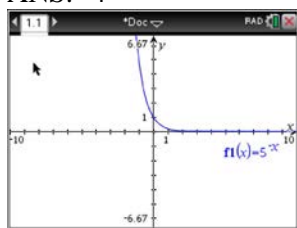KEY: factoring by grouping

262 ANS: 4   REF: 081708aii   NAT: A.APR.B.3   TOP: Solving Polynomial Equations

263 ANS: 1   REF: 081616aii   NAT: F.TF.A.1   TOP: Unit Circle
KEY: bimodalgraph

264 ANS: 4

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

REF: 061615aii   NAT: F.IF.C.7   TOP: Graphing Exponential Functions

265 ANS: 3
Self selection causes bias.

REF: 061703aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: bias

266 ANS: 4

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

REF: 081619aii   NAT: G.GPE.A.2   TOP: Graphing Quadratic Functions

267 ANS: 3   REF: 011708aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: other

268 ANS: 3

$$\frac{f(7) - f(-7)}{7 - -7} = \frac{2^{-0.25(7)} \bullet \sin\left(\dfrac{\pi}{2}(7)\right) - 2^{-0.25(-7)} \bullet \sin\left(\dfrac{\pi}{2}(-7)\right)}{14} \approx -0.26$$

REF: 061721aii   NAT: F.IF.B.6   TOP: Rate of Change

269 ANS: 4   REF: 081718aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: amplitude

270 ANS: 2
$h(x)$ does not have a y-intercept.

REF: 011719aii   NAT: F.IF.C.9   TOP: Comparing Functions

271 ANS: 1
The graph of $y = \sin x$ is unchanged when rotated 180º about the origin.

REF: 081614aii   NAT: F.BF.B.3   TOP: Even and Odd Functions

272 ANS: 1   REF: 081722aii   NAT: S.IC.B.6   TOP: Analysis of Data

273 ANS: 2   REF: 011709aii   NAT: S.IC.B.5   TOP: Analysis of Data

274 ANS: 2

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

REF: 061712aii   NAT: F.TF.C.8   TOP: Determining Trigonometric Functions

275 ANS: 2
The 2010 population is 110 million.

REF: 061718aii   NAT: F.LE.B.5   TOP: Modeling Exponential Functions

276 ANS: 3   REF: 081618aii   NAT: F.LE.A.2   TOP: Sequences
KEY: recursive

277 ANS: 2   REF: 061724aii   NAT: A.SSE.B.4   TOP: Series

278 ANS: 1
The car lost approximately 19% of its value each year.

    REF: 081613aii   NAT: F.LE.B.5   TOP: Modeling Exponential Functions

279 ANS: 1

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

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

$$x = -4, 2$$

    REF: 081701aii   NAT: A.APR.D.6   TOP: Undefined Rationals

280 ANS: 2   REF: 081610aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions
    KEY: increasing/decreasing

281 ANS: 4

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

    REF: 081723aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
    KEY: variables

282 ANS: 2

```
-4 | 1  -11   16    84
   |      -4   60  -304
     1  -15   76
```

Since there is a remainder when the cubic is divided by $x + 4$, this binomial is not a factor.

    REF: 081720aii   NAT: A.APR.B.2   TOP: Remainder Theorem

283 ANS: 4   REF: 081622aii   NAT: F.BF.A.1   TOP: Modeling Exponential Functions

284 ANS: 2

$$B(t) = 750\left(1.16^{\frac{1}{12}}\right)^{12t} \approx 750(1.012)^{12t} \quad B(t) = 750\left(1 + \frac{0.16}{12}\right)^{12t} \text{ is wrong, because the growth is an annual rate}$$

that is not compounded monthly.

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

285 ANS: 1

$$d = 18; \ r = \pm\frac{5}{4}$$

    REF: 011714aii   NAT: F.IF.A.3   TOP: Sequences   KEY: explicit

286 ANS: 2

$$\left(m^{\frac{5}{3}}\right)^{-\frac{1}{2}} = m^{-\frac{5}{6}} = \frac{1}{\sqrt[6]{m^5}}$$

REF: 011707aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
KEY: variables

287 ANS: 2

$$x(30 - 0.01x) - (0.15x^3 + 0.01x^2 + 2x + 120) = 30x - 0.01x^2 - 0.15x^3 - 0.01x^2 - 2x - 120$$
$$= -0.15x^3 - 0.02x^2 + 28x - 120$$

REF: 061709aii   NAT: F.BF.A.1   TOP: Operations with Functions

288 ANS: 4

$$m^5 + m^3 - 6m = m(m^4 + m^2 - 6) = m(m^2 + 3)(m^2 - 2)$$

REF: 011703aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: higher power

289 ANS: 3

$$-2\left(-\frac{1}{2}x^2 = -6x + 20\right)$$
$$x^2 - 12x = -40$$
$$x^2 - 12x + 36 = -40 + 36$$
$$(x - 6)^2 = -4$$
$$x - 6 = \pm 2i$$
$$x = 6 \pm 2i$$

REF: fall1504aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | completing the square

290 ANS: 1

(1) $\dfrac{9 - 0}{2 - 1} = 9$ (2) $\dfrac{17 - 0}{3.5 - 1} = 6.8$ (3) $\dfrac{0 - 0}{5 - 1} = 0$ (4) $\dfrac{17 - -5}{3.5 - 1} \approx 6.3$

REF: 011724aii   NAT: F.IF.B.6   TOP: Rate of Change

291 ANS: 4   REF: 061716aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
KEY: variables

292 ANS: 3   REF: 061720aii   NAT: F.LE.A.2   TOP: Sequences
KEY: explicit

293 ANS: 2

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

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

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

$$y(x - 1) = 2x + 1$$

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

REF: 081714aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: other

294 ANS: 3   REF: 081724aii   NAT: F.BF.A.2   TOP: Sequences
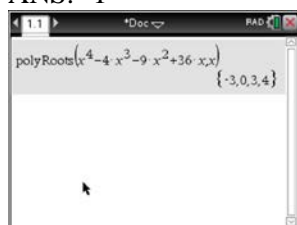
295 ANS: 1

REF: 081711aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: percent

296 ANS: 4   REF: 081707aii   NAT: F.TF.A.2   TOP: Reference Angles
KEY: bimodalgraph

297 ANS: 1

$$x^4 - 4x^3 - 9x^2 + 36x = 0$$

$$x^3(x - 4) - 9x(x - 4) = 0$$

$$(x^3 - 9x)(x - 4) = 0$$

$$x(x^2 - 9)(x - 4) = 0$$

$$x(x + 3)(x - 3)(x - 4) = 0$$

$$x = 0, \pm 3, 4$$

REF: 061606aii   NAT: A.APR.B.3   TOP: Solving Polynomial Equations

298 ANS: 2

$\overline{x} + 2\sigma$ represents approximately 48% of the data.

REF: 061609aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: percent

299 ANS: 4

$4x^2 = -98$

$x^2 = -\dfrac{98}{4}$

$x^2 = -\dfrac{49}{2}$

$x = \pm\sqrt{-\dfrac{49}{2}} = \pm\dfrac{7i}{\sqrt{2}} \cdot \dfrac{\sqrt{2}}{\sqrt{2}} = \pm\dfrac{7i\sqrt{2}}{2}$

REF: 061707aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | taking square roots

300 ANS: 3

$\log_{0.8}\left(\dfrac{V}{17000}\right) = t$ $\dfrac{17,000(0.8)^3 - 17,000(0.8)^1}{3 - 1} \approx -2450$

$0.8^t = \dfrac{V}{17000}$
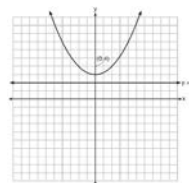
$V = 17000(0.8)^t$

REF: 081709aii   NAT: F.IF.B.6   TOP: Rate of Change

301 ANS: 2

$(2 - yi)(2 - yi) = 4 - 4yi + y^2 i^2 = -y^2 - 4yi + 4$

REF: 061603aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

302   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: $(x - 0)^2 = 4(1)(y - 3)$

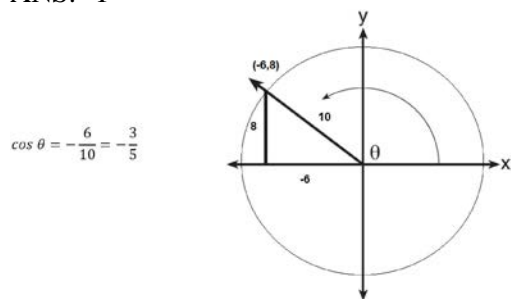$$x^2 = 4y - 12$$

$$x^2 + 12 = 4y$$

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

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: $x^2 + y^2 - 8y + 16 = y^2 - 4y + 4$

$$x^2 + 16 = 4y + 4$$

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

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

303   ANS: 1

$$\cos \theta = -\frac{6}{10} = -\frac{3}{5}$$

REF: 061617aii   NAT: F.TF.A.2   TOP: Determining Trigonometric Functions
KEY: extension to reals

304   ANS: 4

$$\text{period} = \frac{2\pi}{B}$$

$$\frac{1}{60} = \frac{2\pi}{B}$$

$$B = 120\pi$$

REF: 061624aii   NAT: F.TF.B.5   TOP: Modeling Trigonometric Functions

305 ANS: 2

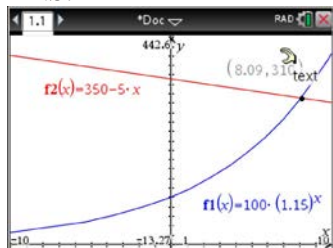The events are independent because $P(A \text{ and } B) = P(A) \cdot P(B)$.

$$0.125 = 0.5 \cdot 0.25$$

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

$$0.625 \neq 0.5 + 0.25$$

REF: 061714aii   NAT: S.CP.B.7   TOP: Theoretical Probability

306 ANS: 2

REF: 011716aii   NAT: A.REI.D.11   TOP: Other Systems

307 ANS: 3   REF: 061602aii   NAT: A.CED.A.1   TOP: Modeling Rationals

308 ANS: 1

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

REF: 081607aii   NAT: S.CP.A.4   TOP: Conditional Probability

309 ANS: 1

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

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

$$3x = -3$$

$$x = -1$$

REF: 011717aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

310 ANS: 4

The scenario represents a decreasing geometric sequence with a common ratio of 0.80.

REF: 061610aii   NAT: F.BF.A.2   TOP: Sequences

311 ANS: 4

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

REF: 061608aii   NAT: F.BF.A.1   TOP: Operations with Functions

312 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. $y = \dfrac{-1}{4p}(x-h)^2 + k$

$$y = \dfrac{-1}{4(1)}(x-0)^2 + 0$$

$$y = -\dfrac{1}{4}x^2$$

REF: 081706aii   NAT: G.GPE.A.2   TOP: Graphing Quadratic Functions

313 ANS: 4

$496 \pm 2(115)$

REF: 011718aii   NAT: S.ID.A.4   TOP: Normal Distributions

KEY: interval

314 ANS: 4

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

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

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

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

REF: fall1505aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials

KEY: factoring by grouping

315 ANS: 2   REF: 081717aii   NAT: S.IC.B.3   TOP: Analysis of Data

KEY: type

316 ANS: 3   REF: 061607aii   NAT: S.IC.A.2   TOP: Analysis of Data

317 ANS: 4

If $1-i$ is one solution, the other is $1+i$. $(x-(1-i))(x-(1+i)) = 0$

$$x^2 - x - ix - x + ix + (1-i^2) = 0$$

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

REF: 081601aii   NAT: A.REI.B.4   TOP: Complex Conjugate Root Theorem

318 ANS: 1

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

REF: 061612aii   NAT: A.REI.B.4   TOP: Solving Quadratics

KEY: complex solutions | quadratic formula

319 ANS: 2   REF: 011701aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions

320 ANS: 3
Since $x + 4$ is a factor of $p(x)$, there is no remainder.

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

321 ANS: 4
$(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3 \neq x^3 + 3xy + y^3$

REF: 081620aii   NAT: A.APR.C.4   TOP: Polynomial Identities

322 ANS: 1   REF: 061701aii   NAT: A.APR.B.3   TOP: Graphing Polynomial Functions

323 ANS: 4

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

REF: 011721aii   NAT: F.IF.B.6   TOP: Rate of Change

324 ANS: 3

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

REF: 081710aii   NAT: A.SSE.B.3   TOP: Modeling Exponential Functions

325 ANS: 4

$d = 32(.8)^{b-1}$ $\quad S_n = \dfrac{32 - 32(.8)^{12}}{1 - .8} \approx 149$

REF: 081721aii   NAT: A.SSE.B.4   TOP: Series

326 ANS: 4
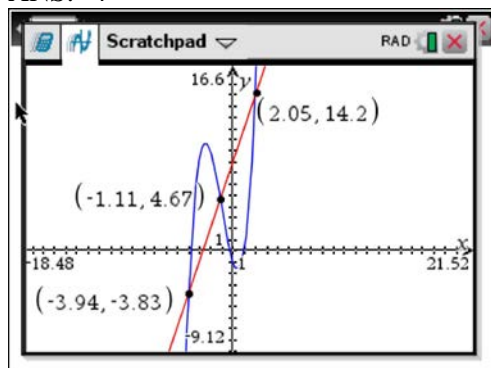
REF: 061622aii   NAT: A.REI.D.11   TOP: Other Systems

327 ANS: 1   REF: 011704aii   NAT: F.TF.C.8   TOP: Simplifying Trigonometric Expressions

328   ANS: 2

Combining (1) and (3): $-6c = -18$ Combining (1) and (2): $5a + 3c = -1$ Using (3): $-(-2) - 5b - 5(3) = 2$

$$c = 3 \qquad\qquad 5a + 3(3) = -1 \qquad\qquad 2 - 5b - 15 = 2$$
$$5a = -10 \qquad\qquad b = -3$$
$$a = -2$$

REF: 081623aii   NAT: A.REI.C.6   TOP: Solving Linear Systems
KEY: three variables

329   ANS: 2

$6xi^3(-4xi + 5) = -24x^2 i^4 + 30xi^3 = -24x^2(1) + 30x(-1) = -24x^2 - 30xi$

REF: 061704aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

330   ANS: 3

$1.0525^{\frac{1}{12}} \approx 1.00427$

REF: 061621aii   NAT: F.BF.A.1   TOP: Modeling Exponential Functions

331   ANS: 2

$\dfrac{212}{1334} \approx .16$ $ME = \left(z\sqrt{\dfrac{p(1-p)}{n}} \right) = \left(1.96\sqrt{\dfrac{(0.16)(0.84)}{1334}} \right) \approx 0.02$ or $\dfrac{1}{\sqrt{1334}} \approx .027$

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

332   ANS: 3

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

$$\frac{1}{J} = \frac{W - F}{FW}$$

$$J = \frac{FW}{W - F}$$

REF: 081617aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

333   ANS: 2

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

REF: 081612aii   NAT: S.IC.B.4   TOP: Analysis of Data

334   ANS: 3   REF: 061623aii   NAT: F.BF.A.2   TOP: Sequences

335   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.

REF: 011713aii   NAT: S.ID.B.6   TOP: Regression   KEY: choose model

336 ANS: 3   REF: 011706aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: type

337 ANS: 4

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

REF: 011711aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

338 ANS: 1   REF: 081609aii   NAT: F.BF.B.6   TOP: Sigma Notation
KEY: represent

339 ANS: 3   REF: 081705aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions
KEY: increasing/decreasing

340 ANS: 2

$$
\begin{array}{r}
2x^2 - 3x + 7 \\
2x+3\overline{\smash{\big)}\,4x^3 + 0x^2 + 5x + 10} \\
\underline{4x^3 + 6x^2} \\
-6x^2 + 5x \\
\underline{-6x^2 - 9x} \\
14x + 10 \\
\underline{14x + 21} \\
-11
\end{array}
$$

REF: 061614aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

341 ANS: 3

$$0.75^{\frac{1}{10}} \approx .9716$$

REF: 061713aii   NAT: A.SSE.B.3   TOP: Modeling Exponential Functions
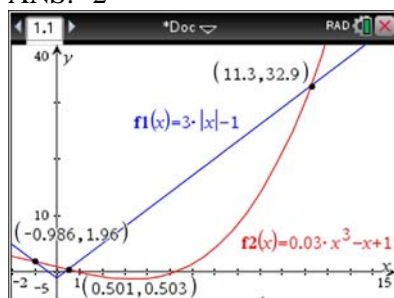
342 ANS: 1

A reference triangle can be sketched using the coordinates $(-4,3)$ in the second quadrant to find the value of $\sin\theta$.
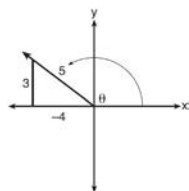
REF: spr1503aii   NAT: F.TF.A.2   TOP: Determining Trigonometric Functions
KEY: extension to reals

343 ANS: 2

REF: 061705aii   NAT: A.REI.D.11   TOP: Other Systems

344 ANS: 4

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

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

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

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

$$x = 6, 1$$

REF: 011705aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

345 ANS: 1   REF: 061708aii   NAT: F.TF.B.5   TOP: Modeling Trigonometric Functions

346 ANS: 4   REF: 081624aii   NAT: F.BF.A.2   TOP: Sequences

Algebra II 2 Point Regents Exam Questions
Answer Section

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

REF: 081828aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: predict

348 ANS:
$$S_{10} = \frac{15 - 15(1.03)^{10}}{1 - 1.03} \approx 171.958$$

REF: 011929aii   NAT: A.SSE.B.4   TOP: Series

349 ANS:
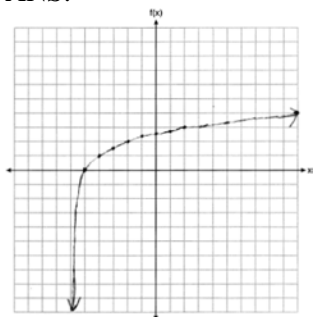
REF: 061927aii   NAT: F.IF.C.7   TOP: Graphing Logarithmic Functions

350 ANS:
$$(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$$
$$x^4 + 2x^2y^2 + y^4 = x^4 - 2x^2y^2 + y^4 + 4x^2y^2$$
$$x^4 + 2x^2y^2 + y^4 = x^4 + 2x^2y^2 + y^4$$

REF: 081727aii   NAT: A.APR.C.4   TOP: Polynomial Identities

351 ANS:

$$x - 2 \overline{\smash{\big)}\, 3x^2 + 7x - 20} \qquad 3x + 13 + \frac{6}{x - 2}$$

$$\begin{array}{r} 3x + 13 \\ \underline{3x^2 - 6x} \\ 13x - 20 \\ \underline{13x - 26} \\ 6 \end{array}$$

REF: 011732aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

352 ANS:

$$\frac{1}{8} + \frac{1}{6} = \frac{1}{t_b}; \quad \frac{24t_b}{8} + \frac{24t_b}{6} = \frac{24t_b}{t_b}$$

$$3t_b + 4t_b = 24$$

$$t_b = \frac{24}{7} \approx 3.4$$

REF: 011827aii   NAT: A.CED.A.1   TOP: Modeling Rationals

353 ANS:

sample: pails of oranges; population: truckload of oranges. It is likely that about 5% of all the oranges are unsatisfactory.

REF: 011726aii   NAT: S.IC.A.2   TOP: Analysis of Data

354 ANS:

$$(1-i)(1-i)(1-i) = (1 - 2i + i^2)(1-i) = -2i(1-i) = -2i + 2i^2 = -2 - 2i$$

REF: 011725aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

355 ANS:

$$3x^3 + x^2 + 3xy + y = x^2(3x+1) + y(3x+1) = \left(x^2 + y\right)(3x+1)$$

REF: 011828aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: factoring by grouping

356 ANS:

$$\frac{10.1 - -2}{2} - \frac{2.5 - -0.1}{2} = 6.05 - 1.3 = 4.75$$

REF: 081930aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: amplitude

357 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. $\left(\sqrt{9}\right)^5 = 243$
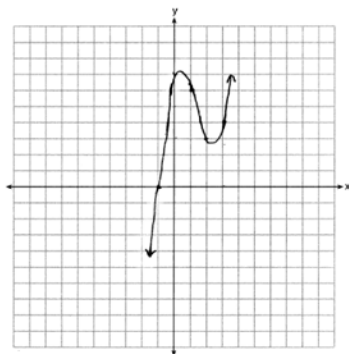
REF: 081926aii   NAT: N.RN.A.1   TOP: Radicals and Rational Exponents

358 ANS:
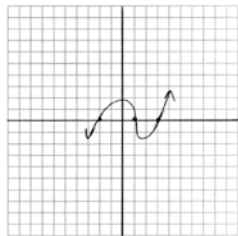
REF: 011729aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions

359 ANS:

REF: 012032aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions

360 ANS:

$b^2 - 4ac = (-4)^2 - 4(1)(13) = 16 - 52 = -36$ imaginary

REF: 062225aii   NAT: A.REI.B.4   TOP: Using the Discriminant
KEY: determine nature of roots given equation, graph, table

361 ANS:

$x^3 - 2x^2 - 9x + 18 = x^2(x - 2) - 9(x - 2) = \left(x^2 - 9 \right)(x - 2) = (x + 3)(x - 3)(x - 2)$

REF: 082226aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: factoring by grouping

362 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.

REF: 061626aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: type

363 ANS:

$$A = Pe^{rt}$$

$$135000 = 100000e^{5r}$$

$$1.35 = e^{5r}$$

$$\ln 1.35 = \ln e^{5r}$$

$$\ln 1.35 = 5r$$

$$.06 \approx r \text{ or } 6\%$$

REF: 061632aii   NAT: F.LE.A.4   TOP: Exponential Growth

364 ANS:
Light wave C. The periods for A, B, and C are 280, 220 and 320.

REF: 012030aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: period

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

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

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

366 ANS:

$$r = \frac{360}{300} = 1.2 \quad S_n = \frac{300 - 300(1.2)^n}{1 - 1.2} \quad S_{10} = \frac{300 - 300(1.2)^{10}}{1 - 1.2} \approx 7787.6$$

REF: 012029aii   NAT: A.SSE.B.4   TOP: Series

367 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.

REF: 081728aii   NAT: S.IC.A.2   TOP: Analysis of Data

368 ANS:

$$\frac{7}{2x} - \frac{2}{x + 1} = \frac{1}{4}$$

$$\frac{7x + 7 - 4x}{2x^2 + 2x} = \frac{1}{4}$$

$$2x^2 + 2x = 12x + 28$$

$$x^2 - 5x - 14 = 0$$

$$(x - 7)(x + 2) = 0$$

$$x = 7, -2$$

REF: 061926aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

369 ANS:

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

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

370 ANS:

69

REF: 061726aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: percent

371 ANS:

$j(-x) = (-x)^4 - 3(-x)^2 - 4 = x^2 - 3x^2 - 4$ Since $j(x) = j(-x)$, the function is even.

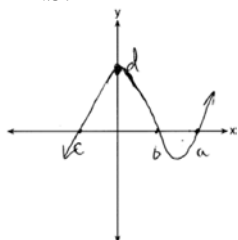REF: 081731aii   NAT: F.BF.B.3   TOP: Even and Odd Functions

372 ANS:

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

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

373 ANS:

REF: 081732aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions

374 ANS:

$$-6(x+3)\left(\frac{-3}{x+3} - \frac{x}{6} + 1 = 0\right)$$

$$18 + x(x+3) - 6(x+3) = 0$$

$$18 + x^2 + 3x - 6x - 18 = 0$$

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

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

$$x = 0, 3$$

REF: 081829aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

375 ANS:

Rewrite $\dfrac{4}{3}$ as $\dfrac{1}{3} \cdot \dfrac{4}{1}$, using the power of a power rule.

REF: 081725aii   NAT: N.RN.A.1   TOP: Radicals and Rational Exponents
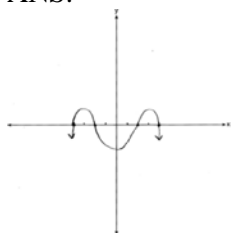
376 ANS:

$(4 - 3i)(5 + 2yi - 5 + 2yi)$

$\quad\quad (4 - 3i)(4yi)$

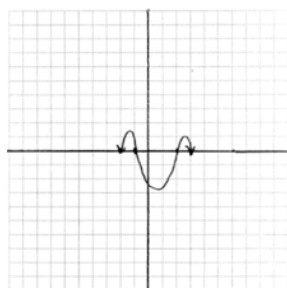$\quad\quad 16yi - 12yi^2$

$\quad\quad 12y + 16yi$

REF: spr1506aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

377 ANS:

REF: 011926aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions

378 ANS:

REF: 011831aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions

379 ANS:
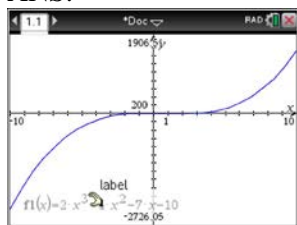
$$2x^2 + 6x + 23$$

$$x - 5 \overline{\smash{\big)}\ 2x^3 - 4x^2 - 7x - 10}$$ Since there is a remainder, $x - 5$ is not a factor.

$$\underline{2x^3 - 10x^2}$$

$$6x^2 - 7x$$

$$\underline{6x^2 - 30x}$$

$$23x - 10$$

$$\underline{23x - 115}$$

$$105$$

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

380 ANS:

$0 = \log_{10}(x - 4)$ The x-intercept of h is $(2,0)$. f has the larger value.

$10^0 = x - 4$

$1 = x - 4$

$x = 5$

REF: 081630aii   NAT: F.IF.C.9   TOP: Comparing Functions

381 ANS:

$\csc \theta = \dfrac{1}{\sin \theta}$, and $\sin \theta$ on a unit circle represents the y value of a point on the unit circle. Since $y = \sin \theta$, $\csc \theta = \dfrac{1}{y}$.

REF: 011727aii   NAT: F.TF.A.2   TOP: Reciprocal Trigonometric Relationships

382 ANS:

$0.133696 \times 9256 \approx 1237$

REF: 082230aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: predict

383 ANS:

4% $8.75 = 1.25(1 + r)^{49}$ or $8.75 = 1.25e^{49r}$

$$7 = (1 + r)^{49} \qquad\qquad \ln 7 = \ln e^{49r}$$

$$r + 1 = \sqrt[49]{7} \qquad\qquad \ln 7 = 49r$$

$$r \approx .04 \qquad\qquad\qquad r = \frac{\ln 7}{49}$$
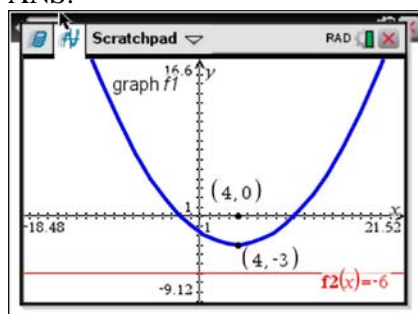
$$r \approx .04$$

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

384 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.

REF: 081629aii   NAT: S.IC.B.6   TOP: Analysis of Data

385 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 $(4, 0)$.

REF: 061630aii   NAT: G.GPE.A.2   TOP: Graphing Quadratic Functions

386 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
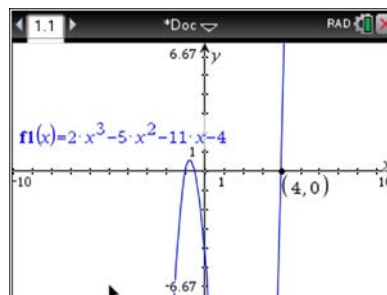
that $x - 4$ is a factor, as suggested by the Remainder Theorem.

REF: spr1507aii   NAT: A.APR.B.2   TOP: Remainder Theorem

387 ANS:

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

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

$$3 - x = -1$$

$$x = 4$$

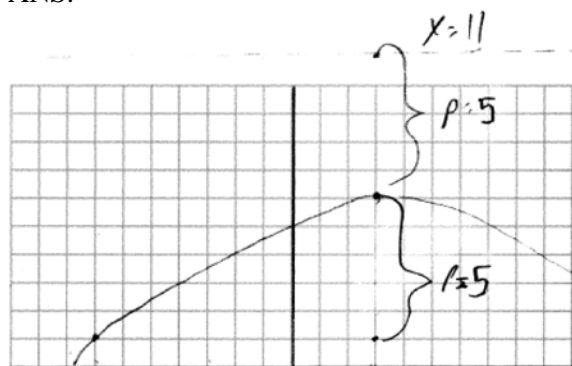REF: 061625aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

388 ANS:

$250(1) + 2450 = 2700$ The maximum lung capacity of a person is 2700 mL.

REF: 081928aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions

389 ANS:

 vertex $(3,6)$, focus $(3,1)$, $p = 5$, directrix $y = 6 + 5 = 11$

REF: 012028aii   NAT: G.GPE.A.2   TOP: Graphing Quadratic Functions

390 ANS:

$$\require{enclose}\begin{array}{r} 2a^2 + 5a + 2 \\ 3a-2 \enclose{longdiv}{6a^3 + 11a^2 - 4a - 9} \\ \end{array} \quad 2a^2 + 5a + 2 - \frac{5}{3a-2}$$

$$\underline{6a^3 - 4a^2}$$

$$15a^2 - 4a$$

$$\underline{15a^2 - 10a}$$

$$6a - 9$$

$$\underline{6a - 4}$$

$$-5$$

REF: 061829aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division
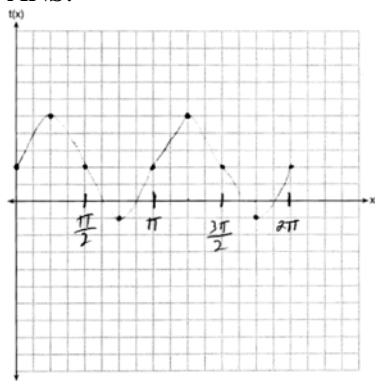
391 ANS:

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

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

392 ANS:

$$M = \frac{(152500 - 15250)\left(\frac{.036}{12}\right)\left(1 + \frac{.036}{12}\right)^{360}}{\left(1 + \frac{.036}{12}\right)^{360} - 1} \approx 624$$

REF: 061831aii   NAT: F.IF.B.4   TOP: Evaluating Exponential Expressions

393 ANS:

REF: 081830aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

394 ANS:

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

REF: 061925aii   NAT: F.IF.B.6   TOP: Rate of Change

395 ANS:

$x^2 + (x - 28)^2 = 400 \quad y = 12 - 28 = -16 \quad y = 16 - 28 = -12$

$x^2 + x^2 - 56x + 784 = 400$

$2x^2 - 56x + 384 = 0$

$x^2 - 28x + 192 = 0$

$(x - 16)(x - 12) = 0$

$x = 12, 16$

REF: 081831aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

396 ANS:

$a_1 = 4$ $\quad\quad\quad a_8 = 639$

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

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

397 ANS:

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

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

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

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

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

REF: 011927aii NAT: A.APR.C.4 TOP: Polynomial Identities

398 ANS:

$$\sqrt[3]{x} \bullet \sqrt{x} = x^{\frac{1}{3}} \bullet x^{\frac{1}{2}} = x^{\frac{3}{6}} \bullet x^{\frac{3}{6}} = x^{\frac{5}{6}}$$

REF: 061731aii NAT: N.RN.A.2 TOP: Operations with Radicals
KEY: with variables, index > 2

399 ANS:

$$P(S \cap M) = P(S) + P(M) - P(S \cup M) = \frac{649}{1376} + \frac{433}{1376} - \frac{974}{1376} = \frac{108}{1376}$$

REF: 061629aii NAT: S.CP.B.7 TOP: Theoretical Probability

400 ANS:

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

REF: 012031aii NAT: F.BF.A.1 TOP: Modeling Exponential Functions

401 ANS:
No, because $P(M/R) \neq P(M)$

$$\frac{70}{180} \neq \frac{230}{490}$$

$$0.38 \neq 0.47$$

REF: 011731aii NAT: S.CP.A.4 TOP: Conditional Probability

402 ANS:
$2(0.042) = 0.084 \approx 0.08$ The percent of users making in-app purchases will be within 8% of 35%.

REF: 081832aii NAT: S.IC.B.4 TOP: Analysis of Data

403 ANS:

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

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

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

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

404 ANS:

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

$$x^2 = y$$

REF: 011730aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
KEY: variables

405 ANS:

$$P(W/D) = \frac{P(W \wedge D)}{P(D)} = \frac{.4}{.5} = .8$$

REF: 081726aii   NAT: S.CP.B.6   TOP: Conditional Probability

406 ANS:

$i^2 = -1$, and not 1; $10 + 10i$

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

407 ANS:

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

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

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

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

408 ANS:

$$\left(p^2 n^{\frac{1}{2}} \right)^8 \sqrt{p^5 n^4} = \left(p^{16} n^4 \right) p^2 n^2 \sqrt{p} = p^{18} n^6 \sqrt{p}$$

REF: 012025aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
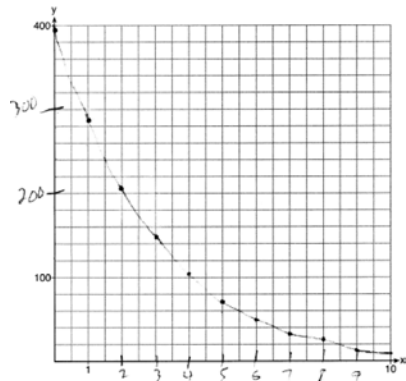
409 ANS:

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

REF: 061827aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

410 ANS:

REF: 061729aii   NAT: F.IF.C.7   TOP: Graphing Exponential Functions

411 ANS:

$$20e^{.05t} = 30e^{.03t}$$

$$\frac{\frac{2}{3}e^{.05t}}{e^{.05t}} = \frac{e^{.03t}}{e^{.05t}}$$

$$\ln\frac{2}{3} = \ln e^{-.02t}$$

$$\ln\frac{2}{3} = -.02t \ln e$$

$$\frac{\ln\frac{2}{3}}{-.02} = t$$

$$20.3 \approx t$$

REF: 011829aii   NAT: A.REI.D.11   TOP: Other Systems

412 ANS:

$$t^2 + \left(\frac{4}{7}\right)^2 = 1 \qquad -\frac{\sqrt{33}}{7}$$

$$t^2 + \frac{16}{49} = \frac{49}{49}$$

$$t^2 = \frac{33}{49}$$

$$t = \frac{\pm\sqrt{33}}{7}$$

REF: 011931aii   NAT: F.TF.A.2   TOP: Unit Circle

413 ANS:

Yes. $P(Bl) = P(Bl \| Gl)$

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

$$.4 = .4$$

REF: 062229aii   NAT: S.CP.A.4   TOP: Conditional Probability

414 ANS:

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

REF: 082225aii   NAT: F.IF.B.6   TOP: Rate of Change

415 ANS:

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

REF: 061832aii   NAT: F.TF.A.2   TOP: Determining Trigonometric Functions
KEY: extension to reals

416 ANS:

$$\frac{p(x)}{x - 1} = x^2 + 7 + \frac{5}{x - 1}$$

$$p(x) = x^3 - x^2 + 7x - 7 + 5$$

$$p(x) = x^3 - x^2 + 7x - 2$$

REF: 061930aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

417 ANS:

Translation 3 units right and 4 units up

REF: 012027aii   NAT: F.IF.C.7   TOP: Graphing Exponential Functions

418 ANS:
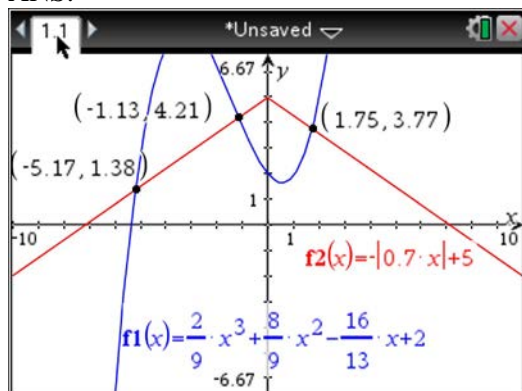
REF: fall1510aii   NAT: A.REI.D.11   TOP: Other Systems

419 ANS:

$\sin^2 \theta + (-0.7)^2 = 1$ Since θ is in Quadrant II, $\sin \theta = \sqrt{.51}$ and $\tan \theta = \dfrac{\sin \theta}{\cos \theta} = \dfrac{\sqrt{.51}}{-0.7} \approx -1.02$

$\qquad \sin^2 \theta = .51$

$\qquad \sin \theta = \pm \sqrt{.51}$

REF: 081628aii   NAT: F.TF.C.8   TOP: Determining Trigonometric Functions

420 ANS:

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

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

421 ANS:

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

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

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

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

REF: 082231aii   NAT: S.CP.A.4   TOP: Conditional Probability

422 ANS:

$$\left(\frac{y^{\frac{17}{8}}}{y^{\frac{10}{8}}} \right)^{-4} = y^n \quad n = -\frac{7}{2}$$

$$\left(y^{\frac{7}{8}} \right)^{-4} = y^n$$

$$y^{-\frac{7}{2}} = y^n$$

REF: 082228aii   NAT: A.APR.D.6   TOP: Expressions with Negative Exponents
KEY: variables

423 ANS:

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

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

424 ANS:

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

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

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

REF: 082229aii   NAT: F.TF.C.8   TOP: Determining Trigonometric Functions

425 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.

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

426 ANS:

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

REF: 062226aii   NAT: A.SSE.B.4   TOP: Series

427 ANS:
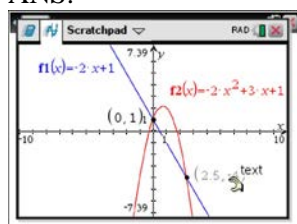
$$-2x + 1 = -2x^2 + 3x + 1$$

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

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

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

REF: fall1507aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

428 ANS:

$a_1 = 4$

$a_n = 3a_{n-1}$

REF: 081931aii   NAT: F.LE.A.2   TOP: Sequences   KEY: recursive

429 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.
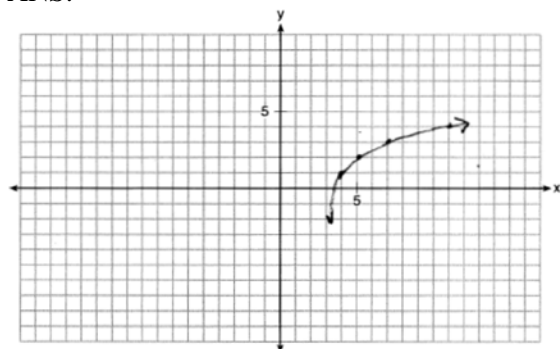
REF: 011832aii   NAT: N.RN.A.1   TOP: Radicals and Rational Exponents

430 ANS:

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

REF: 062232aii   NAT: S.ID.B.6   TOP: Regression   KEY: exponential

431 ANS:

REF: 011932aii   NAT: F.IF.C.7   TOP: Graphing Logarithmic Functions

432 ANS:

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

REF: 081631aii   NAT: F.IF.B.6   TOP: Rate of Change

433 ANS:

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

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

434 ANS:

A student is more likely to jog if both siblings jog. 1 jogs: $\dfrac{416}{2239} \approx 0.19$. both jog: $\dfrac{400}{1780} \approx 0.22$

REF: 061732aii   NAT: S.CP.A.4   TOP: Conditional Probability

435 ANS:

$m(3) = 3^3 - 3^2 - 5(3) - 3 = 27 - 9 - 15 - 3 = 0$ Since $m(3) = 0$, there is no remainder when $m(x)$ is divided by $x - 3$, and so $x - 3$ is a factor.

REF: 012026aii   NAT: A.APR.B.2   TOP: Remainder Theorem

436 ANS:

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

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

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

REF: fall1512aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: a>1

437 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 $9^{\frac{1}{5}} = \sqrt[5]{9}$.

REF: 081626aii   NAT: N.RN.A.1   TOP: Radicals and Rational Exponents

438 ANS:

$$x = \left(y - 3\right)^3 + 1$$

$$x - 1 = \left(y - 3\right)^3$$

$$\sqrt[3]{x-1} = y - 3$$

$$\sqrt[3]{x-1} + 3 = y$$

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

REF: fall1509aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: other

439 ANS:

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

REF: 081625aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: mixed

440 ANS:

$\left(x^2 - 6\right)\left(x^2 + 2\right)$

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

441 ANS:

Based on these data, the two events do not appear to be independent. $P(F) = \dfrac{106}{200} = 0.53$, while

$P(F \mid T) = \dfrac{54}{90} = 0.6$, $P(F \mid R) = \dfrac{25}{65} = 0.39$, and $P(F \mid C) = \dfrac{27}{45} = 0.6$. The probability of being female are not the

same as the conditional probabilities. This suggests that the events are not independent.

REF: fall1508aii   NAT: S.CP.A.4   TOP: Conditional Probability

442 ANS:

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

REF: 011928aii   NAT: S.CP.A.3   TOP: Conditional Probability

443 ANS:

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

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

444 ANS:

$\sqrt[3]{81} = \sqrt[3]{3^4} = 3^{\frac{4}{3}}$ $a = \dfrac{4}{3}$

REF: 062230aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
KEY: variables

445 ANS:

$-\dfrac{1}{2} i^3 (3i - 4) - 3i^2 = -\dfrac{3}{2} i^4 + 2i^3 - 3i^2 = -\dfrac{3}{2} - 2i + 3 = \dfrac{3}{2} - 2i$

REF: 081927aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

446 ANS:

$$\frac{3}{n} = \frac{2}{n^2}$$ 0 is an extraneous solution.

$$3n^2 = 2n$$

$$3n^2 - 2n = 0$$

$$n(3n - 2) = 0$$

$$n = 0, \frac{3}{2}$$

REF: 062228aii   NAT: A.REI.A.2   TOP: Solving Rationals

447 ANS:

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

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

REF: 061931aii   NAT: F.LE.A.2   TOP: Sequences   KEY: recursive

448 ANS:

Self selection is a cause of bias because people with more free time are more likely to respond.

REF: 061828aii   NAT: S.IC.B.3   TOP: Analysis of Data
KEY: bias

449 ANS:

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

REF: 061727aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: factoring by grouping

450 ANS:

period is $\frac{2}{3}$. The wheel rotates once every $\frac{2}{3}$ second.

REF: 061728aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: period

451 ANS:
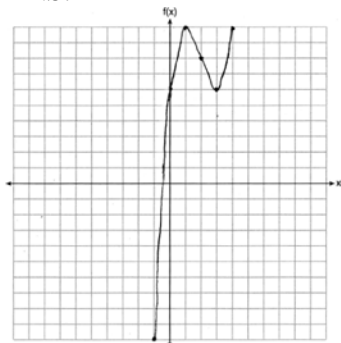
REF: 061826aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions

452   ANS:

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

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

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

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

$x = 6, 20$

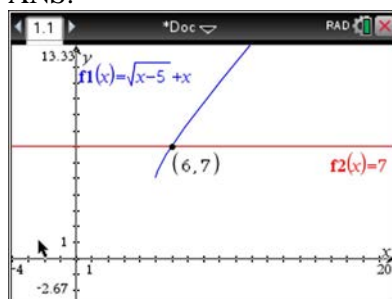REF: 082227aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions

453   ANS:
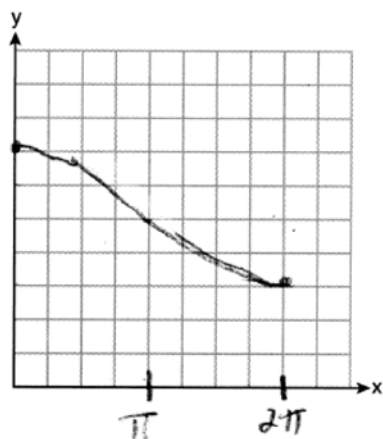
REF: 062231aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

454   ANS:

$\sqrt{x-5} = -x+7$ $\sqrt{x-5} = -9+7 = -2$ is extraneous.

$x - 5 = x^2 - 14x + 49$

$0 = x^2 - 15x + 54$

$0 = (x-6)(x-9)$

$x = 6, 9$

REF: spr1508aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions

455 ANS:

$D = 1.223(2.652)^A$

REF: 011826aii   NAT: S.ID.B.6   TOP: Regression   KEY: exponential

456 ANS:

No. $\left(\sqrt[7]{x^2} \right)\left(\sqrt[5]{x^3} \right) = x^{\frac{2}{7}} \cdot x^{\frac{3}{5}} = x^{\frac{31}{35}} = \sqrt[35]{x^{31}}$

REF: 061929aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
KEY: variables

457 ANS:

$\dfrac{\left(\ln \dfrac{1}{2} \right)}{1590}$ is negative, so $M(t)$ represents decay.

REF: 011728aii   NAT: F.IF.C.7   TOP: Graphing Exponential Functions

458 ANS:

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

REF: 061830aii   NAT: F.IF.A.3   TOP: Sequences   KEY: recursive

459 ANS:

$\dfrac{x^3 + 9}{x^3 + 8} = \dfrac{x^3 + 8}{x^3 + 8} + \dfrac{1}{x^3 + 8}$

$\dfrac{x^3 + 9}{x^3 + 8} = \dfrac{x^3 + 9}{x^3 + 8}$

REF: 061631aii   NAT: A.APR.C.4   TOP: Polynomial Identities

460 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.

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

461 ANS:

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

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

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

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

REF: 062228aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: factoring by grouping

462 ANS:

$\sqrt{x-4} = -x+6 \qquad \sqrt{x-4} = -8+6 = -2$ is extraneous.

$x - 4 = x^2 - 12x + 36$

$0 = x^2 - 13x + 40$

$0 = (x-8)(x-5)$

$x = 5, 8$

REF: 061730aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions

463 ANS:

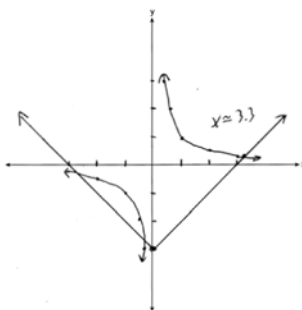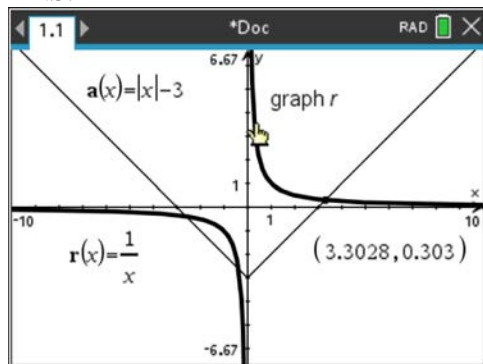$\dfrac{p(8)-p(4)}{8-4} \approx 48.78$

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

464 ANS:

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

REF: 061825aii   NAT: S.CP.A.4   TOP: Conditional Probability

465 ANS:

REF: 081932aii   NAT: A.REI.D.11   TOP: Other Systems

466 ANS:

$2x^2 - 7x + 4 = 11 - 2x \quad y = 11 - 2\left(\dfrac{7}{2}\right) = 4 \quad \left\{\left(\dfrac{7}{2}, 4\right), (-1, 13)\right\}$

$2x^2 - 5x - 7 = 0$

$\qquad\qquad\qquad y = 11 - 2(-1) = 13$

$(2x-7)(x+1) = 0$

$x = \dfrac{7}{2}, -1$

REF: 082232aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

467 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.

REF: 061932aii   NAT: S.IC.A.2   TOP: Analysis of Data

468 ANS:
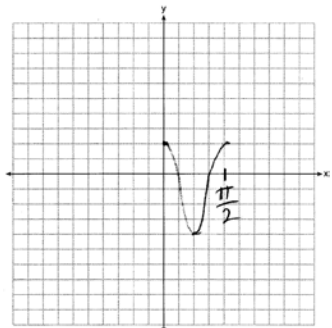
REF: 061628aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

Algebra II 4 Point Regents Exam Questions
Answer Section

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

REF: 011835aii   NAT: S.IC.A.2   TOP: Analysis of Data

470 ANS:
$y = 101.523(.883)^x$ $29 = 101.523(.883)^x$

$$\frac{29}{101.523} = (.883)^x$$

$$\log \frac{29}{101.523} = x \log(.883)$$

$$\frac{\log \dfrac{29}{101.523}}{\log(.883)} = x$$

$$x \approx 10.07$$

REF: 012036aii   NAT: S.ID.B.6   TOP: Regression   KEY: exponential

471 ANS:
$j(-1) = 2(-1)^4 - (-1)^3 - 35(-1)^2 + 16(-1) + 48 = 2 + 1 - 35 - 16 + 48 = 0;$ $x + 1$ is a factor of $j(x)$;

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

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

$$\left(x^2 - 16\right)(2x - 3) = 0$$

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

REF: 081834aii   NAT: A.APR.B.2   TOP: Remainder Theorem

472 ANS:

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

$$\left(2x^3 - 2x^2 + x^2 - x - 3x + 3\right) - \left(2x^2 + 2x - 4\right)$$

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

REF: 011833aii   NAT: F.BF.A.1   TOP: Operations with Functions

473 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.

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

474 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.

REF: 061834aii   NAT: S.IC.B.5   TOP: Analysis of Data

475 ANS:

$y = 4.168(3.981)^x$. $100 = 4.168(3.981)^x$

$$\log\frac{100}{4.168} = \log(3.981)^x$$

$$\log\frac{100}{4.168} = x\log(3.981)$$

$$\frac{\log\frac{100}{4.168}}{\log(3.981)} = x$$

$$x \approx 2.25$$

REF: 081736aii   NAT: S.ID.B.6   TOP: Regression   KEY: exponential

476 ANS:

$$7 = 20(0.5)^{\frac{t}{8.02}}$$

$$\log 0.35 = \log 0.5^{\frac{t}{8.02}}$$

$$\log 0.35 = \frac{t\log 0.5}{8.02}$$

$$\frac{8.02\log 0.35}{\log 0.5} = t$$

$$t \approx 12$$

REF: 081634aii   NAT: F.LE.A.4   TOP: Exponential Decay

477 ANS:

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

REF: 012033aii   NAT: A.SSE.B.4   TOP: Series

478 ANS:

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

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

REF: 011834aii   NAT: S.CP.A.3   TOP: Conditional Probability

479 ANS:

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

with quotient $x^3 \qquad + 4$

$$\underline{x^4 + 2x^3}$$
$$4x - 10$$
$$\underline{4x + 8}$$
$$-18$$

REF: 011934aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

480 ANS:
$0.506 \pm 2 \cdot 0.078 = 0.35 - 0.66.$ The 32.5% value falls below the 95% confidence level.

REF: 061736aii   NAT: S.IC.B.5   TOP: Analysis of Data

481 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.

REF: 081935aii   NAT: S.IC.B.5   TOP: Analysis of Data

482 ANS:
$P(F|L) = \frac{12}{27}$ $P(F) = \frac{22}{45}$ Since $P(F|L) \neq P(F)$, the events are not independent.

REF: 061936aii   NAT: S.CP.A.4   TOP: Conditional Probability

483 ANS:
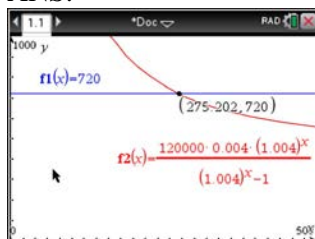
$$720 = \frac{120000\left(\frac{.048}{12}\right)\left(1 + \frac{.048}{12}\right)^{n}}{\left(1 + \frac{.048}{12}\right)^{n} - 1} \qquad \frac{275.2}{12} \approx 23 \text{ years}$$

$$720(1.004)^{n} - 720 = 480(1.004)^{n}$$

$$240(1.004)^{n} = 720$$

$$1.004^{n} = 3$$

$$n \log 1.004 = \log 3$$

$$n \approx 275.2 \text{ months}$$

REF: spr1509aii   NAT: A.CED.A.1   TOP: Exponential Growth

484 ANS:

$$x - 4 \overline{\smash{\big)}\ 3x^3 - 4x^2 + 2x - 1}$$ with quotient $3x^2 + 8x + 34$

$$\underline{3x^3 - 12x^2}$$
$$8x^2 + 2x$$
$$\underline{8x^2 - 32x}$$
$$34x - 1$$
$$\underline{34x - 136}$$
$$135$$

$3x^2 + 8x + 34 + \dfrac{135}{x - 4}$ $x = 4$ is not a root of $f(x)$ because $\dfrac{f(x)}{g(x)}$ has a remainder.

REF: 082235aii   NAT: A.APR.D.6   TOP: Rational Expressions
KEY: division

485 ANS:

$\dfrac{h(2) - h(1)}{2 - 1} = -12,$ $h(t) = 0$ at $t \approx 2.2, 3.8,$ using a graphing calculator to find where $h(t) = 0.$

REF: 061836aii   NAT: F.IF.B.4   TOP: Graphing Trigonometric Functions

486 ANS:

$\dfrac{6.25 - 2.25}{21 - 5} = \dfrac{4}{16} = \$.25$ fine per day. $2.25 - 5(.25) = \$1$ replacement fee. $a_n = 1.25 + (n - 1)(.25).$ $a_{60} = \$16$

REF: 081734aii   NAT: F.BF.A.2   TOP: Sequences

487 ANS:
Jillian's plan, because distance increases by one mile each week. $a_1 = 10$ $a_n = n + 12$

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

REF: 011734aii   NAT: F.LE.A.2   TOP: Sequences   KEY: recursive

488 ANS:

$$M = 172600 \bullet \frac{0.00305(1 + 0.00305)^{12 \cdot 15}}{(1 + 0.00305)^{12 \cdot 15} - 1} \approx 1247 \quad 1100 = (172600 - x) \bullet \frac{0.00305(1 + 0.00305)^{12 \cdot 15}}{(1 + 0.00305)^{12 \cdot 15} - 1}$$

$$1100 \approx (172600 - x) \bullet (0.007228)$$

$$152193 \approx 172600 - x$$

$$20407 \approx x$$

REF: 061734aii   NAT: F.IF.B.4   TOP: Evaluating Exponential Expressions

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

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

490 ANS:
$a_n = x^{n-1}(x + 1)$ $x^{n-1} = 0$ $x + 1 = 0$
              $x = 0$ $x = -1$

REF: spr1511aii   NAT: F.LE.A.2   TOP: Sequences   KEY: recursive

491 ANS:

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

$x + 2y + 3z = 1$ $\underline{x + 2y + 3z = 1}$ $\underline{-x + 3y - 5z = 11}$ $-3z = 3$ $y = 2$ $x = 0$

$-x + 3y - 5z = 11$ $y + 2z = 0$ $4y - 4z = 12$ $z = -1$

              $y = -2z$ $y - z = 3$

REF: 061733aii   NAT: A.REI.C.6   TOP: Solving Linear Systems
KEY: three variables

492 ANS:

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

REF: 011735aii   NAT: S.CP.B.6   TOP: Conditional Probability

493 ANS:

$$x^2 + (2x - 5)^2 = 25 \quad y + 5 = 2(0) \quad y + 5 = 2(4) \quad (0, -5), (4, 3)$$

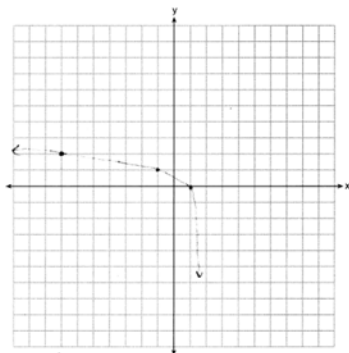$$x^2 + 4x^2 - 20x + 25 = 25 \qquad y = -5 \qquad y = 3$$

$$5x^2 - 20x = 0$$

$$5x(x - 4) = 0$$

$$x = 0, 4$$

REF: 062236aii NAT: A.REI.C.7 TOP: Quadratic-Linear Systems

494 ANS:

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

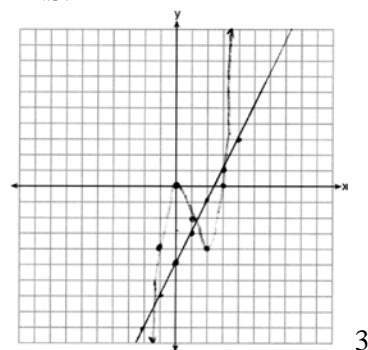REF: 012034aii NAT: F.IF.C.7 TOP: Graphing Logarithmic Functions

495 ANS:

$$20000 = PMT\left(\frac{1 - (1 + .00625)^{-60}}{0.00625}\right) \quad 21000 - x = 300\left(\frac{1 - (1 + .00625)^{-60}}{0.00625}\right)$$

$$PMT \approx 400.76 \qquad\qquad\qquad x \approx 6028$$

REF: 011736aii NAT: F.IF.B.4 TOP: Evaluating Exponential Expressions

496 ANS:

3

REF: 062233aii NAT: A.REI.D.11 TOP: Other Systems

497 ANS:
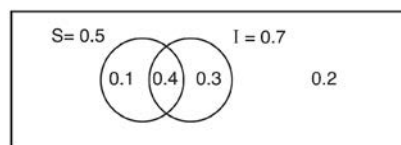
This scenario can be modeled with a Venn Diagram: _____ Since $P(S \cup I)_c = 0.2$, $P(S \cup I) = 0.8$. Then, $P(S \cap I) = P(S) + P(I) - P(S \cup I)$ If S and I are independent, then the

$$= 0.5 + 0.7 - 0.8$$

$$= 0.4$$

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

REF: spr1513aii   NAT: S.CP.A.2   TOP: Probability of Compound Events
KEY: independence

498 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.

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

499 ANS:

$$a + 4b + 6c = 23 \quad a + 2b + c = 2 \quad 8b + 3c = 16 \quad 2b + 5(4) = 21 \quad a + 4\left(\frac{1}{2}\right) + 6(4) = 23$$

$$\underline{a + 2b + c = 2} \quad \underline{-a + 6b + 2c = 14} \quad \underline{8b + 20c = 84} \quad 2b = 1$$

$$a + 2 + 24 = 23$$

$$2b + 5c = 21 \qquad 8b + 3c = 16 \qquad 17c = 68 \qquad b = \frac{1}{2} \qquad a = -3$$

$$c = 4$$

REF: 011933aii   NAT: A.REI.C.6   TOP: Solving Linear Systems
KEY: three variables

500 ANS:

$$2x^3 - 10x^2 + 11x - 7 = 2x^3 + hx^2 + 3x - 8x^2 - 4hx - 12 + k \quad h = -2$$

$$-2x^2 + 8x + 5 = hx^2 - 4hx + k \qquad\qquad k = 5$$

REF: 011733aii   NAT: A.APR.C.4   TOP: Polynomial Identities

501 ANS:
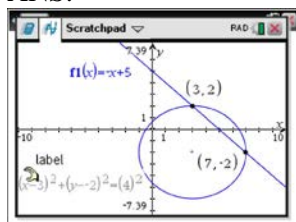
$$y = -x + 5 \quad y = -7 + 5 = -2$$

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

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

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

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

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

$$x = 7, 3$$

REF: 061633aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

502 ANS:

$$4x + 6y - 8z = -2 \quad 4x + 6y - 8z = -2 \quad 4x - 8y + 20z = 12 \quad z + 2 = 3z - 4 \quad y = 3 + 2 \quad -4x + 5 + 3 = 16$$

$$4x - 8y + 20z = 12 \quad \underline{-4x + y + z = 16} \quad \underline{-4x + y + z = 16} \qquad 6 = 2z \qquad\qquad = 5 \qquad\qquad -4x = 8$$

$$-4x + y + z = 16 \quad 7y - 7z = 14 \qquad -7y + 21z = 28 \qquad z = 3 \qquad\qquad\qquad\qquad x = -2$$

$$y - z = 2 \qquad\qquad y - 3z = -4$$

$$y = z + 2 \qquad\qquad y = 3z - 4$$

REF: 081833aii   NAT: A.REI.C.6   TOP: Solving Linear Systems
KEY: three variables

503 ANS:
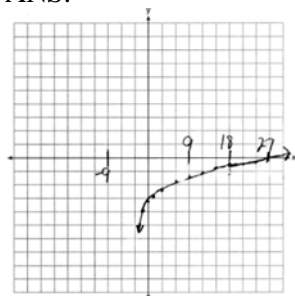
As $x \to -3, y \to -\infty$. As $x \to \infty, y \to \infty$.

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

504 ANS:

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

REF: 011836aii   NAT: A.APR.B.3   TOP: Graphing Polynomial Functions

505 ANS:

normcdf$(510, 540, 480, 24) = 0.0994$ $z = \dfrac{510 - 480}{24} = 1.25$ $1.25 = \dfrac{x - 510}{20}$ $2.5 = \dfrac{x - 510}{20}$ 535-560

$$z = \dfrac{540 - 480}{24} = 2.5 \qquad x = 535 \qquad x = 560$$

REF: fall1516aii   NAT: S.ID.A.4   TOP: Normal Distributions
KEY: probability

506 ANS:

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

$$3p^2 + 9p = p^2 - 3p - 10$$
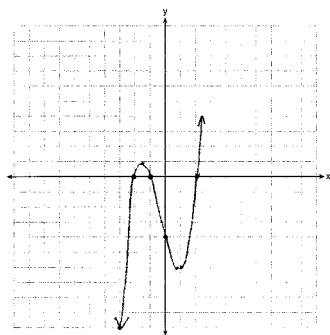
$$2p^2 + 12p + 10 = 0$$

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

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

$$p = -5, -1$$

REF: 081733aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

507 ANS:

$$0 = x^2(x+1) - 4(x+1)$$

$$0 = (x^2 - 4)(x+1)$$

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

$$x = -2, -1, 2$$

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

508 ANS:

$$C(t) = 63000\left(1 + \frac{0.0255}{12}\right)^{12t} \quad 63000\left(1 + \frac{0.0255}{12}\right)^{12t} = 100000$$

$$12t\log(1.002125) = \log\frac{100}{63}$$

$$t \approx 18.14$$

REF: 061835aii   NAT: A.CED.A.1   TOP: Exponential Growth

509 ANS:

$6x - 3y + 2z = -10$ $x + 3y + 5z = 45$ $4x + 10z = 62$ $4x + 4(7) = 20$ $6(-2) - 3y + 2(7) = -10$

$-2x + 3y + 8z = 72$ $6x - 3y + 2z = -10$ $4x + 4z = 20$ $4x = -8$ $-3y = -12$

$4x + 10z = 62$ $7x + 7z = 35$ $6z = 42$ $x = -2$ $y = 4$

$4x + 4z = 20$ $z = 7$

REF: spr1510aii   NAT: A.REI.C.6   TOP: Solving Linear Systems
KEY: three variables

510 ANS:

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

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

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

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

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

REF: 081936aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | completing the square

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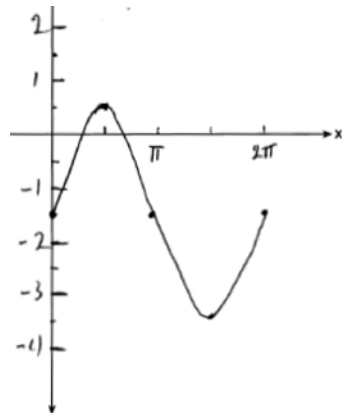
Part a sketch is shifted $\frac{\pi}{3}$ units right.

REF: 081735aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

512 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.

REF: fall1514aii   NAT: S.IC.B.5   TOP: Analysis of Data

513 ANS:

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

$$\sqrt{6-2x}=x+21 \qquad\qquad \sqrt{64} \neq -8$$

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

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

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

$$x=-29,-15$$

REF: 061833aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions

514 ANS:

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

REF: 061933aii   NAT: F.IF.B.4   TOP: Graphing Polynomial Functions

515 ANS:

$N(t)=950e^{0.0475t}$ The base is e because growth is continuous. $N\left(\frac{36}{24}\right) \approx 1020$

REF: 081933aii   NAT: F.LE.A.2   TOP: Modeling Exponential Functions

516 ANS:

$$0 = 6(-5)^3 + b(-5)^2 - 52(-5) + 15 \quad z(x) = 6x^3 + 19x^2 - 52x + 15$$

$$0 = -750 + 25b + 260 + 15$$

$$475 = 25b$$

$$19 = b$$

```
-5 |  6    19   -52   15
   |      -30    55   15
   ┗━━━━━━━━━━━━━━━━━━━━━
      6   -11     3    0
```
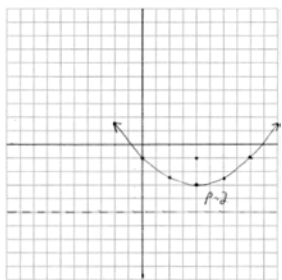
$$6x^2 - 11x + 3 = 0$$

$$(2x - 3)(3x - 1) = 0$$

$$x = \frac{3}{2}, \frac{1}{3}, -5$$

REF: fall1515aii   NAT: A.APR.B.2   TOP: Remainder Theorem

517 ANS:

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

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

518 ANS:

$$\left(\sqrt{2x - 7}\right)^2 = (5 - x)^2 \qquad \sqrt{2(4) - 7} + 4 = 5 \quad \sqrt{2(8) - 7} + 8 = 5$$

$$2x - 7 = 25 - 10x + x^2 \qquad\qquad \sqrt{1} = 1 \qquad\qquad \sqrt{9} \neq -3$$

$$0 = x^2 - 12x + 32$$

$$0 = (x - 8)(x - 4)$$

$$x = 4, 8$$

REF: 081635aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions

519 ANS:

$$s(t) = 200(0.5)^{\frac{t}{15}} \qquad \frac{1}{10} = (0.5)^{\frac{t}{15}}$$

$$\log\frac{1}{10} = \log(0.5)^{\frac{t}{15}}$$

$$-1 = \frac{t \cdot \log(0.5)}{15}$$

$$t = \frac{-15}{\log(0.5)} \approx 50$$

REF: 061934aii   NAT: F.LE.A.4   TOP: Exponential Decay

520 ANS:

$$3\sqrt{x} - 2x = -5 \qquad\qquad \text{1 is extraneous.}$$

$$3\sqrt{x} = 2x - 5$$

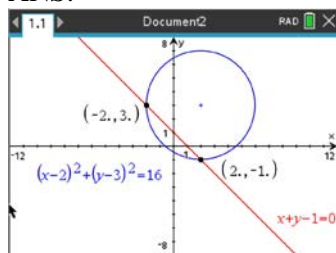$$9x = 4x^2 - 20x + 25$$

$$4x^2 - 29x + 25 = 0$$

$$(4x - 25)(x - 1) = 0$$

$$x = \frac{25}{4}, 1$$

REF: 011936aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: extraneous solutions

521 ANS:

$$y = -x + 1 \quad y = -2 + 1 = -1 \quad (2, -1)$$

$$(x - 2)^2 + (-x + 1 - 3)^2 = 16 \qquad y = 2 + 1 = 3 \quad (-2, 3)$$

$$x^2 - 4x + 4 + x^2 + 4x + 4 = 16$$

$$2x^2 = 8$$

$$x = -2, 2$$

REF: 012035aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems

522 ANS:

 12.6

REF: 082234aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions

523 ANS:

$2 = e^{0.0375t}$

$t \approx 18.5$

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

524 ANS:
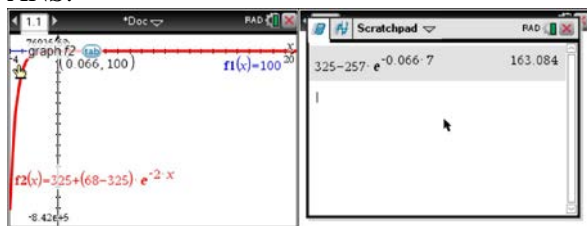
$100 = 325 + (68 - 325)e^{-2k}$ $T = 325 - 257e^{-0.066t}$

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

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

$k \approx 0.066$

REF: fall1513aii   NAT: F.LE.A.4   TOP: Exponential Growth

525 ANS:

a) $p(t) = 11000(2)^{\frac{t}{20}}$; b) $\dfrac{1000000}{11000} = \dfrac{11000(2)^{\frac{t}{20}}}{11000}$

$$\log\frac{1000}{11} = \log 2^{\frac{t}{20}}$$

$$\log\frac{1000}{11} = \frac{t \cdot \log 2}{20}$$

$$\frac{20\log\dfrac{1000}{11}}{\log 2} = t$$

$$t \approx 130.13$$

REF: 082233aii   NAT: F.LE.A.4   TOP: Exponential Growth

526 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, $\left(\sqrt{\dfrac{p(1-p)}{n}}\right)$ or $\left(\sqrt{\dfrac{(0.25)(0.75)}{50}}\right)$

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.

REF: spr1512aii   NAT: S.IC.B.4   TOP: Analysis of Data

527 ANS:

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

REF: 062235aii   NAT: S.IC.A.2   TOP: Analysis of Data

528 ANS:

$\dfrac{f(4) - f(-2)}{4 - -2} = \dfrac{80 - 1.25}{6} = 13.125$ $g(x)$ has a greater rate of change

$\dfrac{g(4) - g(-2)}{4 - -2} = \dfrac{179 - -49}{6} = 38$

REF: 061636aii   NAT: F.IF.C.9   TOP: Comparing Functions

529 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.
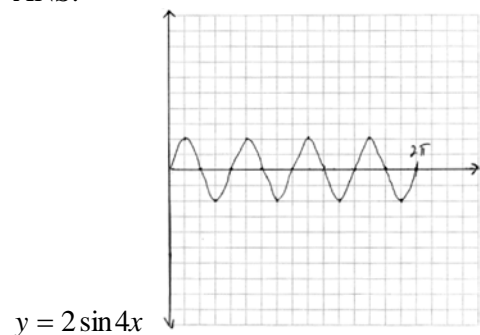
REF: 061635aii   NAT: S.IC.B.5   TOP: Analysis of Data

530 ANS:

$$S_n = \frac{33000 - 33000(1.04)^n}{1 - 1.04} \quad S_{15} = \frac{33000 - 33000(1.04)^{15}}{1 - 1.04} \approx 660778.39$$

REF: 061634aii   NAT: A.SSE.B.4   TOP: Series

531 ANS:

$y = 2\sin 4x$

REF: 081934aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

532 ANS:

$$t = 2\pi\sqrt{\frac{67}{9.81}} \approx 16.4 \quad 9.6 = 2\pi\sqrt{\frac{L}{9.81}}$$

$$L \approx 22.9$$

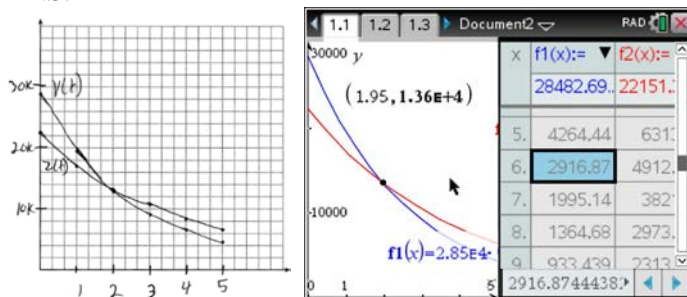REF: 062234aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: context

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

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

Algebra II 6 Point Regents Exam Questions
Answer Section

534 ANS:

 At 1.95 years, the value of the car equals the loan balance. Zach can cancel the policy after 6 years.

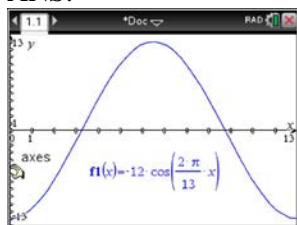REF: 081737aii   NAT: A.REI.D.11   TOP: Other Systems

535 ANS:
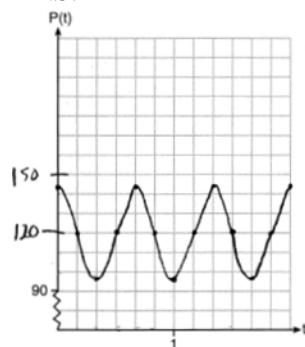
 The period of P is $\frac{2}{3}$, which means the patient's blood pressure reaches a high every $\frac{2}{3}$ second and a low every $\frac{2}{3}$ second. The patient's blood pressure is high because 144 over 96 is greater than 120 over 80.

REF: 011837aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

536 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 $P = \dfrac{2\pi}{B}$ (where P is the period), it is determined that $B = \dfrac{2\pi}{13}$.
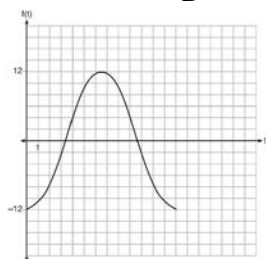

$$f(t) = -12\cos\left(\frac{2\pi}{13} t\right)$$

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.

REF: spr1514aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

537 ANS:
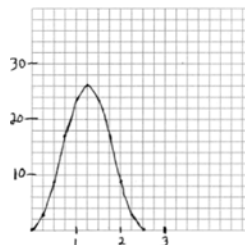
period $= \dfrac{2\pi}{0.8\pi} = 2.5$. The wheel rotates once every 2.5 seconds.   No, because the maximum of $f(t) = 26$.

REF: 061937aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

538 ANS:

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

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

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

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

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

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

REF: 011737aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: context

539 ANS:

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

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

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

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

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

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

$$s \approx 115$$

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

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

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

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

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

$$s \approx 55 \qquad s \approx 64$$

REF: 081937aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: context

540 ANS:

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

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

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

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

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

$$n \approx 15.2$$

REF: 081637aii $\quad$ NAT: A.CED.A.1 $\quad$ TOP: Exponential Growth

541 ANS:

$100 = 140\left(\dfrac{1}{2}\right)^{\frac{5}{h}}$ $\quad$ $\log \dfrac{100}{140} = \log\left(\dfrac{1}{2}\right)^{\frac{5}{h}}$ $\qquad$ $40 = 140\left(\dfrac{1}{2}\right)^{\frac{t}{10.3002}}$

$$\log \frac{5}{7} = \frac{5}{h} \log \frac{1}{2}$$

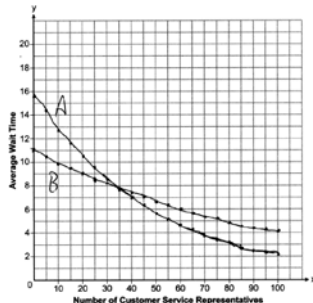$$\log \frac{2}{7} = \log\left(\frac{1}{2}\right)^{\frac{t}{10.3002}}$$

$$h = \frac{5 \log \dfrac{1}{2}}{\log \dfrac{5}{7}} \approx 10.3002$$

$$\log \frac{2}{7} = \frac{t \log\left(\dfrac{1}{2}\right)}{10.3002}$$

$$t = \frac{10.3002 \log \dfrac{2}{7}}{\log \dfrac{1}{2}} \approx 18.6$$

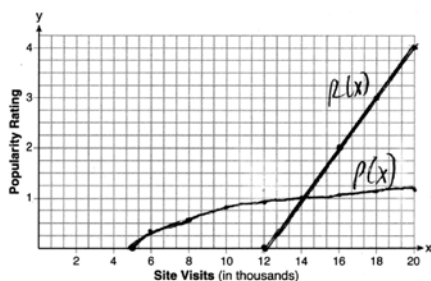REF: 061737aii $\quad$ NAT: F.LE.A.4 $\quad$ TOP: Exponential Decay

542 ANS:

35; $B(100) - A(100) \approx 2$, which represents the difference of the average wait time when there are 100 CSRs between the plans.

REF: 082237aii $\quad$ NAT: A.REI.D.11 $\quad$ TOP: Other Systems

543 ANS:

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

REF: 061837aii   NAT: A.REI.D.11   TOP: Other Systems

544 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.

$\dfrac{A(10) - A(0)}{10 - 0} = \dfrac{89.58132 - 100}{10} = -1.041868$ The estimated mass at $t = 40$ is $100 - 40(-1.041868) \approx 58.3$. The

actual mass is $A(40) = 100(0.5)^{\frac{40}{63}} \approx 64.3976$. The estimated mass is less than the actual mass.

REF: fall1517aii   NAT: F.LE.A.2   TOP: Modeling Exponential Functions

545 ANS:

1.5%; $P(t) = 92.2(1.015)^t$; $\dfrac{300}{92.2} = (1.015)^t$

$$\log \frac{300}{92.2} = t \log(1.015)$$

$$\frac{\log \dfrac{300}{92.2}}{\log(1.015)} = t$$

$$t \approx 79$$

REF: 062237aii   NAT: A.CED.A.1   TOP: Exponential Growth

546 ANS:

antibiotic $n(0) = \dfrac{0+1}{0+5} + \dfrac{18}{0^2 + 8(0) + 15} = \dfrac{3}{15} + \dfrac{18}{15} = \dfrac{21}{15}$ $\dfrac{t+1}{t+5} + \dfrac{18}{t^2 + 8t + 15} = \dfrac{9}{t+3}$

$a(0) = \dfrac{9}{0+3} = 3$ $\dfrac{(t+1)(t+3)}{(t+5)(t+3)} + \dfrac{18}{(t+3)(t+5)} = \dfrac{9(t+5)}{(t+3)(t+5)}$

$$t^2 + 4t + 3 + 18 = 9t + 45$$
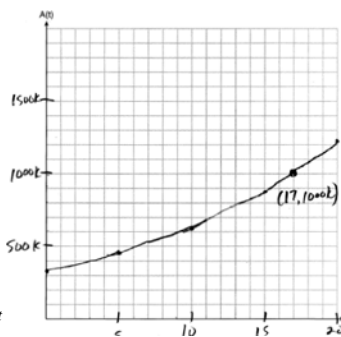
$$t^2 - 5t - 24 = 0$$

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

$$t = 8$$

REF: 012037aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

547 ANS:

$A(t) = 318000(1.07)^t$ $318000(1.07)^t = 1000000$ The graph of $A(t)$ nearly intersects

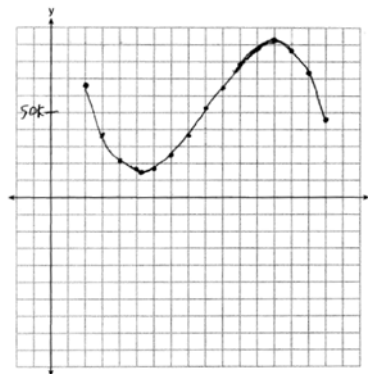$$1.07^t = \frac{1000}{318}$$

$$t \log 1.07 = \log \frac{1000}{318}$$

$$t = \frac{\log \dfrac{1000}{318}}{\log 1.07}$$

$$t \approx 17$$

the point $(17, 1000000)$.

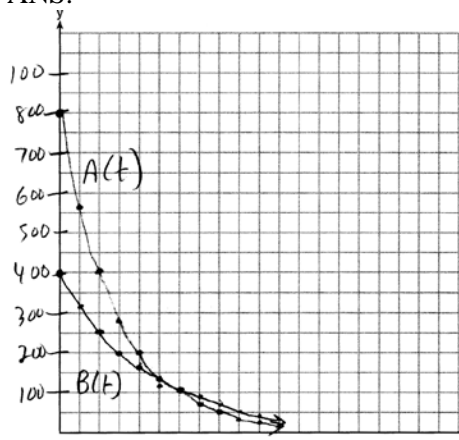REF: 011937aii   NAT: A.CED.A.1   TOP: Exponential Growth

548 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 $P(x)$.

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

549 ANS:

$A(t) = 800e^{-0.347t}$ $\quad 800e^{-0.347t} = 400e^{-0.231t}$ $\quad 0.15 = e^{-0.347t}$
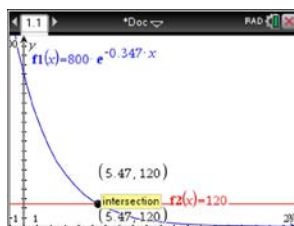
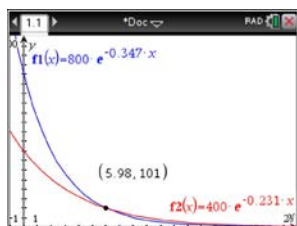$B(t) = 400e^{-0.231t}$ $\quad \ln 2e^{-0.347t} = \ln e^{-0.231t}$ $\quad \ln 0.15 = \ln e^{-0.347t}$

$\ln 2 + \ln e^{-0.347t} = \ln e^{-0.231t}$ $\quad \ln 0.15 = -0.347t \cdot \ln e$

$\ln 2 - 0.347t = -0.231t$ $\quad 5.5 \approx t$

$\ln 2 = 0.116t$

$6 \approx t$

REF: 061637aii   NAT: A.REI.D.11   TOP: Other Systems