JMAP
REGENTS BY COMMON CORE STATE STANDARD: TOPIC

NY Algebra II Regents Exam Questions
from Spring 2015 to August 2017 sorted by CCSS: Topic

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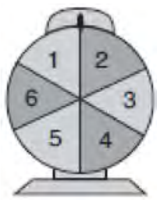
Algebra II Regents Exam Questions by Common Core State Standard: Topic

GRAPHS AND STATISTICS

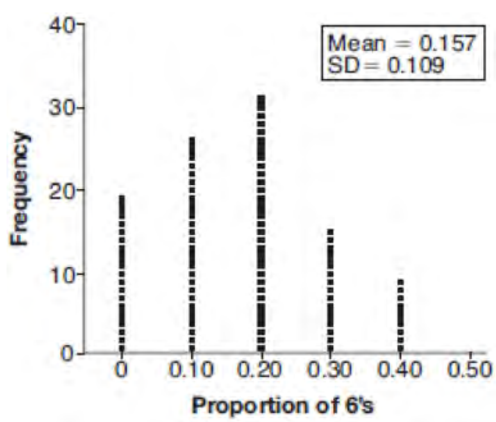
S.IC.A.2, S.IC.B.3-6: ANALYSIS OF DATA

1 A game spinner is divided into 6 equally sized regions, as shown in the diagram below.



For Miles to win, the spinner must land on the number 6. After spinning the spinner 10 times, and losing all 10 times, Miles complained that the spinner is unfair. At home, his dad ran 100 simulations of spinning the spinner 10 times, assuming the probability of winning each spin is $\frac{1}{6}$.

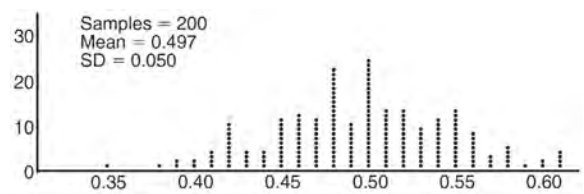
The output of the simulation is shown in the diagram below.



Which explanation is appropriate for Miles and his dad to make?

1 The spinner was likely unfair, since the number 6 failed to occur in about 20% of the simulations.
2 The spinner was likely unfair, since the spinner should have landed on the number 6 by the sixth spin.
3 The spinner was likely not unfair, since the number 6 failed to occur in about 20% of the simulations.
4 The spinner was likely not unfair, since in the output the player wins once or twice in the majority of the simulations.

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



Given the results of her coin flips and of her computer simulation, which statement is most accurate?

1 73 of the computer's next 100 coin flips will be heads.
2 50 of her next 100 coin flips will be heads.
3 Her coin is not fair.
4 Her coin is fair.

3 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.

4 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.

5 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.

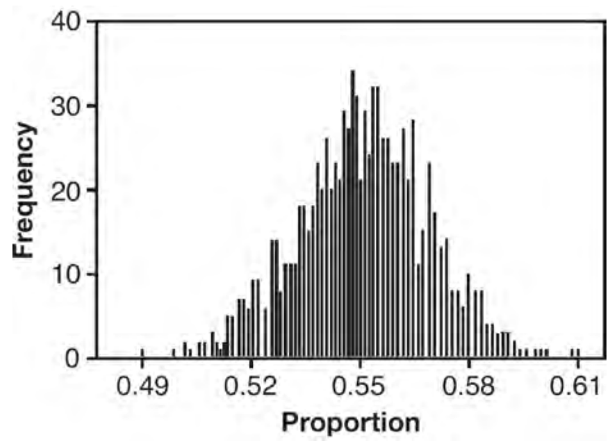
6 Which statement(s) about statistical studies is true?
I. A survey of all English classes in a high school would be a good sample to determine the number of hours students throughout the school spend studying.
II. A survey of all ninth graders in a high school would be a good sample to determine the 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

7 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

8 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.

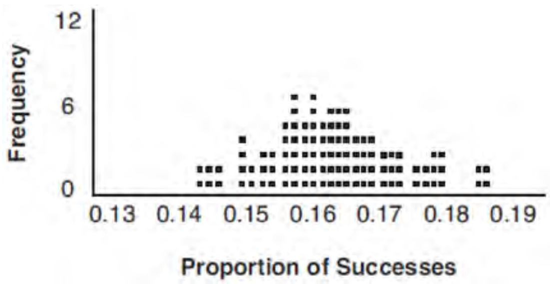
9 Describe how a controlled experiment can be created to examine the effect of ingredient *X* in a toothpaste.

10 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

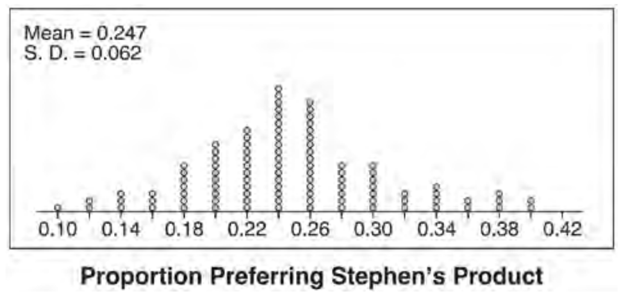
11 A study conducted in 2004 in New York City found that 212 out of 1334 participants had hypertension. Kim ran a simulation of 100 studies based on these data. The output of the simulation is shown in the diagram below.



At a 95% confidence level, the proportion of New York City residents with hypertension and the margin of error are closest to

1 proportion $\approx .16$; margin of error $\approx .01$
2 proportion $\approx .16$; margin of error $\approx .02$
3 proportion $\approx .01$; margin of error $\approx .16$
4 proportion $\approx .02$; margin of error $\approx .16$

12 Stephen's Beverage Company is considering whether to produce a new brand of cola. The company will launch the product if at least 25% of cola drinkers will buy the product. Fifty cola drinkers are randomly selected to take a blind taste-test of products *A*, *B*, and the new product. Nine out of fifty participants preferred Stephen's new cola to products *A* and *B*. The company then devised a simulation based on the requirement that 25% of cola drinkers will buy the product. Each dot in the graph shown below represents the proportion of people who preferred Stephen's new product, each of sample size 50, simulated 100 times.

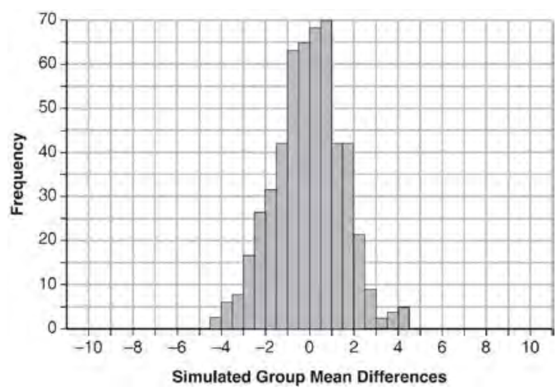


Assume the set of data is approximately normal and the company wants to be 95% confident of its results. Does the sample proportion obtained from the blind taste-test, nine out of fifty, fall within the margin of error developed from the simulation? Justify your answer. The company decides to continue developing the product even though only nine out of fifty participants preferred its brand of cola in the taste-test. Describe how the simulation data could be used to support this decision.

13 Seventy-two students are randomly divided into two equally-sized study groups. Each member of the first group (group 1) is to meet with a tutor after school twice each week for one hour. The second group (group 2), is given an online subscription to a tutorial account that they can access for a maximum of two hours each week. Students in both groups are given the same tests during the year. A summary of the two groups' final grades is shown below:

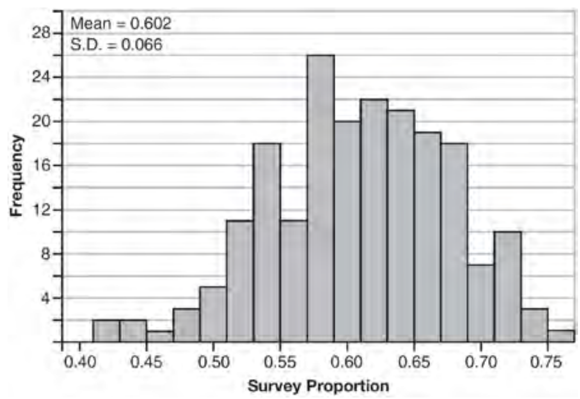
	Group 1	**Group 2**
$\bar{x}$	80.16	83.8
S_x	6.9	5.2

Calculate the mean difference in the final grades (group 1 – group 2) and explain its meaning in the context of the problem. A simulation was conducted in which the students' final grades were rerandomized 500 times. The results are shown below.



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

14 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.

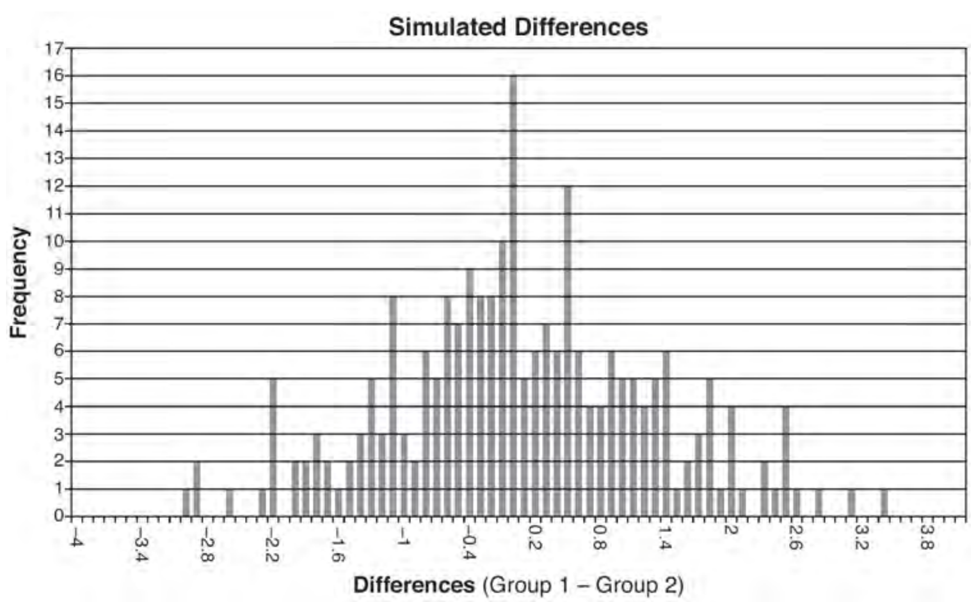


Using the results of the simulation, determine a plausible interval containing the middle 95% of the data. Round all values to the *nearest hundredth*. Members of the prom committee are concerned that a vote of all students attending the prom may produce a 50% – 50% split. Explain what statistical evidence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

15 Ayva designed an experiment to determine the effect of a new energy drink on a group of 20 volunteer students. Ten students were randomly selected to form group 1 while the remaining 10 made up group 2. Each student in group 1 drank one energy drink, and each student in group 2 drank one cola drink. Ten minutes later, their times were recorded for reading the same paragraph of a novel. The results of the experiment are shown below.

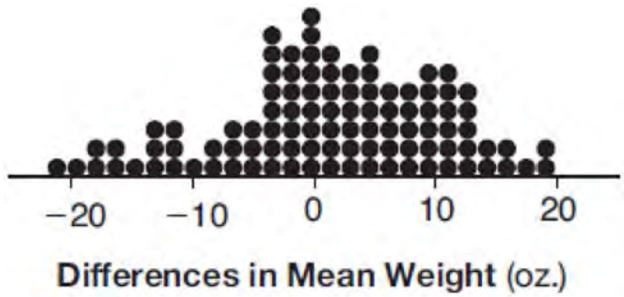
Group 1 (seconds)	**Group 2** (seconds)
17.4	23.3
18.1	18.8
18.2	22.1
19.6	12.7
18.6	16.9
16.2	24.4
16.1	21.2
15.3	21.2
17.8	16.3
19.7	14.5
Mean = 17.7	Mean = 19.1

Ayva thinks drinking energy drinks makes students read faster. Using information from the experimental design or the results, explain why Ayva's hypothesis may be *incorrect*. Using the given results, Ayva randomly mixes the 20 reading times, splits them into two groups of 10, and simulates the difference of the means 232 times.



Ayva has decided that the difference in mean reading times is not an unusual occurrence. Support her decision using the results of the simulation. Explain your reasoning.

16 Gabriel performed an experiment to see if planting 13 tomato plants in black plastic mulch leads to larger tomatoes than if 13 plants are planted without mulch. He observed that the average weight of the tomatoes from tomato plants grown in black plastic mulch was 5 ounces greater than those from the plants planted without mulch. To determine if the observed difference is statistically significant, he rerandomized the tomato groups 100 times to study these random differences in the mean weights. The output of his simulation is summarized in the dotplot below.



Given these results, what is an appropriate inference that can be drawn?

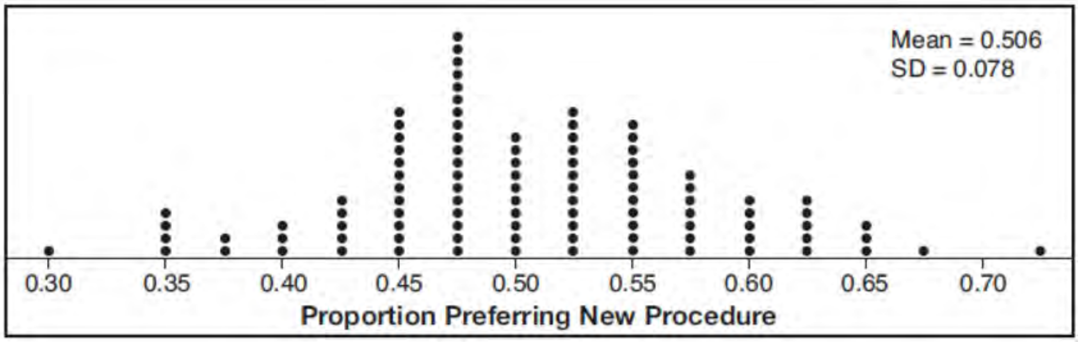
1 There was no effect observed between the two groups.

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.

17 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.

18 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.

19 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.

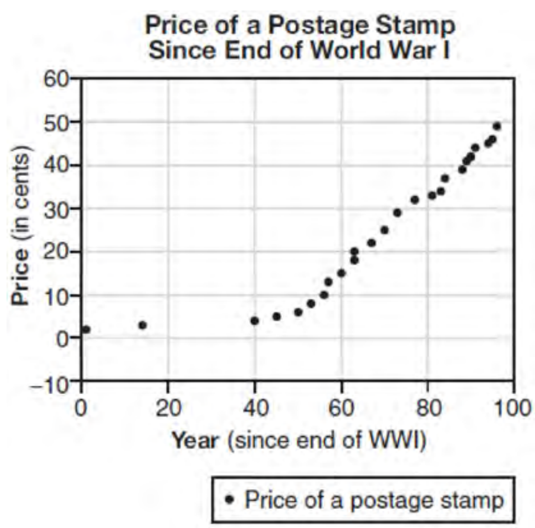
S.ID.B.6: REGRESSION

20 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.

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

S.ID.A.4: NORMAL DISTRIBUTIONS

22 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

23 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

24 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

25 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

26 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.

27 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?

PROBABILITY

S.CP.A.2, S.CP.B.7: THEORETICAL PROBABILITY

28 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.

29 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.

30 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

31 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?

S.CP.A.3-4, S.CP.B.6: CONDITIONAL PROBABILITY

32 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

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

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

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

1 $\frac{157}{229}$

2 $\frac{157}{312}$

3 $\frac{157}{384}$

4 $\frac{157}{456}$

34 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.

35 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.

36 Data collected about jogging from students with two older siblings are shown in the table below.

	Neither Sibling Jogs	**One Sibling Jogs**	**Both Siblings Jogs**
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.

37 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.

38 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?

RATE

F.IF.B.6: RATE OF CHANGE

39 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

40 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

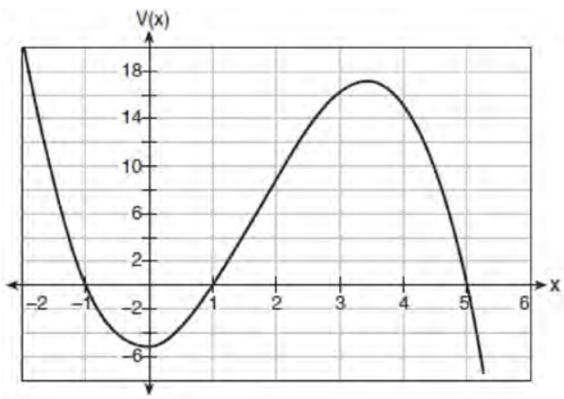
$$g(x) = 4x^3 - 5x^2 + 3$$

41 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.

42 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]

43 The function $f(x) = 2^{-0.25x} \bullet \sin\left(\frac{\pi}{2}x\right)$ represents a damped sound wave function. What is the average rate of change for this function on the interval $[-7,7]$, to the *nearest hundredth*?
1 -3.66
2 -0.30
3 -0.26
4 3.36

44 The value of a new car depreciates over time. Greg purchased a new car in June 2011. The value, V, of his car after t years can be modeled by the equation $\log_{0.8}\left(\frac{V}{1700}\right) = t$. 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

QUADRATICS

A.REI.B.4: SOLVING QUADRATICS

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

46 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 $-1 - 4i$

47 The solutions to the equation $-\frac{1}{2}x^2 = -6x + 20$ are
1 $-6 \pm 2i$
2 $-6 \pm 2\sqrt{19}$
3 $6 \pm 2i$
4 $6 \pm 2\sqrt{19}$

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

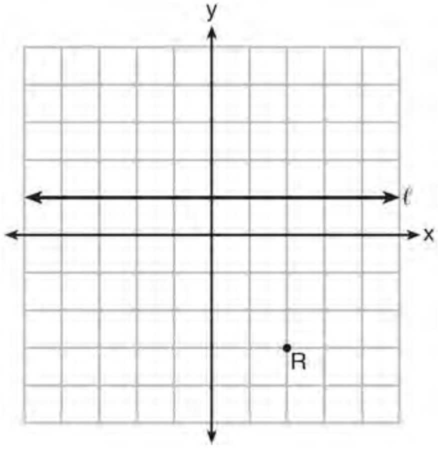
49 The solution to the equation $18x^2 - 24x + 87 = 0$ is
1 $-\frac{2}{3} \pm 6i\sqrt{158}$
2 $-\frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$
3 $\frac{2}{3} \pm 6i\sqrt{158}$
4 $\frac{2}{3} \pm \frac{1}{6}i\sqrt{158}$

A.REI.B.4: COMPLEX CONJUGATE ROOT THEOREM

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

G.GPE.A.2: GRAPHING QUADRATIC FUNCTIONS

51 Which equation represents the set of points equidistant from line ℓ and point R shown on the graph below?



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

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

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

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

52 Which equation represents a parabola with a focus of $(0,4)$ and a directrix of $y = 2$?

1 $y = x^2 + 3$

2 $y = -x^2 + 1$

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

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

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

54 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 $x^2 = 4y$

55 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.

SYSTEMS

A.REI.C.6: SOLVING LINEAR SYSTEMS

56 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

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

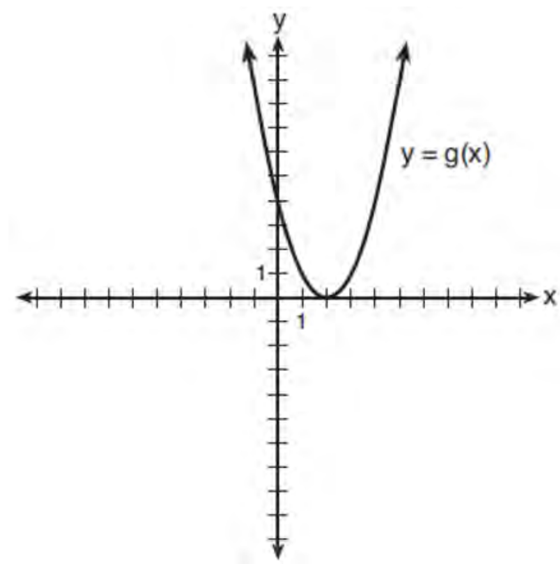
$$x+3y+5z=45$$
$$6x-3y+2z=-10$$
$$-2x+3y+8z=72$$

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

$$x+y+z=1$$
$$2x+4y+6z=2$$
$$-x+3y-5z=11$$

A.REI.C.7, A.REI.D.11: QUADRATIC-LINEAR SYSTEMS

59 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 $\{(1,1),(6,16)\}$

60 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

61 Algebraically determine the values of x that satisfy the system of equations below.

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

62 Solve the system of equations shown below algebraically.

$$(x-3)^2 + (y+2)^2 = 16$$
$$2x + 2y = 10$$

63 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 $t = 11$

A.REI.D.11: OTHER SYSTEMS

64 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

65 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

66 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 $(1.4, 3.4)$

67 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 $(11.29, 32.87)$

68 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?

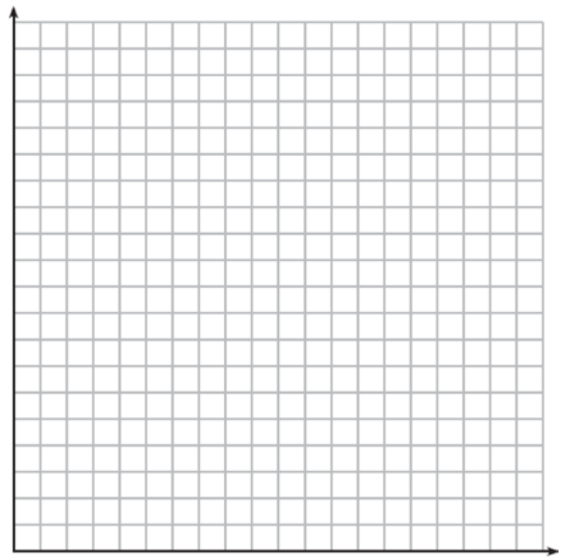
1 7
2 8
3 13
4 36

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

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

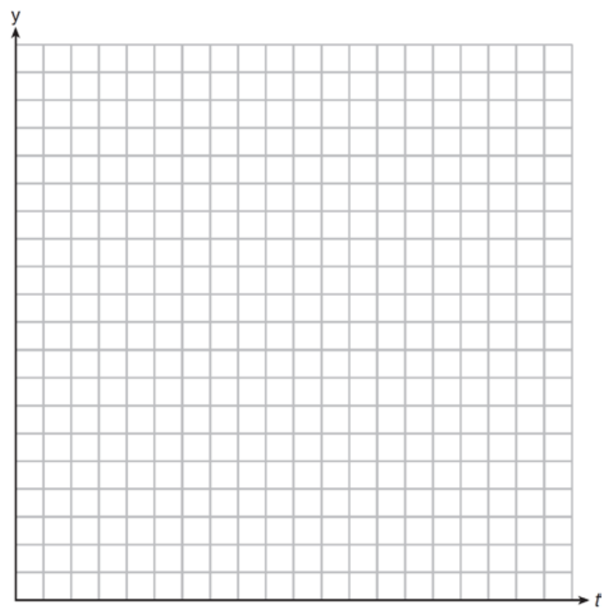
State the solutions to the equation $h(x) = k(x)$, rounded to the *nearest hundredth*.

70 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.

71 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.

POWERS

A.SSE.B.3, F.BF.A.1, F.IF.C.8, F.LE.A.2, F.LE.B.5: MODELING EXPONENTIAL FUNCTIONS

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

73 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 $P = 714(0.9750)^y$

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

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

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

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

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

75 Which function represents exponential decay?

1 $y = 2^{0.3t}$

2 $y = 1.2^{3t}$

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

4 $y = 5^{-t}$

76 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.

77 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 $(1.00427)^{\frac{m}{12}}$

78 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 $300(1.30)^{\frac{365}{14}}$

79 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 $300e^{-0.42}$

80 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

81 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.

82 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.

83 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

F.IF.B.4: EVALUATING LOGARITHMIC EXPRESSIONS

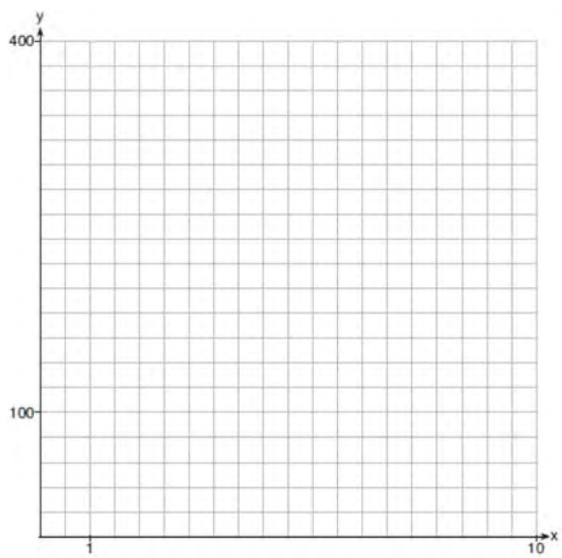
84 The loudness of sound is measured in units called decibels (dB). These units are measured by first assigning an intensity I_0 to a very soft sound that is called the threshold sound. The sound to be measured is assigned an intensity, I, and the decibel rating, d, of this sound is found using $d = 10\log\frac{I}{I_0}$. The threshold sound audible to the average person is 1.0×10^{-12} W/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

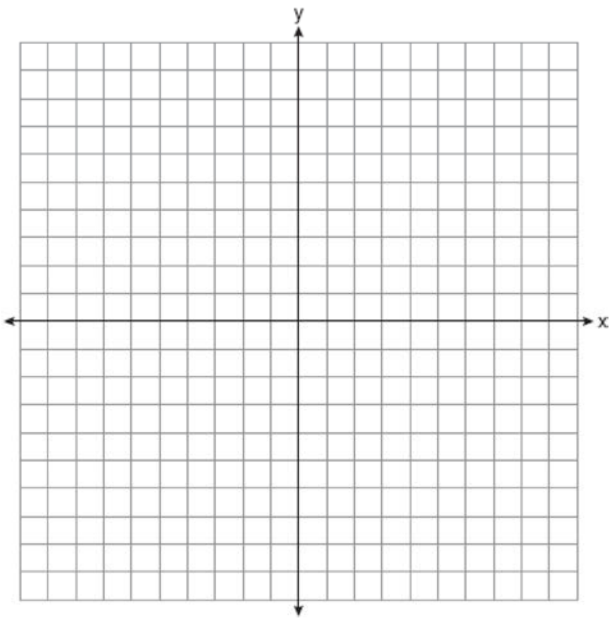
F.IF.C.7: GRAPHING EXPONENTIAL AND LOGARITHMIC FUNCTIONS

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



86 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.

87 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.

A.CED.A.1, F.LE.A.4: EXPONENTIAL EQUATIONS

88 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.

89 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.

90 What is the solution to $8(2^{x+3}) = 48$?

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

2 $x = 0$

3 $x = \frac{\ln 48}{\ln 16} - 3$

4 $x = \ln 4 - 3$

91 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:

$$T = T_a + \left(T_0 - T_a\right)e^{-kt}$$

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.

92 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*.

93 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.*

94 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.

95 A radioactive substance has a mass of 140 g at 3 p.m. and 100 g at 8 p.m. Write an equation in the form $A = A_0\left(\frac{1}{2}\right)^{\frac{t}{h}}$ that models this situation, where h is the constant representing the number of hours in the half-life, A_0 is the initial mass, and A is the mass t hours after 3 p.m. Using this equation, solve for h, to the *nearest ten thousandth*. Determine when the mass of the radioactive substance will be 40 g. Round your answer to the *nearest tenth of an hour*.

POLYNOMIALS

A.SSE.A.2: FACTORING POLYNOMIALS

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

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

98 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 $2d(d-3)^2(d+3)$

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

100 Which expression has been rewritten correctly to form a true statement?

1 $(x+2)^2 + 2(x+2) - 8 = (x+6)x$

2 $x^4 + 4x^2 + 9x^2y^2 - 36y^2 = (x+3y)^2(x-2)^2$

3 $x^3 + 3x^2 - 4xy^2 - 12y^2 = (x-2y)(x+3)^2$

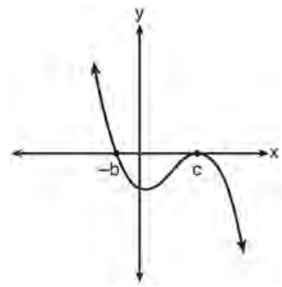
4 $(x^2 - 4)^2 - 5(x^2 - 4) - 6 = (x^2 - 7)(x^2 - 6)$

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

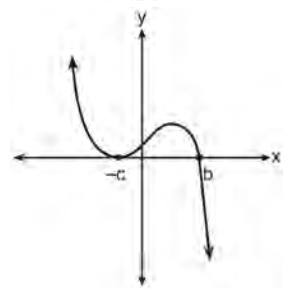
102 Over the set of integers, factor the expression $4x^3 - x^2 + 16x - 4$ completely.

A.APR.B.3: ZEROS OF POLYNOMIALS

103 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



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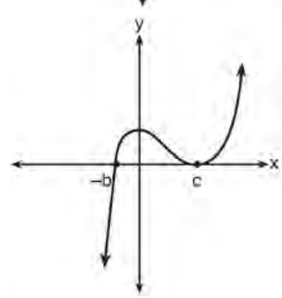

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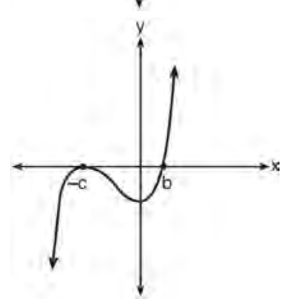
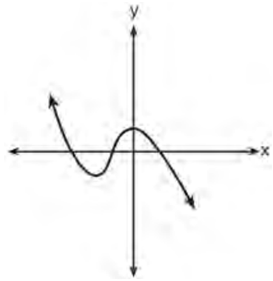
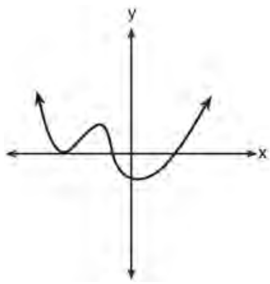
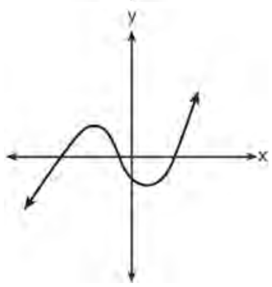


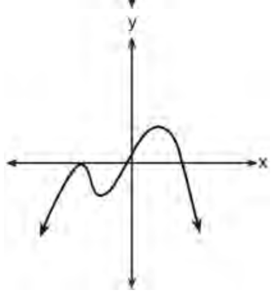
4

104 Which graph has the following characteristics?
- three real zeros
- as $x \to -\infty$, $f(x) \to -\infty$
- as $x \to \infty$, $f(x) \to \infty$

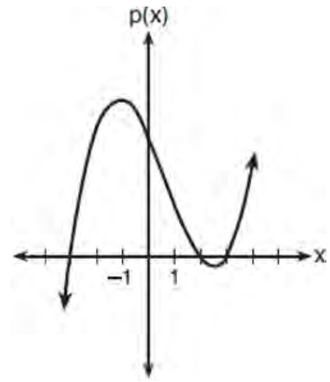
1 

2 

3 

4 

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

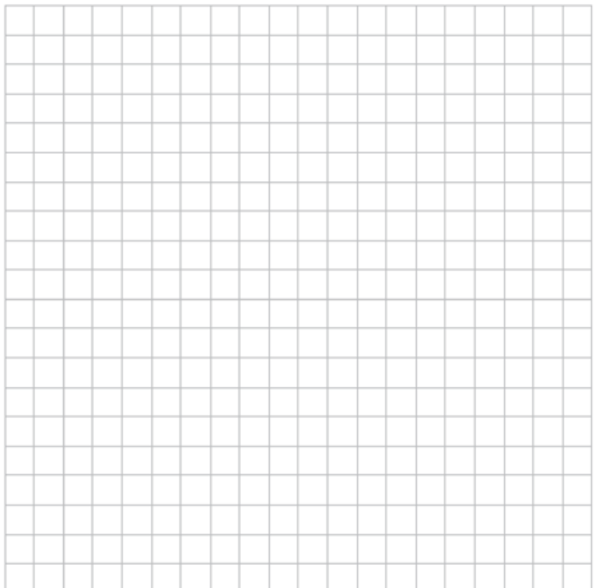
106 What are the zeros of $P(m) = (m^2 - 4)(m^2 + 1)$?

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

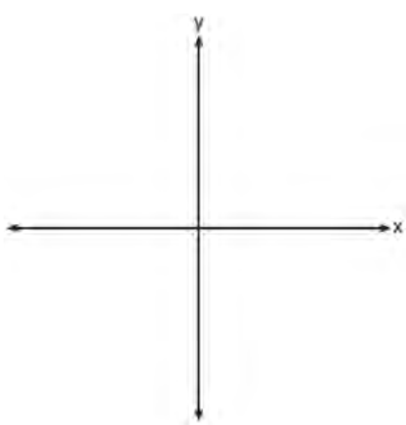
107 The zeros for $f(x) = x^4 - 4x^3 - 9x^2 + 36x$ are

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

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

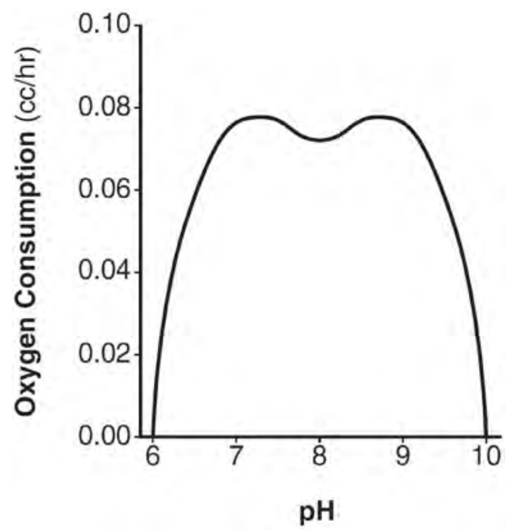


109 On the axes below, sketch a possible function $p(x) = (x - a)(x - b)(x + c)$, where a, b, and c are positive, $a > b$, and $p(x)$ has a positive y-intercept of d. Label all intercepts.



F.IF.B.4, F.IF.C.7: GRAPHING POLYNOMIAL FUNCTIONS

110 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.

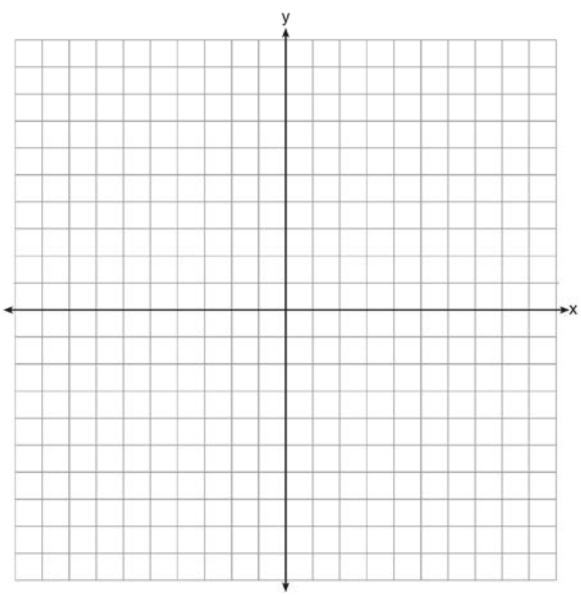


Which statement about this function is *incorrect*?

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.

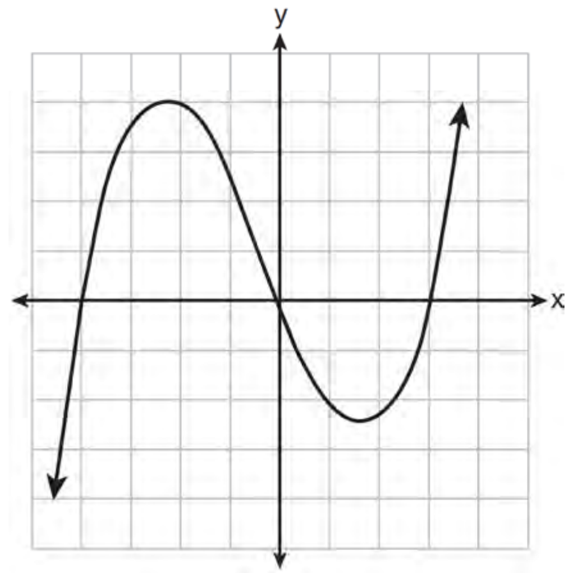
111 A polynomial equation of degree three, $p(x)$, is used to model the volume of a rectangular box. The graph of $p(x)$ has x intercepts at -2, 10, and 14. Which statements regarding $p(x)$ could be true?
A. The equation of $p(x) = (x-2)(x+10)(x+14)$.
B. The equation of $p(x) = -(x+2)(x-10)(x-14)$.
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*

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



A.APR.B.2: REMAINDER THEOREM

113 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

114 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 $g(x)$.

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

116 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 $x - 7$

117 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.

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

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

120 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.

A.APR.C.4: POLYNOMIAL IDENTITIES

121 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

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

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

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

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

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

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

RADICALS

N.RN.A.2: OPERATIONS WITH RADICALS

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

A.REI.A.2: SOLVING RADICALS

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

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

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

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

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

132 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.

N.RN.A.1-2: RADICALS AND RATIONAL EXPONENTS

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

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

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

136 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 $\dfrac{1}{m\sqrt[5]{m}}$

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

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

$$\text{I. } \frac{\sqrt[6]{x}}{\sqrt[3]{x}} \quad \text{II. } \frac{x^{\frac{1}{6}}}{x^{\frac{1}{3}}} \quad \text{III. } x^{\frac{-1}{6}}$$

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

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

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

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

N.CN.A.2: OPERATIONS WITH COMPLEX NUMBERS

141 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

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

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

143 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 $9k^2-12ki+4$

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

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

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

RATIONALS

A.APR.D.6: UNDEFINED RATIONALS

147 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

A.APR.D.6: EXPRESSIONS WITH NEGATIVE EXPONENTS

148 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 $-3x^{-1}+x^{-2}$

A.APR.D.6: RATIONAL EXPRESSIONS

149 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 $3x^2+13x+\dfrac{49}{2}+\dfrac{151}{2x+3}$

150 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 $2x^2-2.5x-5-\dfrac{20}{2x+3}$

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

1 x^2+3

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

3 $2x^2+x+6$

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

152 Which expression is equivalent to $\frac{4x^3+9x-5}{2x-1}$, where $x \neq \frac{1}{2}$?

1 $2x^2+x+5$

2 $2x^2+\frac{11}{2}+\frac{1}{2(2x-1)}$

3 $2x^2-x+5$

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

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

A.CED.A.1: MODELING RATIONALS

154 Julie averaged 85 on the first three tests of the semester in her mathematics class. If she scores 93 on each of the remaining tests, her average will be 90. Which equation could be used to determine how many tests, T, are left in the semester?

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

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

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

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

155 Mallory wants to buy a new window air conditioning unit. The cost for the unit is $329.99. If she plans to run the unit three months out of the year for an annual operating cost of $108.78, which function models the cost per year over the lifetime of the unit, $C(n)$, in terms of the number of years, n, that she owns the air conditioner.

1 $C(n)=329.99+108.78n$

2 $C(n)=329.99+326.34n$

3 $C(n)=\frac{329.99+108.78n}{n}$

4 $C(n)=\frac{329.99+326.34n}{n}$

A.REI.A.2: SOLVING RATIONALS

156 What is the solution set of the equation $\frac{3x+25}{x+7}-5=\frac{3}{x}$?

1 $\left\{\frac{3}{2},7\right\}$

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

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

4 $\left\{-\frac{7}{2},-3\right\}$

157 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

158 To solve $\frac{2x}{x-2}-\frac{11}{x}=\frac{8}{x^2-2x}$, Ren multiplied both sides by the least common denominator. Which statement is true?

1 2 is an extraneous solution.
2 $\frac{7}{2}$ is an extraneous so1ution.
3 0 and 2 are extraneous solutions.
4 This equation does not contain any extraneous solutions.

159 The focal length, F, of a camera's lens is related to the distance of the object from the lens, J, and the distance to the image area in the camera, W, by the formula below.

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

When this equation is solved for J in terms of F and W, J equals

1 $F-W$

2 $\frac{FW}{F-W}$

3 $\frac{FW}{W-F}$

4 $\frac{1}{F}-\frac{1}{W}$

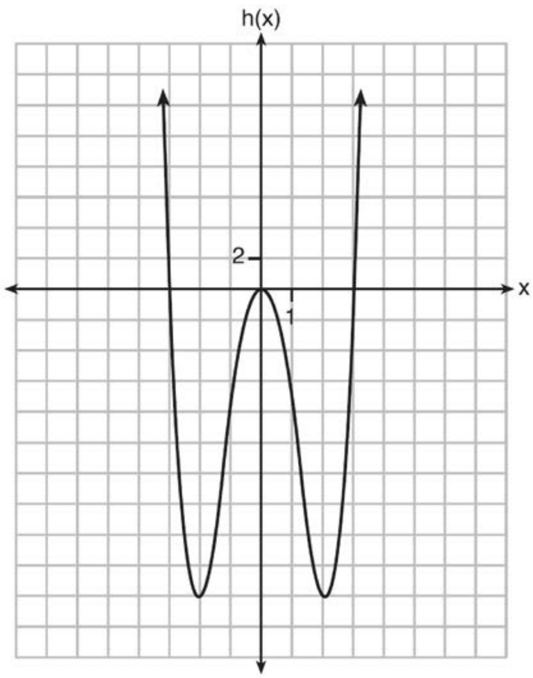
160 Solve for x: $\frac{1}{x}-\frac{1}{3}=-\frac{1}{3x}$

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

FUNCTIONS
F.BF.B.3: EVEN AND ODD FUNCTIONS

162 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.

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

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

F.BF.A.1: OPERATIONS WITH FUNCTIONS

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

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

167 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 $-0.15x^3 + 32x + 120$

F.IF.C.9: COMPARING FUNCTIONS

168 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

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

$f(x) = 3\sin 2x$, 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.

F.BF.B.4: INVERSE OF FUNCTIONS

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

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

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

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

172 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 $x = 3^y$

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

SEQUENCES AND SERIES

F.LE.A.2, F.IF.A.3, F.BF.A.2: SEQUENCES

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

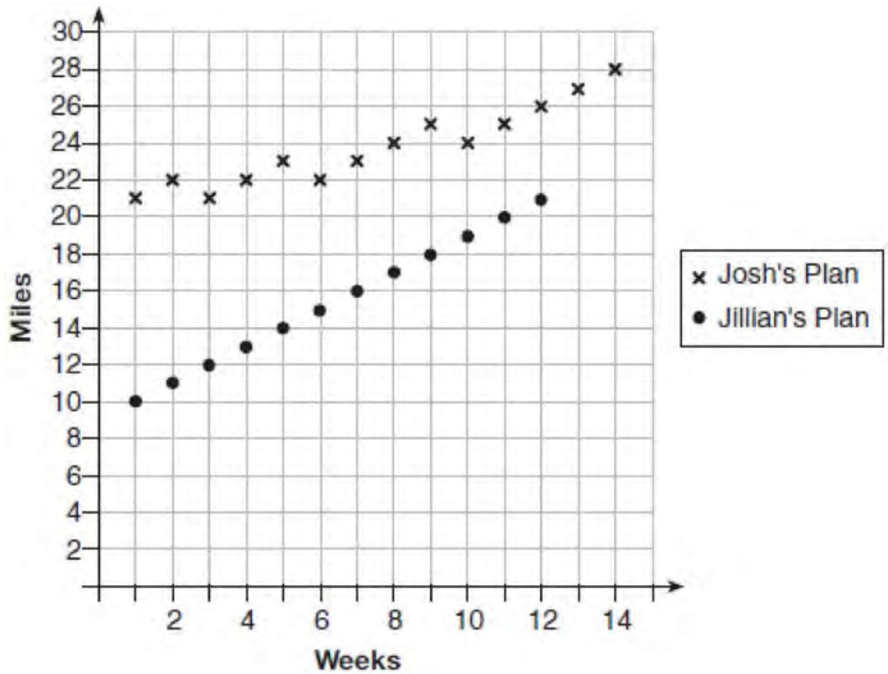
175 Given $f(9) = -2$, which function can be used to generate the sequence $-8, -7.25, -6.5, -5.75, \ldots$?

1 $f(n) = -8 + 0.75n$
2 $f(n) = -8 - 0.75(n-1)$
3 $f(n) = -8.75 + 0.75n$
4 $f(n) = -0.75 + 8(n-1)$

176 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.

177 Simon lost his library card and has an overdue library book. When the book was 5 days late, he owed $2.25 to replace his library card and pay the fine for the overdue book. When the book was 21 days late, he owed $6.25 to replace his library card and pay the fine for the overdue book. Suppose the total amount Simon owes when the book is *n* days late can be determined by an arithmetic sequence. Determine a formula for a_n, the *n*th term of this sequence. Use the formula to determine the amount of money, in dollars, Simon needs to pay when the book is 60 days late.

178 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.

179 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

180 A recursive formula for the sequence $18, 9, 4.5, \ldots$ is

1 $g_1 = 18$

$g_n = \frac{1}{2} g_{n-1}$

2 $g_n = 18\left(\frac{1}{2}\right)^{n-1}$

3 $g_1 = 18$

$g_n = 2g_{n-1}$

4 $g_n = 18(2)^{n-1}$

181 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.

182 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 $j_1 = 250,000$

$j_n = 1.00375 j_{n-1}$

4 $j_1 = 250,000$

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

183 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 $P_0 = 19,378,000$

$P_t = 1.015P_{t-1}$

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

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

$$a_1 = x + 1$$
$$a_n = x(a_{n-1})$$

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

F.BF.B.6: SIGMA NOTATION

186 Kristin wants to increase her running endurance. According to experts, a gradual mileage increase of 10% per week can reduce the risk of injury. If Kristin runs 8 miles in week one, which expression can help her find the total number of miles she will have run over the course of her 6-week training program?

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

A.SSE.B.4: SERIES

187 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

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

189 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*.

190 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*.

$$P_n = PMT\left(\frac{1-(1+i)^{-n}}{i}\right)$$

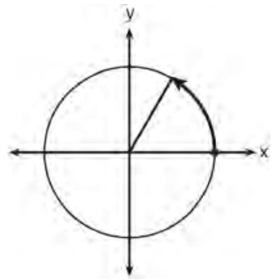
P_n = present amount borrowed
n = number of monthly pay periods
PMT = monthly payment
i = interest rate per month
The affordable monthly payment is \$300 for the same time period. Determine an appropriate down payment, to the *nearest dollar*.

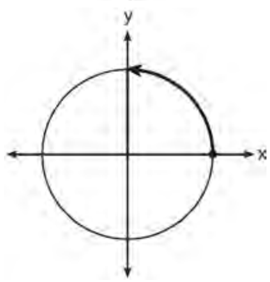
191 Jim is looking to buy a vacation home for \$172,600 near his favorite southern beach. The formula to compute a mortgage payment, M, is $M = P \bullet \dfrac{r(1+r)^N}{(1+r)^N - 1}$ where P is the principal amount of the loan, r is the monthly interest rate, and N is the number of monthly payments. 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.

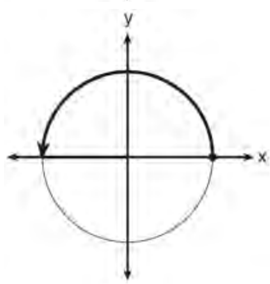
TRIGONOMETRY

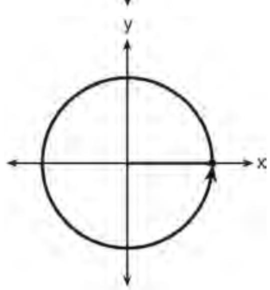
F.TF.A.1: UNIT CIRCLE

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

1


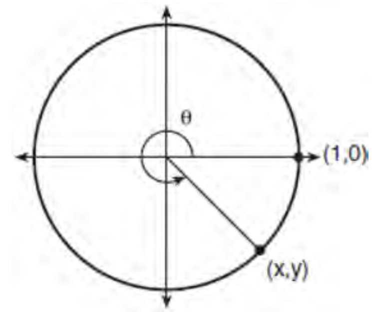
2


3


4


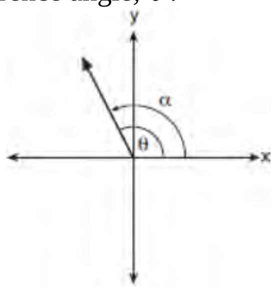
F.TF.A.2: RECIPROCAL TRIGONOMETRIC FUNCTIONS

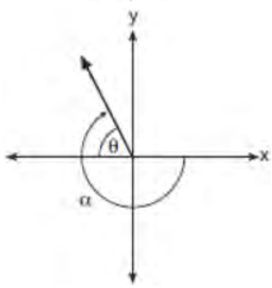
193 Using the unit circle below, explain why $\csc\theta = \frac{1}{y}$.

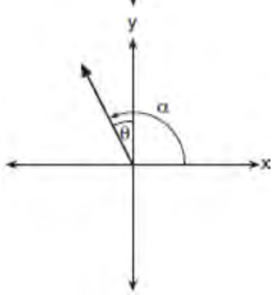


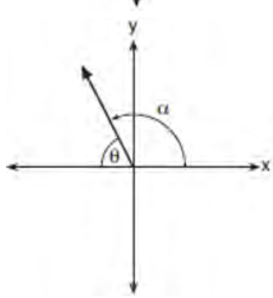
F.TF.A.2: REFERENCE ANGLES

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

1 

2 

3 

4 

F.TF.A.2, F.TF.C.8: DETERMINING TRIGONOMETRIC FUNCTIONS

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

196 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 $\dfrac{4}{5}$

197 Given that $\sin^2\theta + \cos^2\theta = 1$ and $\sin\theta = -\frac{\sqrt{2}}{5}$, what is a possible value of $\cos\theta$?
1 $\frac{5+\sqrt{2}}{5}$
2 $\frac{\sqrt{23}}{5}$
3 $\frac{3\sqrt{3}}{5}$
4 $\frac{\sqrt{35}}{5}$

198 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.

F.TF.C.8: SIMPLIFYING TRIGONOMETRIC IDENTITIES

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

F.TF.B.5: MODELING TRIGONOMETRIC FUNCTIONS

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

F.IF.B.4, F.IF.C.7: GRAPHING TRIGONOMETRIC FUNCTIONS

201 The Ferris wheel at the landmark Navy Pier in Chicago takes 7 minutes to make one full rotation. The height, H, in feet, above the ground of one of the six-person cars can be modeled by $H(t) = 70\sin\left(\frac{2\pi}{7}(t-1.75)\right) + 80$, where t is time, in minutes. Using $H(t)$ for one full rotation, this car's minimum height, in feet, is
1 150
2 70
3 10
4 0

202 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 $(300,400)$

203 As x increases from 0 to $\frac{\pi}{2}$, the graph of the equation $y = 2\tan x$ will
1 increase from 0 to 2
2 decrease from 0 to –2
3 increase without limit
4 decrease without limit

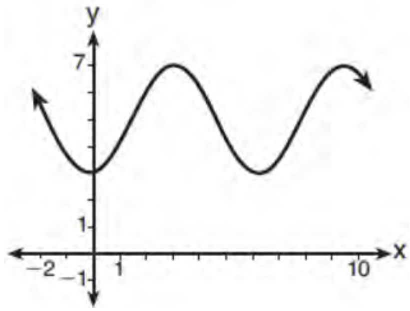
204 Relative to the graph of $y = 3\sin x$, what is the shift of the graph of $y = 3\sin\left(x + \frac{\pi}{3}\right)$?
1 $\frac{\pi}{3}$ right
2 $\frac{\pi}{3}$ left
3 $\frac{\pi}{3}$ up
4 $\frac{\pi}{3}$ down

205 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

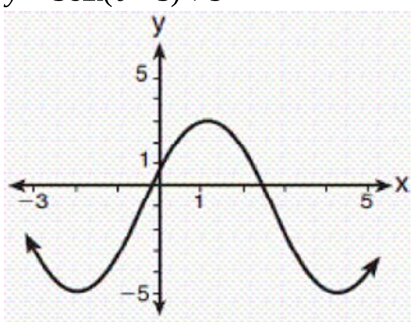
206 Based on climate data that have been collected in Bar Harbor, Maine, the average monthly temperature, in degrees F, can be modeled by the equation $B(x) = 23.914\sin(0.508x - 2.116) + 55.300$. The same governmental agency collected average monthly temperature data for Phoenix, Arizona, and found 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.

207 Which statement is *incorrect* for the graph of the function $y = -3\cos\left[\frac{\pi}{3}(x - 4)\right] + 7$?
1 The period is 6.
2 The amplitude is 3.
3 The range is [4,10].
4 The midline is $y = -4$.

208 Which sinusoid has the greatest amplitude?

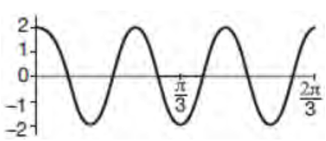
1 

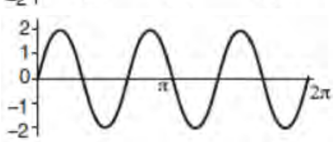
2 $y = 3\sin(\theta - 3) + 5$

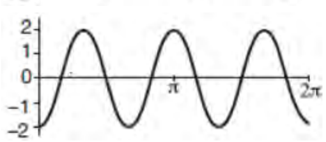
3 

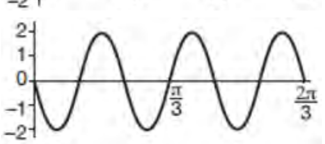
4 $y = -5\sin(\theta - 1) - 3$

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

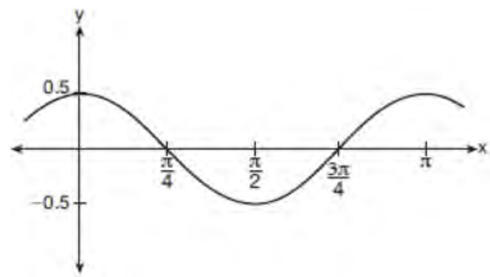
1 

2 

3 

4 

210 Which equation is represented by the graph shown below?



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

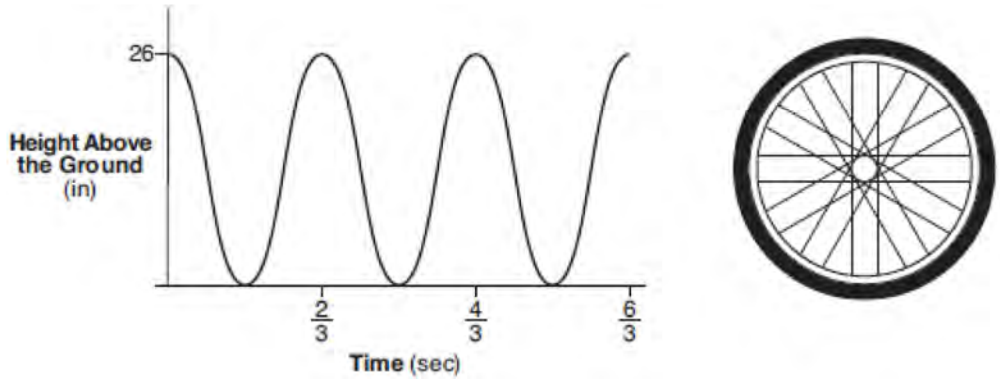
2 $y = \cos x$

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

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

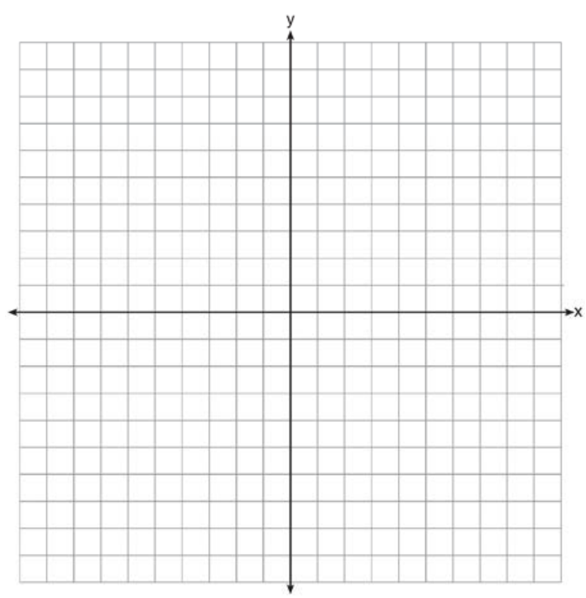
211 The volume of air in a person's lungs, as the person breathes in and out, can be modeled by a sine graph. A scientist is studying the differences in this volume for people at rest compared to people told to take a deep breath. When examining the graphs, should the scientist focus on the amplitude, period, or midline? Explain your choice.

212 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.

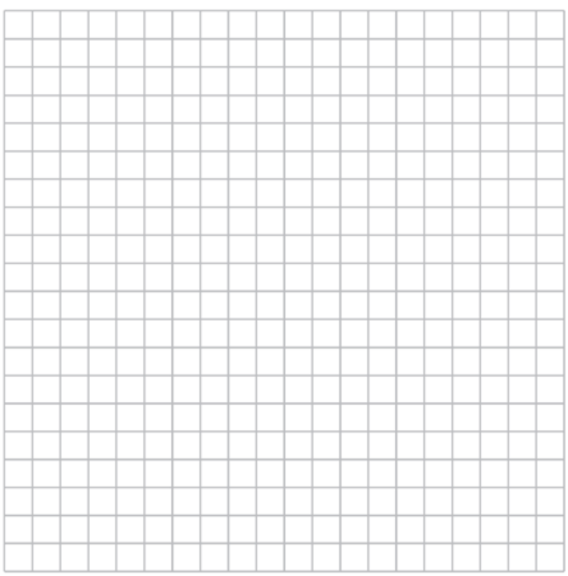


Identify the period of the graph and describe what the period represents in this context.

213 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 $(0,2)$.

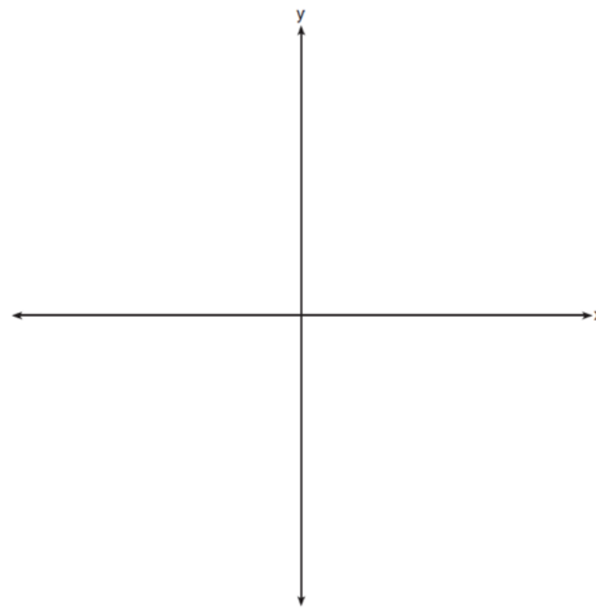


214 The ocean tides near Carter Beach follow a repeating pattern over time, with the amount of time between each low and high tide remaining relatively constant. On a certain day, low tide occurred at 8:30 a.m. and high tide occurred at 3:00 p.m. At high tide, the water level was 12 inches above the 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.

215 a) On the axes below, sketch *at least one* cycle of a sine curve with an amplitude of 2, a midline at $y = -\frac{3}{2}$, and a period of 2π.



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

CONICS
G.GPE.A.1: EQUATIONS OF CIRCLES

216 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 $4(x-3)^2 + 4(y+9)^2 = 436$

Algebra II Regents Exam Questions by Common Core State Standard: Topic
Answer Section

1 ANS: 3 PTS: 2 REF: 061710aii NAT: S.IC.A.2
TOP: Analysis of Data

2 ANS: 3 PTS: 2 REF: 061607aii NAT: S.IC.A.2
TOP: Analysis of Data

3 ANS:
sample: pails of oranges; population: truckload of oranges. It is likely that about 5% of all the oranges are unsatisfactory.

PTS: 2 REF: 011726aii NAT: S.IC.A.2 TOP: Analysis of Data

4 ANS:
Since there are six flavors, each flavor can be assigned a number, 1-6. Use the simulation to see the number of times the same number is rolled 4 times in a row.

PTS: 2 REF: 081728aii NAT: S.IC.A.2 TOP: Analysis of Data

5 ANS: 3 PTS: 2 REF: 011706aii NAT: S.IC.B.3
TOP: Analysis of Data KEY: type

6 ANS: 1
II. Ninth graders drive to school less often; III.Students know little about adults; IV. Calculus students love math!

PTS: 2 REF: 081602aii NAT: S.IC.B.3 TOP: Analysis of Data
KEY: bias

7 ANS: 3
Self selection causes bias.

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

8 ANS: 2 PTS: 2 REF: 081717aii NAT: S.IC.B.3
TOP: Analysis of Data KEY: type

9 ANS:
Randomly assign participants to two groups. One group uses the toothpaste with ingredient *X* and the other group uses the toothpaste without ingredient *X*.

PTS: 2 REF: 061626aii NAT: S.IC.B.3 TOP: Analysis of Data
KEY: type

10 ANS: 2

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

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

11 ANS: 2

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

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

12 ANS:

Yes. The margin of error from this simulation indicates that 95% of the observations fall within ± 0.12 of the simulated proportion, 0.25. The margin of error can be estimated by multiplying the standard deviation, shown to be 0.06 in the dotplot, by 2, or applying the estimated standard error formula, $\left(\sqrt{\frac{p(1-p)}{n}}\right)$ or $\left(\sqrt{\frac{(0.25)(0.75)}{50}}\right)$ and multiplying by 2. The interval 0.25 ± 0.12 includes plausible values for the true proportion of people who prefer Stephen's new product. The company has evidence that the population proportion could be at least 25%. As seen in the dotplot, it can be expected to obtain a sample proportion of 0.18 (9 out of 50) or less several times, even when the population proportion is 0.25, due to sampling variability. Given this information, the results of the survey do not provide enough evidence to suggest that the true proportion is not at least 0.25, so the development of the product should continue at this time.

PTS: 4 REF: spr1512aii NAT: S.IC.B.4 TOP: Analysis of Data

13 ANS:

The mean difference between the students' final grades in group 1 and group 2 is –3.64. This value indicates that students who met with a tutor had a mean final grade of 3.64 points less than students who used an on-line subscription. One can infer whether this difference is due to the differences in intervention or due to which students were assigned to each group by using a simulation to rerandomize the students' final grades many (500) times. If the observed difference –3.64 is the result of the assignment of students to groups alone, then a difference of –3.64 or less should be observed fairly regularly in the simulation output. However, a difference of –3 or less occurs in only about 2% of the rerandomizations. Therefore, it is quite unlikely that the assignment to groups alone accounts for the difference; rather, it is likely that the difference between the interventions themselves accounts for the difference between the two groups' mean final grades.

PTS: 4 REF: fall1514aii NAT: S.IC.B.5 TOP: Analysis of Data

14 ANS:

$0.602 \pm 2 \cdot 0.066 = 0.47 - 0.73$. Since 0.50 falls within the 95% interval, this supports the concern there may be an even split.

PTS: 4 REF: 061635aii NAT: S.IC.B.5 TOP: Analysis of Data

15 ANS:

Some of the students who did not drink energy drinks read faster than those who did drink energy drinks.

$17.7 - 19.1 = -1.4$ Differences of -1.4 and less occur $\frac{25}{232}$ or about 10% of the time, so the difference is not unusual.

PTS: 4 REF: 081636aii NAT: S.IC.B.5 TOP: Analysis of Data

16 ANS: 2 PTS: 2 REF: 011709aii NAT: S.IC.B.5

TOP: Analysis of Data

17 ANS:
$0.506 \pm 2 \cdot 0.078 = 0.35 - 0.66$. The 32.5% value falls below the 95% confidence level.

PTS: 4 REF: 061736aii NAT: S.IC.B.5 TOP: Analysis of Data

18 ANS: 1 PTS: 2 REF: 081722aii NAT: S.IC.B.6
TOP: Analysis of Data

19 ANS:
Using a 95% level of confidence, $x \pm 2$ standard deviations sets the usual wait time as 150-302 seconds. 360 seconds is unusual.

PTS: 2 REF: 081629aii NAT: S.IC.B.6 TOP: Analysis of Data

20 ANS:
$y = 4.168(3.981)^x$. $100 = 4.168(3.981)^x$

$$\log\frac{100}{4.168} = \log(3.981)^x$$

$$\log\frac{100}{4.168} = x\log(3.981)$$

$$\frac{\log\frac{100}{4.168}}{\log(3.981)} = x$$

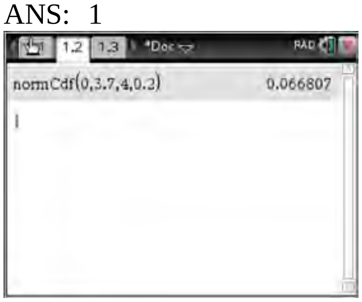
$$x \approx 2.25$$

PTS: 4 REF: 081736aii NAT: S.ID.B.6 TOP: Regression
KEY: exponential AII

21 ANS: 3
The pattern suggests an exponential pattern, not linear or sinusoidal. A 4% growth rate is accurate, while a 43% growth rate is not.

PTS: 2 REF: 011713aii NAT: S.ID.B.6 TOP: Regression
KEY: choose model

22 ANS: 1



PTS: 2 REF: 081711aii NAT: S.ID.A.4 TOP: Normal Distributions
KEY: percent

23 ANS: 2

$\bar{x} + 2\sigma$ represents approximately 48% of the data.

PTS: 2 REF: 061609aii NAT: S.ID.A.4 TOP: Normal Distributions
KEY: percent

24 ANS: 3

PTS: 2 REF: 081604aii NAT: S.ID.A.4 TOP: Normal Distributions
KEY: probability

25 ANS: 4

$496 \pm 2(115)$

PTS: 2 REF: 011718aii NAT: S.ID.A.4 TOP: Normal Distributions
KEY: interval

26 ANS:

69

PTS: 2 REF: 061726aii NAT: S.ID.A.4 TOP: Normal Distributions
KEY: percent

27 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

$z = \dfrac{540-480}{24} = 2.5$ $x = 535$ $x = 560$

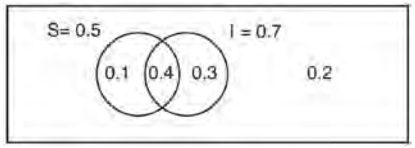
PTS: 4 REF: fall1516aii NAT: S.ID.A.4 TOP: Normal Distributions
KEY: probability

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

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

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

PTS: 2 REF: 081632aii NAT: S.CP.A.2 TOP: Theoretical Probability

29 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.

PTS: 4 REF: spr1513aii NAT: S.CP.A.2 TOP: Theoretical Probability

30 ANS: 2
The events are independent because $P(A \text{ and } B) = P(A) \cdot P(B)$.

$0.125 = 0.5 \cdot 0.25$

If $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = 0.25 + 0.5 - .125 = 0.625$, then the events are not mutually exclusive because $P(A \text{ or } B) = P(A) + P(B)$

$0.625 \neq 0.5 + 0.25$

PTS: 2 REF: 061714aii NAT: S.CP.B.7 TOP: Theoretical Probability

31 ANS:
$P(S \cap M) = P(S) + P(M) - P(S \cup M) = \dfrac{649}{1376} + \dfrac{433}{1376} - \dfrac{974}{1376} = \dfrac{108}{1376}$

PTS: 2 REF: 061629aii NAT: S.CP.B.7 TOP: Theoretical Probability

32 ANS: 1
The probability of rain equals the probability of rain, given that Sean pitches.

PTS: 2 REF: 061611aii NAT: S.CP.A.3 TOP: Conditional Probability

33 ANS: 1
$\dfrac{157}{25 + 47 + 157}$

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

34 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.

PTS: 2 REF: fall1508aii NAT: S.CP.A.4 TOP: Conditional Probability

35 ANS:

No, because $P(M / R) \neq P(M)$

$$\frac{70}{180} \neq \frac{230}{490}$$

$$0.38 \neq 0.47$$

PTS: 2 REF: 011731aii NAT: S.CP.A.4 TOP: Conditional Probability

36 ANS:

A student is more likely to jog if both siblings jog. 1 jogs: $\dfrac{416}{2239} \approx 0.19$. both jog: $\dfrac{400}{1780} \approx 0.22$

PTS: 2 REF: 061732aii NAT: S.CP.A.4 TOP: Conditional Probability

37 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.

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

38 ANS:

$P(W / D) = \dfrac{P(W \wedge D)}{P(D)} = \dfrac{.4}{.5} \approx .8$

PTS: 2 REF: 081726aii NAT: S.CP.B.6 TOP: Conditional Probability

39 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) $\dfrac{B(73) - B(60)}{73 - 60} \approx 46\%$

PTS: 2 REF: 011721aii NAT: F.IF.B.6 TOP: Rate of Change
KEY: AII

40 ANS:

$\dfrac{f(4) - f(-2)}{4 - -2} = \dfrac{80 - 1.25}{6} = 13.125$ $g(x)$ has a greater rate of change

$\dfrac{g(4) - g(-2)}{4 - -2} = \dfrac{179 - -49}{6} = 38$

PTS: 4 REF: 061636aii NAT: F.IF.B.6 TOP: Rate of Change
KEY: AII

41 ANS:

$\frac{156.25-56.25}{70-50}=\frac{150}{20}=7.5$ Between 50-70 mph, each additional mph in speed requires 7.5 more feet to stop.

PTS: 2 REF: 081631aii NAT: F.IF.B.6 TOP: Rate of Change
KEY: AII

42 ANS: 1

(1) $\frac{9-0}{2-1}=9$ (2) $\frac{17-0}{3.5-1}=6.8$ (3) $\frac{0-0}{5-1}=0$ (4) $\frac{17--5}{3.5-1}\approx 6.3$

PTS: 2 REF: 011724aii NAT: F.IF.B.6 TOP: Rate of Change
KEY: AII

43 ANS: 3

$$\frac{f(7)-f(-7)}{7--7}=\frac{=2^{-0.25(7)}\bullet\sin\left(\frac{\pi}{2}(7)\right)-2^{-0.25(-7)}\bullet\sin\left(\frac{\pi}{2}(-7)\right)}{14}\approx -0.26$$

PTS: 2 REF: 061721aii NAT: F.IF.B.6 TOP: Rate of Change
KEY: AII

44 ANS: 3

$$\log_{0.8}\left(\frac{V}{1700}\right)=t \qquad \frac{17,000(0.8)^3-17,000(0.8)^1}{3-1}\approx -2450$$

$$0.8^t=\frac{V}{17000}$$

$$V=17000(0.8)^t$$

PTS: 2 REF: 081709aii NAT: F.IF.B.6 TOP: Rate of Change
KEY: AII

45 ANS: 4

$$4x^2=-98$$

$$x^2=-\frac{98}{4}$$

$$x^2=-\frac{49}{2}$$

$$x=\pm\sqrt{-\frac{49}{2}}=\pm\frac{7i}{\sqrt{2}}\cdot\frac{\sqrt{2}}{\sqrt{2}}=\pm\frac{7i\sqrt{2}}{2}$$

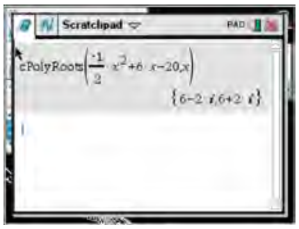
PTS: 2 REF: 061707aii NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | taking square roots

46 ANS: 3

$$x^2+2x+1=-5+1$$
$$(x+1)^2=-4$$
$$x+1=\pm 2i$$
$$x=-1\pm 2i$$

PTS: 2 REF: 081703aii NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | completing the square

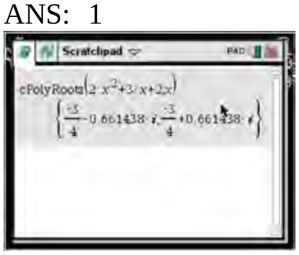
47 ANS: 3



$$-2\left(-\frac{1}{2}x^2=-6x+20\right)$$
$$x^2-12x=-40$$
$$x^2-12x+36=-40+36$$
$$(x-6)^2=-4$$
$$x-6=\pm 2i$$
$$x=6\pm 2i$$

PTS: 2 REF: fall1504aii NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | completing the square

48 ANS: 1



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

PTS: 2 REF: 061612aii NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

49 ANS: 4

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

PTS: 2 REF: 011711aii NAT: A.REI.B.4 TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

50 ANS: 4
If $1-i$ is one solution, the other is $1+i$.

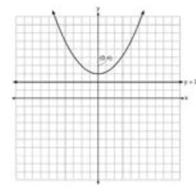
$$(x-(1-i))(x-(1+i))=0$$
$$x^2-x-ix-x+ix+(1-i^2)=0$$
$$x^2-2x+2=0$$

PTS: 2 REF: 081601aii NAT: A.REI.B.4 TOP: Complex Conjugate Root Theorem

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

PTS: 2 REF: 081619aii NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

52 ANS: 4

A parabola with a focus of $(0,4)$ and a directrix of $y=2$ is sketched as follows:  By inspection, it is determined that the vertex of the parabola is $(0,3)$. It is also evident that the distance, p, between the vertex and the focus is 1. It is possible to use the formula $(x-h)^2=4p(y-k)$ to derive the equation of the parabola as follows: $(x-0)^2=4(1)(y-3)$

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

or A point (x,y) on the parabola must be the same distance from the focus as it is from the directrix. For any such point (x,y), the distance to the focus is $\sqrt{(x-0)^2+(y-4)^2}$ and the distance to the directrix is $y-2$. Setting this equal leads to: $x^2+y^2-8y+16=y^2-4y+4$

$$x^2+16=4y+4$$
$$\frac{x^2}{4}+3=y$$

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

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

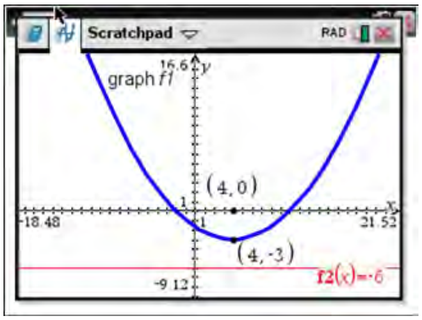
PTS: 2 REF: 061717aii NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

54 ANS: 2
The vertex of the parabola is $(0,0)$. The distance, p, between the vertex and the focus or the vertex and the directrix is 1. $y = \frac{-1}{4p}(x-h)^2 + k$

$$y = \frac{-1}{4(1)}(x-0)^2 + 0$$

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

PTS: 2 REF: 081706aii NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

55 ANS:


The vertex of the parabola is $(4,-3)$. The x-coordinate of the focus and the vertex is the same. Since the distance from the vertex to the directrix is 3, the distance from the vertex to the focus is 3, so the y-coordinate of the focus is 0. The coordinates of the focus are $(4,0)$.

PTS: 2 REF: 061630aii NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

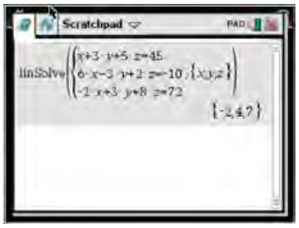
56 ANS: 2
Combining (1) and (3): $-6c = -18$, $c = 3$

Combining (1) and (2): $5a + 3c = -1$, $5a + 3(3) = -1$, $5a = -10$, $a = -2$

Using (3): $-(-2) - 5b - 5(3) = 2$, $2 - 5b - 15 = 2$, $b = -3$

PTS: 2 REF: 081623aii NAT: A.REI.C.6 TOP: Solving Linear Systems
KEY: three variables

57 ANS:



$$\begin{array}{cccc}
6x-3y+2z=-10 & x+3y+5z=45 & 4x+10z=62 & 4x+4(7)=20 \\
-2x+3y+8z=72 & 6x-3y+2z=-10 & 4x+4z=20 & 4x=-8 \\
4x+10z=62 & 7x+7z=35 & 6z=42 & x=-2 \\
 & 4x+4z=20 & z=7 &
\end{array}$$

$$\begin{aligned}
6(-2)-3y+2(7)&=-10 \\
-3y&=-12 \\
y&=4
\end{aligned}$$

PTS: 4 REF: spr1510aii NAT: A.REI.C.6 TOP: Solving Linear Systems
KEY: three variables

58 ANS:

$$\begin{array}{ccccc}
x+y+z=1 & 2x+2y+2z=2 & -2z-z=3 & y-(-1)=3 & x+2-1=1 \\
\underline{-x+3y-5z=11} & \underline{2x+4y+6z=2} & -3z=3 & y=2 & x=0 \\
4y-4z=12 & 2y+4z=0 & z=-1 & & \\
y-z=3 & y+2z=0 & & & \\
 & y=-2z & & &
\end{array}$$

PTS: 4 REF: 061733aii NAT: A.REI.C.6 TOP: Solving Linear Systems
KEY: three variables

59 ANS: 4

$$y=g(x)=(x-2)^2 \qquad \begin{aligned}
(x-2)^2&=3x-2 \\
x^2-4x+4&=3x-2 \\
x^2-7x+6&=0 \\
(x-6)(x-1)&=0 \\
x&=6,1
\end{aligned} \qquad \begin{aligned}
y&=3(6)-2=16 \\
y&=3(1)-2=1
\end{aligned}$$

PTS: 2 REF: 011705aii NAT: A.REI.C.7 TOP: Quadratic-Linear Systems
KEY: AII

60 ANS: 1

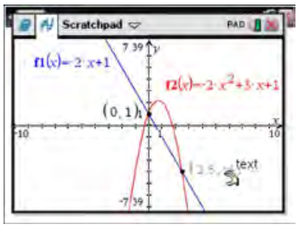
$$(x+3)^2+(2x-4)^2=8 \qquad b^2-4ac$$

$$x^2+6x+9+4x^2-16x+16=8 \qquad 100-4(5)(17)<0$$

$$5x^2-10x+17=0$$

PTS: 2 REF: 081719aii NAT: A.REI.C.7 TOP: Quadratic-Linear Systems
KEY: AII

61 ANS:



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

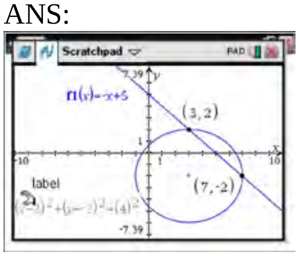
$$2x^2-5x=0$$

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

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

PTS: 2 REF: fall1507aii NAT: A.REI.C.7 TOP: Quadratic-Linear Systems
KEY: AII

62 ANS:



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

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

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

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

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

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

$$x=7,3$$

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

63 ANS: 3

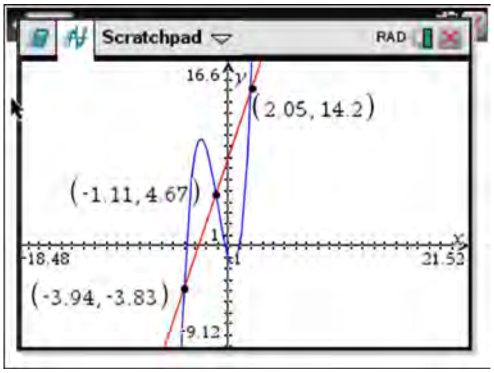
$$-33t^2 + 360t = 700 + 5t$$

$$-33t^2 + 355t - 700 = 0$$

$$t = \frac{-355 \pm \sqrt{355^2 - 4(-33)(-700)}}{2(-33)} \approx 3,8$$

PTS: 2 REF: 081606aii NAT: A.REI.D.11 TOP: Quadratic-Linear Systems
KEY: AII

64 ANS: 4

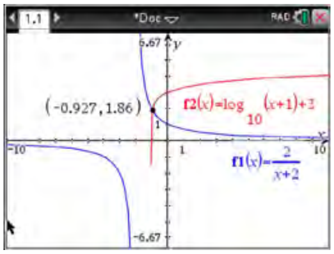


PTS: 2 REF: 061622aii NAT: A.REI.D.11 TOP: Other Systems
KEY: AII

65 ANS: 2

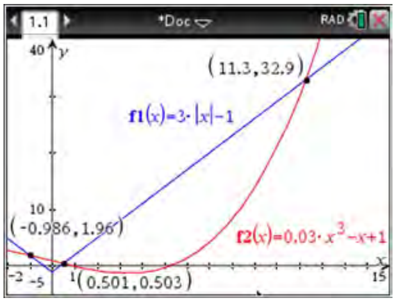
PTS: 2 REF: 081603aii NAT: A.REI.D.11 TOP: Other Systems
KEY: AII

66 ANS: 2



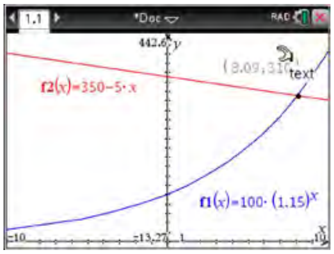
PTS: 2 REF: 011712aii NAT: A.REI.D.11 TOP: Other Systems
KEY: AII

67 ANS: 2



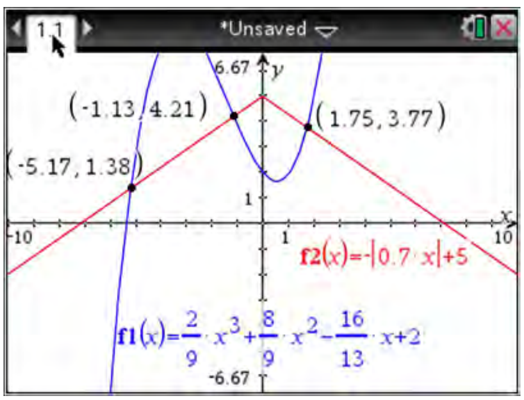
PTS: 2 REF: 061705aii NAT: A.REI.D.11 TOP: Other Systems
KEY: AII

68 ANS: 2



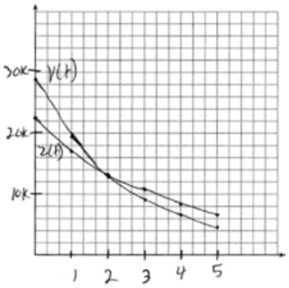
PTS: 2 REF: 011716aii NAT: A.REI.D.11 TOP: Other Systems
KEY: AII

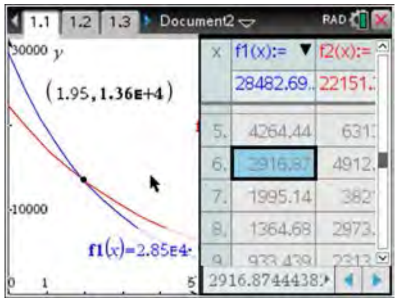
69 ANS:



PTS: 2 REF: fall1510aii NAT: A.REI.D.11 TOP: Other Systems
KEY: AII

70 ANS:

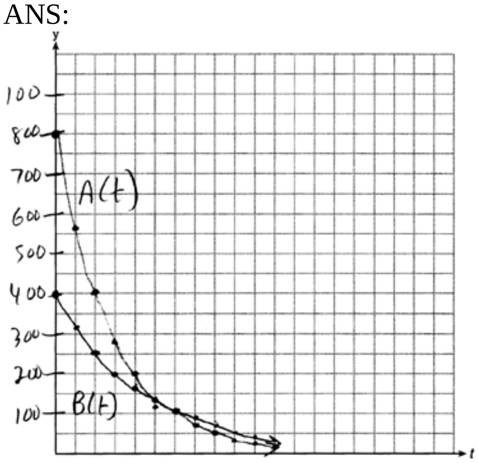




At 1.95 years, the value of the car equals the loan balance. Zach can cancel the policy after 6 years.

PTS: 4 REF: 081737aii NAT: A.REI.D.11 TOP: Other Systems
KEY: AII

71 ANS:

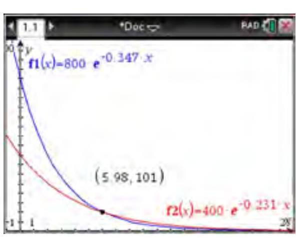


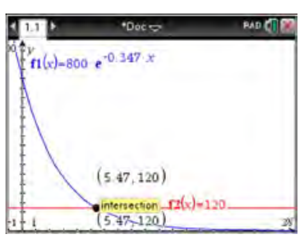
$A(t) = 800e^{-0.347t}$

$B(t) = 400e^{-0.231t}$

$$800e^{-0.347t} = 400e^{-0.231t}$$
$$\ln 2e^{-0.347t} = \ln e^{-0.231t}$$
$$\ln 2 + \ln e^{-0.347t} = \ln e^{-0.231t}$$
$$\ln 2 - 0.347t = -0.231t$$
$$\ln 2 = 0.116t$$
$$6 \approx t$$

$$0.15 = e^{-0.347t}$$
$$\ln 0.15 = \ln e^{-0.347t}$$
$$\ln 0.15 = -0.347t \cdot \ln e$$
$$5.5 \approx t$$





PTS: 6 REF: 061637aii NAT: A.REI.D.11 TOP: Other Systems
KEY: AII

72 ANS: 2

$B(t)=750\left(1.16^{\frac{1}{12}}\right)^{12t}\approx 750(1.012)^{12t}$ $B(t)=750\left(1+\frac{0.16}{12}\right)^{12t}$ is wrong, because the growth is an annual rate that is not compounded monthly.

PTS: 2 REF: spr1504aii NAT: A.SSE.B.3 TOP: Modeling Exponential Functions
KEY: AII

73 ANS: 3

$0.75^{\frac{1}{10}}\approx .9716$

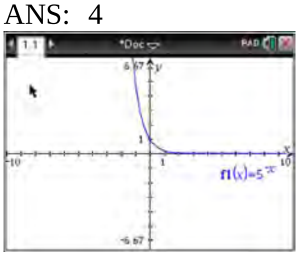
PTS: 2 REF: 061713aii NAT: A.SSE.B.3 TOP: Modeling Exponential Functions
KEY: AII

74 ANS: 3

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

PTS: 2 REF: 081710aii NAT: A.SSE.B.3 TOP: Modeling Exponential Functions
KEY: AII

75 ANS: 4



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

PTS: 2 REF: 061615aii NAT: F.IF.C.8 TOP: Modeling Exponential Functions

76 ANS:

$\frac{\left(\ln\frac{1}{2}\right)}{1590}$ is negative, so $M(t)$ represents decay.

PTS: 2 REF: 011728aii NAT: F.IF.C.8 TOP: Modeling Exponential Functions

77 ANS: 3

$1.0525^{\frac{1}{12}}\approx 1.00427$

PTS: 2 REF: 061621aii NAT: F.BF.A.1 TOP: Modeling Exponential Functions
KEY: AII

78 ANS: 4 PTS: 2 REF: 081622aii NAT: F.BF.A.1
TOP: Modeling Exponential Functions KEY: AII

79 ANS: 1

$$\frac{A}{P} = e^{rt}$$

$$0.42 = e^{rt}$$

$$\ln 0.42 = \ln e^{rt}$$

$$-0.87 \approx rt$$

PTS: 2 REF: 011723aii NAT: F.BF.A.1 TOP: Modeling Exponential Functions
KEY: AII

80 ANS: 1

$$P(28) = 5(2)^{\frac{98}{28}} \approx 56$$

PTS: 2 REF: 011702aii NAT: F.LE.A.2 TOP: Modeling Exponential Functions
KEY: AII

81 ANS:

$A(t) = 100(0.5)^{\frac{t}{63}}$, where t is time in years, and $A(t)$ is the amount of titanium-44 left after t years.
$\frac{A(10) - A(0)}{10 - 0} = \frac{89.58132 - 100}{10} = -1.041868$ The estimated mass at $t = 40$ is $100 - 40(-1.041868) \approx 58.3$. The actual mass is $A(40) = 100(0.5)^{\frac{40}{63}} \approx 64.3976$. The estimated mass is less than the actual mass.

PTS: 6 REF: fall1517aii NAT: F.LE.A.2 TOP: Modeling Exponential Functions
KEY: AII

82 ANS: 1
The car lost approximately 19% of its value each year.

PTS: 2 REF: 081613aii NAT: F.LE.B.5 TOP: Modeling Exponential Functions

83 ANS: 2
The 2010 population is 110 million.

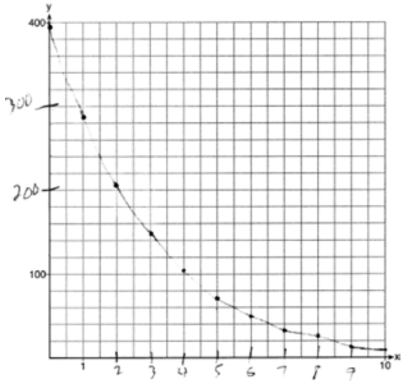
PTS: 2 REF: 061718aii NAT: F.LE.B.5 TOP: Modeling Exponential Functions

84 ANS: 3

$$d = 10\log\frac{6.3 \times 10^{-3}}{1.0 \times 10^{-12}} \approx 98$$

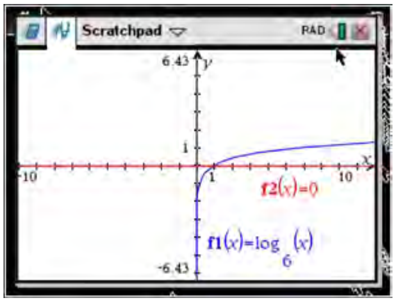
PTS: 2 REF: 011715aii NAT: F.IF.B.4 TOP: Evaluating Logarithmic Expressions

85 ANS:



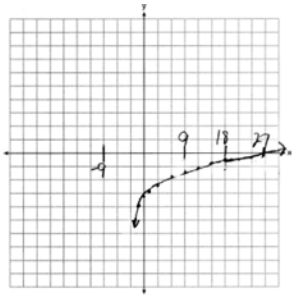
PTS: 2 REF: 061729aii NAT: F.IF.C.7 TOP: Graphing Exponential Functions
KEY: AII

86 ANS: 1



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

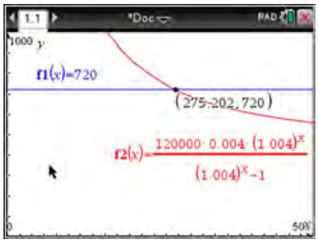
87 ANS:



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

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

88 ANS:



$$720 = \frac{120000\left(\frac{.048}{12}\right)\left(1+\frac{.048}{12}\right)^n}{\left(1+\frac{.048}{12}\right)^n - 1} \quad \frac{275.2}{12} \approx 23 \text{ years}$$

$$720(1.004)^n - 720 = 480(1.004)^n$$

$$240(1.004)^n = 720$$

$$1.004^n = 3$$

$$n \log 1.004 = \log 3$$

$$n \approx 275.2 \text{ months}$$

PTS: 4 REF: spr1509aii NAT: A.CED.A.1 TOP: Exponential Growth

89 ANS:

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

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

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

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

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

$$n \approx 15.2$$

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

90 ANS: 1

$$8(2^{x+3}) = 48$$

$$2^{x+3} = 6$$

$$(x+3)\ln 2 = \ln 6$$

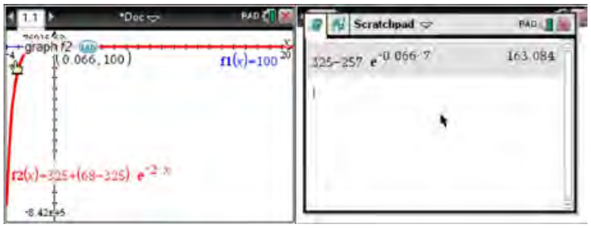
$$x+3 = \frac{\ln 6}{\ln 2}$$

$$x = \frac{\ln 6}{\ln 2} - 3$$

PTS: 2 REF: 061702aii NAT: F.LE.A.4 TOP: Exponential Equations

KEY: without common base

91 ANS:



$$100 = 325 + (68 - 325)e^{-2k}$$
$$-225 = -257e^{-2k}$$
$$k = \frac{\ln\left(\frac{-225}{-257}\right)}{-2}$$
$$k \approx 0.066$$

$$T = 325 - 257e^{-0.066t}$$
$$T = 325 - 257e^{-0.066(7)} \approx 163$$

PTS: 4 REF: fall1513aii NAT: F.LE.A.4 TOP: Exponential Growth

92 ANS:

$$A = Pe^{rt}$$
$$135000 = 100000e^{5r}$$
$$1.35 = e^{5r}$$
$$\ln 1.35 = \ln e^{5r}$$
$$\ln 1.35 = 5r$$
$$.06 \approx r \text{ or } 6\%$$

PTS: 2 REF: 061632aii NAT: F.LE.A.4 TOP: Exponential Growth

93 ANS:

$$8.75 = 1.25x^{49} \qquad 4$$
$$7 = x^{49}$$
$$x = \sqrt[49]{7} \approx 1.04$$

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

94 ANS:

$$7 = 20(0.5)^{\frac{t}{8.02}}$$

$$\log 0.35 = \log 0.5^{\frac{t}{8.02}}$$

$$\log 0.35 = \frac{t \log 0.5}{8.02}$$

$$\frac{8.02 \log 0.35}{\log 0.5} = t$$

$$t \approx 12$$

PTS: 4 REF: 081634aii NAT: F.LE.A.4 TOP: Exponential Decay

95 ANS:

$$100 = 140\left(\frac{1}{2}\right)^{\frac{5}{h}} \quad \log \frac{100}{140} = \log\left(\frac{1}{2}\right)^{\frac{5}{h}}$$

$$\log \frac{5}{7} = \frac{5}{h} \log \frac{1}{2}$$

$$h = \frac{5 \log \frac{1}{2}}{\log \frac{5}{7}} \approx 10.3002$$

$$40 = 140\left(\frac{1}{2}\right)^{\frac{t}{10.3002}}$$

$$\log \frac{2}{7} = \log\left(\frac{1}{2}\right)^{\frac{t}{10.3002}}$$

$$\log \frac{2}{7} = \frac{t \log\left(\frac{1}{2}\right)}{10.3002}$$

$$t = \frac{10.3002 \log \frac{2}{7}}{\log \frac{1}{2}} \approx 18.6$$

PTS: 6 REF: 061737aii NAT: F.LE.A.4 TOP: Exponential Decay

96 ANS: 4

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

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

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

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

PTS: 2 REF: fall1505aii NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

97 ANS: 3

$$(m-2)^2(m+3) = (m^2 - 4m + 4)(m+3) = m^3 + 3m^2 - 4m^2 - 12m + 4m + 12 = m^3 - m^2 - 8m + 12$$

PTS: 2 REF: 081605aii NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

98 ANS: 3

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

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

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

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

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

PTS: 2 REF: 081615aii NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

99 ANS: 4

$m^5+m^3-6m=m(m^4+m^2-6)=m(m^2+3)(m^2-2)$

PTS: 2 REF: 011703aii NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: higher power AII

100 ANS: 1

1) let $y=x+2$, then y^2+2y-8

$(y+4)(y-2)$

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

$(x+6)x$

PTS: 2 REF: 081715aii NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: multivariable

101 ANS:

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

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

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

PTS: 2 REF: fall1512aii NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: a>1

102 ANS:

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

PTS: 2 REF: 061727aii NAT: A.SSE.A.2 TOP: Factoring Polynomials
KEY: factoring by grouping

103 ANS: 1

The zeros of the polynomial are at $-b$, and c. The sketch of a polynomial of degree 3 with a negative leading coefficient should have end behavior showing as x goes to negative infinity, $f(x)$ goes to positive infinity. The multiplicities of the roots are correctly represented in the graph.

PTS: 2 REF: spr1501aii NAT: A.APR.B.3 TOP: Zeros of Polynomials
KEY: AII

104 ANS: 3
The graph shows three real zeros, and has end behavior matching the given end behavior.

PTS: 2 REF: 061604aii NAT: A.APR.B.3 TOP: Zeros of Polynomials
KEY: AII

105 ANS: 1 PTS: 2 REF: 061701aii NAT: A.APR.B.3
TOP: Zeros of Polynomials KEY: AII

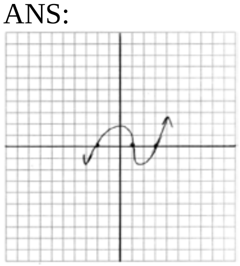
106 ANS: 4 PTS: 2 REF: 081708aii NAT: A.APR.B.3
TOP: Zeros of Polynomials KEY: AII

107 ANS: 1

$$x^4-4x^3-9x^2+36x=0$$
$$x^3(x-4)-9x(x-4)=0$$
$$(x^3-9x)(x-4)=0$$
$$x(x^2-9)(x-4)=0$$
$$x(x+3)(x-3)(x-4)=0$$
$$x=0,\pm3,4$$

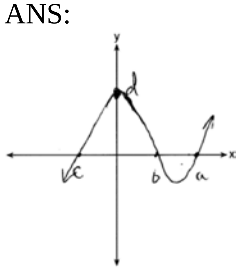
PTS: 2 REF: 061606aii NAT: A.APR.B.3 TOP: Zeros of Polynomials
KEY: AII

108 ANS:



PTS: 2 REF: 011729aii NAT: A.APR.B.3 TOP: Zeros of Polynomials

109 ANS:



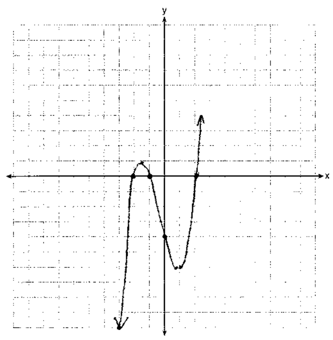
PTS: 2 REF: 081732aii NAT: A.APR.B.3 TOP: Zeros of Polynomials
KEY: AII

110 ANS: 2 PTS: 2 REF: 061620aii NAT: F.IF.B.4
TOP: Graphing Polynomial Functions

111 ANS: 4
The maximum volume of $p(x) = -(x+2)(x-10)(x-14)$ is about 56, at $x = 12.1$

PTS: 2 REF: 081712aii NAT: F.IF.B.4 TOP: Graphing Polynomial Functions

112 ANS:



$0 = x^2(x+1) - 4(x+1)$

$0 = (x^2 - 4)(x+1)$

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

$x = -2, -1, 2$

PTS: 4 REF: 081633aii NAT: F.IF.C.7 TOP: Graphing Polynomial Functions

113 ANS: 3
Since $x+4$ is a factor of $p(x)$, there is no remainder.

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

114 ANS: 2 PTS: 2 REF: 011720aii NAT: A.APR.B.2
TOP: Remainder Theorem

115 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.

PTS: 2 REF: 061711aii NAT: A.APR.B.2 TOP: Remainder Theorem

116 ANS: 2

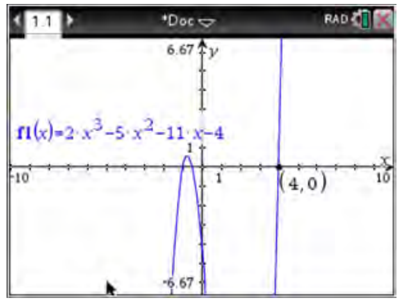
-4	1	-11	16	84
		-4	60	-304
	1	-15	76	

Since there is a remainder when the cubic is divided by $x+4$, this binomial is not a factor.

PTS: 2 REF: 081720aii NAT: A.APR.B.2 TOP: Remainder Theorem

117 ANS:

$f(4) = 2(4)^3 - 5(4)^2 - 11(4) - 4 = 128 - 80 - 44 - 4 = 0$ Any method that demonstrates 4 is a zero of $f(x)$ confirms that $x - 4$ is a factor, as suggested by the Remainder Theorem.



PTS: 2 REF: spr1507aii NAT: A.APR.B.2 TOP: Remainder Theorem

118 ANS:

$0 = 6(-5)^3 + b(-5)^2 - 52(-5) + 15$ $z(x) = 6x^3 + 19x^2 - 52x + 15$

$0 = -750 + 25b + 260 + 15$

$475 = 25b$

$19 = b$

-5	6	19	-52	15
		-30	55	15
	6	-11	3	0

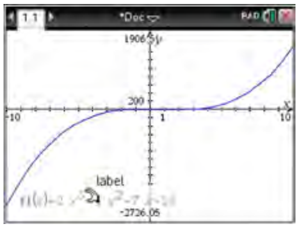
$6x^2 - 11x + 3 = 0$

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

$x = \frac{3}{2}, \frac{1}{3}, -5$

PTS: 4 REF: fall1515aii NAT: A.APR.B.2 TOP: Remainder Theorem

119 ANS:



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

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

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

120 ANS:

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

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

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

121 ANS: 4

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

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

122 ANS:

Let x equal the first integer and $x+1$ equal the next. $(x+1)^2-x^2=x^2+2x+1-x^2=2x+1$. $2x+1$ is an odd integer.

PTS: 2 REF: fall1511aii NAT: A.APR.C.4 TOP: Polynomial Identities

123 ANS:

$$\frac{x^3+9}{x^3+8}=\frac{x^3+8}{x^3+8}+\frac{1}{x^3+8}$$

$$\frac{x^3+9}{x^3+8}=\frac{x^3+9}{x^3+8}$$

PTS: 2 REF: 061631aii NAT: A.APR.C.4 TOP: Polynomial Identities

124 ANS:

$$2x^3 - 10x^2 + 11x - 7 = 2x^3 + hx^2 + 3x - 8x^2 - 4hx - 12 + k \quad h = -2$$
$$-2x^2 + 8x + 5 = hx^2 - 4hx + k \quad k = 5$$

PTS: 4 REF: 011733aii NAT: A.APR.C.4 TOP: Polynomial Identities

125 ANS:

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

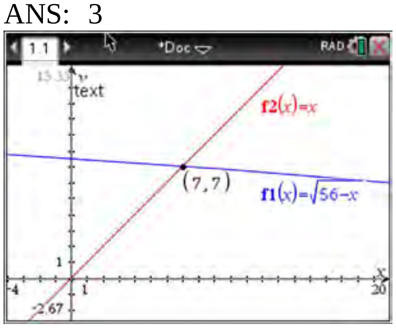
PTS: 2 REF: 081727aii NAT: A.APR.C.4 TOP: Polynomial Identities

126 ANS:

$$\sqrt[3]{x} \bullet \sqrt{x} = x^{\frac{1}{3}} \bullet x^{\frac{1}{2}} = x^{\frac{3}{6}} \bullet x^{\frac{3}{6}} = x^{\frac{5}{6}}$$

PTS: 2 REF: 061731aii NAT: N.RN.A.2 TOP: Operations with Radicals
KEY: with variables, index > 2

127 ANS: 3



$$\sqrt{56 - x} = x$$
$$56 - x = x^2$$
$$0 = x^2 + x - 56$$
$$0 = (x + 8)(x - 7)$$
$$x = 7$$

-8 is extraneous.

PTS: 2 REF: 061605aii NAT: A.REI.A.2 TOP: Solving Radicals
KEY: extraneous solutions

128 ANS: 2

$$\sqrt{x+14} = \sqrt{2x+5}+1 \qquad \sqrt{22+14} - \sqrt{2(22)+5} = 1$$

$$x+14 = 2x+5+2\sqrt{2x+5}+1 \qquad 6-7 \neq 1$$

$$-x+8 = 2\sqrt{2x+5}$$

$$x^2 - 16x + 64 = 8x + 20$$

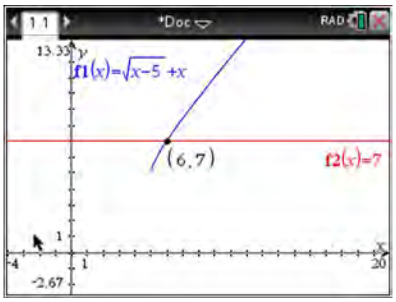
$$x^2 - 24x + 44 = 0$$

$$(x-22)(x-2) = 0$$

$$x = 2, 22$$

PTS: 2 REF: 081704aii NAT: A.REI.A.2 TOP: Solving Radicals
KEY: advanced

129 ANS:



$$\sqrt{x-5} = -x+7 \qquad \sqrt{x-5} = -9+7 = -2 \text{ is extraneous.}$$

$$x-5 = x^2 - 14x + 49$$

$$0 = x^2 - 15x + 54$$

$$0 = (x-6)(x-9)$$

$$x = 6, 9$$

PTS: 2 REF: spr1508aii NAT: A.REI.A.2 TOP: Solving Radicals
KEY: extraneous solutions

130 ANS:

$$\sqrt{x-4} = -x+6 \qquad \sqrt{x-4} = -8+6 = -2 \text{ is extraneous.}$$

$$x-4 = x^2 - 12x + 36$$

$$0 = x^2 - 13x + 40$$

$$0 = (x-8)(x-5)$$

$$x = 5, 8$$

PTS: 2 REF: 061730aii NAT: A.REI.A.2 TOP: Solving Radicals
KEY: extraneous solutions

131 ANS:

$\left(\sqrt{2x-7}\right)^2 = (5-x)^2$ $\quad$ $\sqrt{2(4)-7}+4=5$ $\quad$ $\sqrt{2(8)-7}+8=5$

$2x-7 = 25-10x+x^2$ $\quad$ $\sqrt{1}=1$ $\quad$ $\sqrt{9}\neq -3$

$0 = x^2-12x+32$

$0=(x-8)(x-4)$

$x = 4,8$

PTS: 4 REF: 081635aii NAT: A.REI.A.2 TOP: Solving Radicals
KEY: extraneous solutions

132 ANS:

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

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

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

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

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

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

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

PTS: 6 REF: 011737aii NAT: A.REI.A.2 TOP: Solving Radicals
KEY: context

133 ANS:

Applying the commutative property, $\left(3^{\frac{1}{5}}\right)^2$ can be rewritten as $\left(3^2\right)^{\frac{1}{5}}$ or $9^{\frac{1}{5}}$. A fractional exponent can be rewritten as a radical with the denominator as the index, or $9^{\frac{1}{5}}=\sqrt[5]{9}$.

PTS: 2 REF: 081626aii NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

134 ANS:

Rewrite $\frac{4}{3}$ as $\frac{1}{3}\cdot\frac{4}{1}$, using the power of a power rule.

PTS: 2 REF: 081725aii NAT: N.RN.A.1 TOP: Radicals and Rational Exponents

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

136 ANS: 2

$$\left(m^{\frac{5}{3}}\right)^{-\frac{1}{2}} = m^{-\frac{5}{6}} = \frac{1}{\sqrt[6]{m^5}}$$

PTS: 2 REF: 011707aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents
KEY: variables

137 ANS: 4

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

PTS: 2 REF: 081723aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents
KEY: variables

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

139 ANS:

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

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

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

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

140 ANS:

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

$$x^2 = y$$

PTS: 2 REF: 011730aii NAT: N.RN.A.2 TOP: Radicals and Rational Exponents
KEY: variables

141 ANS: 2

$(2 - yi)(2 - yi) = 4 - 4yi + y^2 i^2 = -y^2 - 4yi + 4$

PTS: 2 REF: 061603aii NAT: N.CN.A.2 TOP: Operations with Complex Numbers

142 ANS: 2
$6xi^3(-4xi+5) = -24x^2i^4 + 30xi^3 = -24x^2(1) + 30x(-1) = -24x^2 - 30xi$

PTS: 2 REF: 061704aii NAT: N.CN.A.2 TOP: Operations with Complex Numbers

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

PTS: 2 REF: 081702aii NAT: N.CN.A.2 TOP: Operations with Complex Numbers

144 ANS:
$(1-i)(1-i)(1-i) = (1-2i+i^2)(1-i) = -2i(1-i) = -2i + 2i^2 = -2-2i$

PTS: 2 REF: 011725aii NAT: N.CN.A.2 TOP: Operations with Complex Numbers

145 ANS:
$(4-3i)(5+2yi-5+2yi)$

$(4-3i)(4yi)$

$16yi - 12yi^2$

$12y + 16yi$

PTS: 2 REF: spr1506aii NAT: N.CN.A.2 TOP: Operations with Complex Numbers

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

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

147 ANS: 1
$x^2 + 2x - 8 = 0$

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

$x = -4, 2$

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

148 ANS: 4
$$\frac{-3x^2-5x+2}{x^3+2x^2} = \frac{(-3x+1)(x+2)}{x^2(x+2)} = \frac{-3x}{x^2} + \frac{1}{x^2} = -3x^{-1} + x^{-2}$$

PTS: 2 REF: 061723aii NAT: A.APR.D.6 TOP: Expressions with Negative Exponents
KEY: variables

149 ANS: 1

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

PTS: 2 REF: fall1503aii NAT: A.APR.D.6 TOP: Rational Expressions

150 ANS: 2

$$
\begin{array}{r}
2x^2-3x+7 \\
2x+3\overline{\big)4x^3+0x^2+5x+10} \\
\underline{4x^3+6x^2} \\
-6x^2+5x \\
\underline{-6x^2-9x} \\
14x+10 \\
\underline{14x+21} \\
-11
\end{array}
$$

PTS: 2 REF: 061614aii NAT: A.APR.D.6 TOP: Rational Expressions

151 ANS: 2

$$
\begin{array}{r}
x^2+0x+1 \\
x+2\overline{\big)x^3+2x^2+x+6} \\
\underline{x^3+2x^2} \\
0x^2+x \\
\underline{0x^2+0x} \\
x+6 \\
\underline{x+2} \\
4
\end{array}
$$

PTS: 2 REF: 081611aii NAT: A.APR.D.6 TOP: Rational Expressions

152 ANS: 1

$$\begin{array}{r} 2x^2+x+5 \\ 2x-1\overline{)4x^3+0x^2+9x-5} \\ \underline{4x^3-2x^2} \\ 2x^2+9x \\ \underline{2x^2-x} \\ 10x-5 \\ \underline{10x-5} \end{array}$$

PTS: 2 REF: 081713aii NAT: A.APR.D.6 TOP: Rational Expressions

153 ANS:

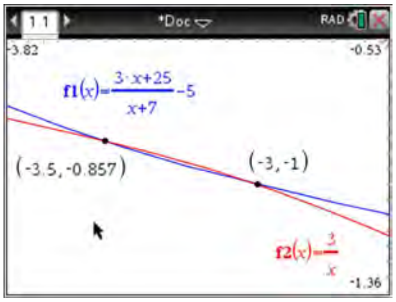
$$\begin{array}{r} 3x+13 \\ x-2\overline{)3x^2+7x-20} \\ \underline{3x^2-6x \quad\quad} \\ 13x-20 \\ \underline{13x-26} \\ 6 \end{array} \quad 3x+13+\frac{6}{x-2}$$

PTS: 2 REF: 011732aii NAT: A.APR.D.6 TOP: Rational Expressions

154 ANS: 3 PTS: 2 REF: 061602aii NAT: A.CED.A.1
TOP: Modeling Rationals

155 ANS: 3 PTS: 2 REF: 061722aii NAT: A.CED.A.1
TOP: Modeling Rationals

156 ANS: 4



$$x(x+7)\left[\frac{3x+25}{x+7}-5=\frac{3}{x}\right]$$

$$x(3x+25)-5x(x+7)=3(x+7)$$

$$3x^2+25x-5x^2-35x=3x+21$$

$$2x^2+13x+21=0$$

$$(2x+7)(x+3)=0$$

$$x=-\frac{7}{2},-3$$

PTS: 2 REF: fall1501aii NAT: A.REI.A.2 TOP: Solving Rationals
KEY: rational solutions

157 ANS: 1

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

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

$$3x=-3$$

$$x=-1$$

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

158 ANS: 1

$$\frac{2x}{x-2}\left(\frac{x}{x}\right)-\frac{11}{x}\left(\frac{x-2}{x-2}\right)=\frac{8}{x^2-2x}$$

$$2x^2-11x+22=8$$

$$2x^2-11x+14=0$$

$$(2x-7)(x-2)=0$$

$$x=\frac{7}{2},2$$

PTS: 2 REF: 061719aii NAT: A.REI.A.2 TOP: Solving Rationals

159 ANS: 3

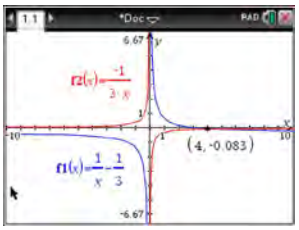
$$\frac{1}{J}=\frac{1}{F}-\frac{1}{W}$$

$$\frac{1}{J}=\frac{W-F}{FW}$$

$$J=\frac{FW}{W-F}$$

PTS: 2 REF: 081617aii NAT: A.REI.A.2 TOP: Solving Rationals
KEY: rational solutions

160 ANS:



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

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

$$3-x=-1$$

$$x=4$$

PTS: 2 REF: 061625aii NAT: A.REI.A.2 TOP: Solving Rationals
KEY: rational solutions

161 ANS:

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

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

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

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

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

$$p=-5,-1$$

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

162 ANS: 3

$f(x)=-f(x)$, so $f(x)$ is odd. $g(-x)\neq g(x)$, so $g(x)$ is not even. $g(-x)\neq -g(x)$, so $g(x)$ is not odd. $h(-x)=h(x)$, so $h(x)$ is even.

PTS: 2 REF: fall1502aii NAT: F.BF.B.3 TOP: Even and Odd Functions

163 ANS: 1
The graph of $y = \sin x$ is unchanged when rotated 180º about the origin.

PTS: 2 REF: 081614aii NAT: F.BF.B.3 TOP: Even and Odd Functions

164 ANS:
$j(-x) = (-x)^4 - 3(-x)^2 - 4 = x^2 - 3x^2 - 4$ Since $j(x) = j(-x)$, the function is even.

PTS: 2 REF: 081731aii NAT: F.BF.B.3 TOP: Even and Odd Functions

165 ANS: 4
$$\frac{m(c)}{g(c)} = \frac{c+1}{1-c^2} = \frac{c+1}{(1+c)(1-c)} = \frac{1}{1-c}$$

PTS: 2 REF: 061608aii NAT: F.BF.A.1 TOP: Operations with Functions

166 ANS: 3 PTS: 2 REF: 011710aii NAT: F.BF.A.1
TOP: Operations with Functions

167 ANS: 2
$$\begin{aligned} x(30-0.01x)-(0.15x^3+0.01x^2+2x+120) &= 30x-0.01x^2-0.15x^3-0.01x^2-2x-120 \\ &= -0.15x^3-0.02x^2+28x-120 \end{aligned}$$

PTS: 2 REF: 061709aii NAT: F.BF.A.1 TOP: Operations with Functions

168 ANS:
$0 = \log_{10}(x-4)$ The x-intercept of h is $(2,0)$. f has the larger value.

$$\begin{aligned} 10^0 &= x-4 \\ 1 &= x-4 \\ x &= 5 \end{aligned}$$

PTS: 2 REF: 081630aii NAT: F.IF.C.9 TOP: Comparing Functions
KEY: AII

169 ANS: 2
$h(x)$ does not have a y-intercept.

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

170 ANS: 2
$$\begin{aligned} x &= -\frac{3}{4}y+2 \\ -4x &= 3y-8 \\ -4x+8 &= 3y \\ -\frac{4}{3}x+\frac{8}{3} &= y \end{aligned}$$

PTS: 2 REF: 061616aii NAT: F.BF.B.4 TOP: Inverse of Functions
KEY: equations

171 ANS: 2

$$x = \frac{y+1}{y-2}$$
$$xy - 2x = y + 1$$
$$xy - y = 2x + 1$$
$$y(x-1) = 2x + 1$$
$$y = \frac{2x+1}{x-1}$$

PTS: 2 REF: 081714aii NAT: F.BF.B.4 TOP: Inverse of Functions
KEY: equations

172 ANS: 3 PTS: 2 REF: 011708aii NAT: F.BF.B.4
TOP: Inverse of Functions KEY: equations

173 ANS:

$$x = \left(y-3\right)^3 + 1$$
$$x - 1 = \left(y-3\right)^3$$
$$\sqrt[3]{x-1} = y - 3$$
$$\sqrt[3]{x-1} + 3 = y$$
$$f^{-1}(x) = \sqrt[3]{x-1} + 3$$

PTS: 2 REF: fall1509aii NAT: F.BF.B.4 TOP: Inverse of Functions
KEY: equations

174 ANS: 3 PTS: 2 REF: 081618aii NAT: F.LE.A.2
TOP: Sequences

175 ANS: 3 PTS: 2 REF: 061720aii NAT: F.LE.A.2
TOP: Sequences KEY: AII

176 ANS:

$a_1 = 4$ $a_8 = 639$

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

PTS: 2 REF: 081729aii NAT: F.LE.A.2 TOP: Sequences

177 ANS:

$\dfrac{6.25 - 2.25}{21 - 5} = \dfrac{4}{16} = \$.25$ fine per day. $2.25 - 5(.25) = \$1$ replacement fee. $a_n = 1.25 + (n-1)(.25)$. $a_{60} = \$16$

PTS: 4 REF: 081734aii NAT: F.LE.A.2 TOP: Sequences

178 ANS:
Jillian’s plan, because distance increases by one mile each week. $a_1 = 10$ $a_n = n + 12$

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

PTS: 4 REF: 011734aii NAT: F.LE.A.2 TOP: Sequences

179 ANS: 1

$d = 18;\ r = \pm\frac{5}{4}$

PTS: 2 REF: 011714aii NAT: F.IF.A.3 TOP: Sequences
KEY: term

180 ANS: 1
(2) is not recursive

PTS: 2 REF: 081608aii NAT: F.BF.A.2 TOP: Sequences

181 ANS: 4
The scenario represents a decreasing geometric sequence with a common ratio of 0.80.

PTS: 2 REF: 061610aii NAT: F.BF.A.2 TOP: Sequences

182 ANS: 3 PTS: 2 REF: 061623aii NAT: F.BF.A.2
TOP: Sequences

183 ANS: 4 PTS: 2 REF: 081624aii NAT: F.BF.A.2
TOP: Sequences

184 ANS: 3 PTS: 2 REF: 081724aii NAT: F.BF.A.2
TOP: Sequences

185 ANS:

$a_n = x^{n-1}(x+1)$ $x^{n-1} = 0$ $x + 1 = 0$

$x = 0$ $x = -1$

PTS: 4 REF: spr1511aii NAT: F.BF.A.2 TOP: Sequences

186 ANS: 1 PTS: 2 REF: 081609aii NAT: F.BF.B.6
TOP: Sigma Notation KEY: represent

187 ANS: 4

$d = 32(.8)^{b-1}$ $S_n = \dfrac{32 - 32(.8)^{12}}{1 - .8} \approx 149$

PTS: 2 REF: 081721aii NAT: A.SSE.B.4 TOP: Series

188 ANS: 2 PTS: 2 REF: 061724aii NAT: A.SSE.B.4
TOP: Series

189 ANS:

$S_n = \dfrac{33000 - 33000(1.04)^n}{1 - 1.04}$ $S_{15} = \dfrac{33000 - 33000(1.04)^{15}}{1 - 1.04} \approx 660778.39$

PTS: 4 REF: 061634aii NAT: A.SSE.B.4 TOP: Series

190 ANS:

$$20000 = PMT\left(\frac{1-(1+.00625)^{-60}}{0.00625}\right) \quad 21000 - x = 300\left(\frac{1-(1+.00625)^{-60}}{0.00625}\right)$$

$$PMT \approx 400.76 \qquad\qquad x \approx 6028$$

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

191 ANS:

$$M = 172600 \bullet \frac{0.00305(1+0.00305)^{12 \cdot 15}}{(1+0.00305)^{12 \cdot 15}-1} \approx 1247 \qquad 1100 = (172600 - x) \bullet \frac{0.00305(1+0.00305)^{12 \cdot 15}}{(1+0.00305)^{12 \cdot 15}-1}$$

$$1100 \approx (172600 - x) \bullet (0.007228)$$

$$152193 \approx 172600 - x$$

$$20407 \approx x$$

PTS: 4 REF: 061734aii NAT: A.SSE.B.4 TOP: Series

192 ANS: 1 PTS: 2 REF: 081616aii NAT: F.TF.A.1
TOP: Unit Circle

193 ANS:

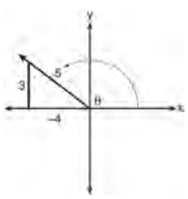
$\csc\theta = \frac{1}{\sin\theta}$, and $\sin\theta$ on a unit circle represents the y value of a point on the unit circle. Since $y = \sin\theta$, $\csc\theta = \frac{1}{y}$.

PTS: 2 REF: 011727aii NAT: F.TF.A.2 TOP: Reciprocal Trigonometric Relationships

194 ANS: 4 PTS: 2 REF: 081707aii NAT: F.TF.A.2
TOP: Reference Angles

195 ANS: 1

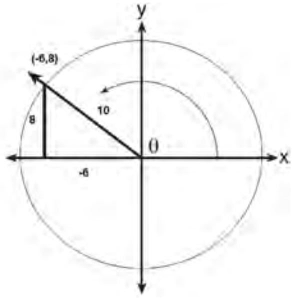
A reference triangle can be sketched using the coordinates $(-4,3)$ in the second quadrant to find the value of $\sin\theta$.



PTS: 2 REF: spr1503aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

196 ANS: 1

$\cos\theta = -\frac{6}{10} = -\frac{3}{5}$



PTS: 2 REF: 061617aii NAT: F.TF.A.2 TOP: Determining Trigonometric Functions
KEY: extension to reals

197 ANS: 2

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

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

198 ANS:

$$\sin^2\theta + (-0.7)^2 = 1$$
$$\sin^2\theta = .51$$
$$\sin\theta = \pm\sqrt{.51}$$

Since θ is in Quadrant II, $\sin\theta = \sqrt{.51}$ and $\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{\sqrt{.51}}{-0.7} \approx -1.02$

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

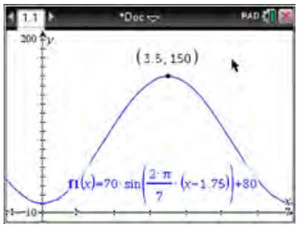
199 ANS: 1 PTS: 2 REF: 011704aii NAT: F.TF.C.8
TOP: Simplifying Trigonometric Expressions

200 ANS: 4

$$\text{period} = \frac{2\pi}{B}$$
$$\frac{1}{60} = \frac{2\pi}{B}$$
$$B = 120\pi$$

PTS: 2 REF: 061624aii NAT: F.TF.B.5 TOP: Modeling Trigonometric Functions

201 ANS: 3



$H(t)$ is at a minimum at $70(-1)+80=10$

PTS: 2 REF: 061613aii NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions
KEY: maximum/minimum

202 ANS: 2 PTS: 2 REF: 081610aii NAT: F.IF.B.4
TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

203 ANS: 3 PTS: 2 REF: 081705aii NAT: F.IF.B.4
TOP: Graphing Trigonometric Functions KEY: increasing/decreasing

204 ANS: 2 PTS: 2 REF: 011701aii NAT: F.IF.B.4
TOP: Graphing Trigonometric Functions

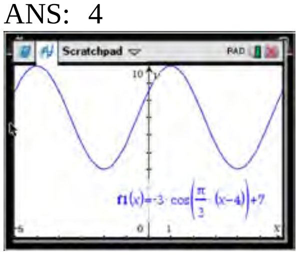
205 ANS: 4 PTS: 2 REF: 061706aii NAT: F.IF.B.4
TOP: Graphing Trigonometric Functions

206 ANS: 4

	Bar Harbor	**Phoenix**
Minimum	31.386	66.491
Midline	55.3	86.729
Maximum	79.214	106.967
Range	47.828	40.476

PTS: 2 REF: 061715aii NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions
KEY: maximum/minimum

207 ANS: 4



As the range is [4,10], the midline is $y=\frac{4+10}{2}=7$.

PTS: 2 REF: fall1506aii NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: mixed

208 ANS: 4 PTS: 2 REF: 081718aii NAT: F.IF.C.7
TOP: Graphing Trigonometric Functions KEY: amplitude

209 ANS: 3
(3) repeats 3 times over 2π.

PTS: 2 REF: 011722aii NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: recognize

210 ANS: 1 PTS: 2 REF: 061708aii NAT: F.IF.C.7
TOP: Graphing Trigonometric Functions KEY: identify

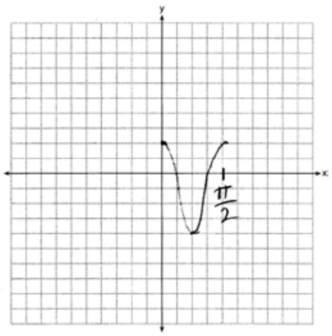
211 ANS:
Amplitude, because the height of the graph shows the volume of the air.

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

212 ANS:
period is $\frac{2}{3}$. The wheel rotates once every $\frac{2}{3}$ second.

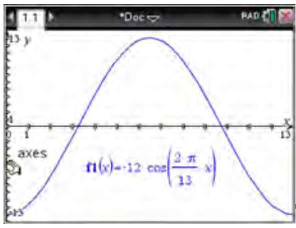
PTS: 2 REF: 061728aii NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: period

213 ANS:



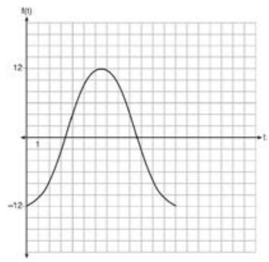
PTS: 2 REF: 061628aii NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: graph

214 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 $B = \dfrac{2\pi}{13}$.

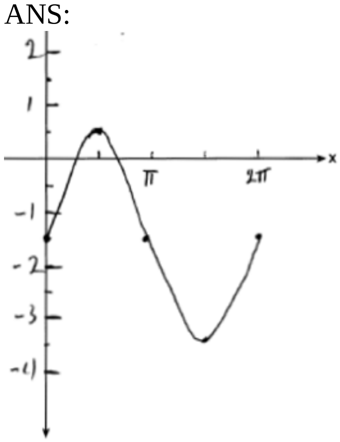
$f(t) = -12\cos\left(\dfrac{2\pi}{13}t\right)$



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

PTS: 6 REF: spr1514aii NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: graph

215 ANS:



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

PTS: 4 REF: 081735aii NAT: F.IF.C.7 TOP: Graphing Trigonometric Functions
KEY: graph

216 ANS: 4

$$4(x^2 - 6x + 9) + 4(y^2 + 18y + 81) = 76 + 36 + 324$$

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

PTS: 2 REF: 061619aii NAT: G.GPE.A.1 TOP: Equations of Circles
KEY: completing the square