3

1.

Which of the following expressions is equal to 0 for some value of x?

A) $|x-2|+1$
B) $|x-2|-2$
C) $|x+2|+1$
D) $|x-2|+2$

2.

$$\frac{3x}{2y} = 6$$
$$2(y+4) = 16$$

If (x,y) is the solution to the system of equations above, what is the value of y?

A) 2
B) 4
C) 19
D) 75

3.

$$f(x) = \frac{2}{3}x + b$$

In the function above, b is a constant. If $f(3) = 7$, what is the value of $f(-1)$?

A) -5
B) $-\frac{8}{3}$
C) $\frac{13}{3}$
D) 7

4.

If $f(x) = -2x + 9$, what is $f(-5x)$ equal to?

A) $10x + 9$
B) $-10x + 9$
C) $20x - 9$
D) $20x + 9$

5.

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

Which of the following is equivalent to the expression above?

A) $43x$
B) $24x^2 + 3$
C) $16x^2 + 20x + 1$
D) $12x^2 + 20x + 8$

6.

If $\frac{a-b}{b} = \frac{5}{8}$, which of the following must also be true?

A) $\frac{a}{b} = \frac{21}{8}$
B) $\frac{a}{b} = \frac{14}{8}$
C) $\frac{a+b}{b} = \frac{21}{8}$
D) $\frac{a-b}{b} = -\frac{1}{8}$

7.

To prepare for a marathon, Lisa created a training schedule in which the distance of her longest run every week increased by a constant amount. If Lisa's training schedule requires that her longest run in week 3 is a distance of 9 miles and her longest run in week 15 is a distance of 27 miles, which of the following best describes how the distance Amelia runs changes between week 3 and week 15 of her training schedule?

Lisa increases the distance of her longest run by 1.5 miles each week.

A) Lisa increases the distance of her longest run by 3 miles each week.
B) Lisa decreases the distance of her longest run by 1.5 miles a week.
C) Lisa increases the distance of her longest run by 3 miles every 2 weeks.
D) Lisa increases the distance of her longest mile by 1.8 miles each week.

3

8.

Which of the following equations represents a line that is parallel to the line with equation $y = -6x + 5$?

A) $6x + 2y = 8$
B) $18x + 3y = 4$
C) $3x - y = 10$
D) $x + 12y = 0$

9.

$\sqrt{x - a} = \frac{1}{2}x - 6$

If $a = 4$, what is the solution set of the equation above?

A) {20}
B) {8,20}
C) {8}
D) {0}

10.

If $\frac{t+7}{t-7} = 14$, what is the value of t?

A) $\frac{105}{13}$
B) $\frac{13}{105}$
C) $\frac{7}{2}$
D) $\frac{100}{15}$

11.

$x = 2y + 3$

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

How many ordered pairs (x, y) satisfy the system of equations shown above?

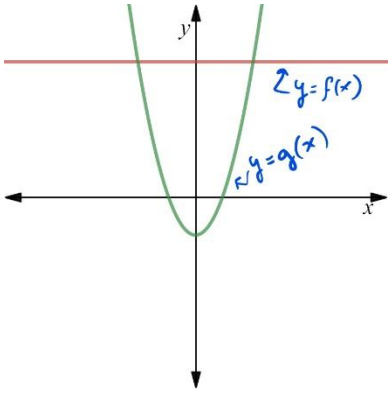
A) 0
B) 1
C) 2
D) Infinitely many

12.

Ria and Olivia each ordered a salad at a restaurant. The price of Ria's salad was x dollars, and the price of Olivia's salad was $2 more than the price of Ria's salad. If Ria and Olivia split the cost of the salads evenly and each paid a 10% tip, which of the following expressions represents the amount, in dollars, each of them paid?

A) $0.2x + 2.4$
B) $2.1x + 0.7$
C) $1.2x + 0.6$
D) $1.1x + 1.1$

13.



The functions f and g, defined by $f(x) = 7$ and $g(x) = x^2 - 2$, are graphed in the xy-plane above. The graphs of f and g intersect at the points $(-k, 7)$ and $(k, 7)$. What is the value of k?

A) 2
B) 3
C) 4.5
D) 7

3

14.

$$\frac{7 - i}{3 - 2i}$$

If the expression above is rewritten in the form of $a + bi$, where a and b are real numbers, what is the value of a? (Note: $i = \sqrt{-1}$)

A) 2

B) $\frac{23}{13}$

C) $\frac{32}{3}$

D) $\frac{31}{25}$

15.

$$x^2 - \frac{k}{3}x = 2p$$

In the quadratic equation above, k and p are constants. What are the solutions for x?

A) $x = \frac{k}{3} \pm \frac{\sqrt{k^2 + 3p}}{3}$

B) $x = \frac{k}{3} \pm \frac{\sqrt{k^2 + 8p}}{12}$

C) $x = \frac{k}{6} \pm \frac{\sqrt{k^2 + 72p}}{6}$

D) $x = \frac{k}{6} \pm \frac{\sqrt{k^2 + 18p}}{4}$

16.

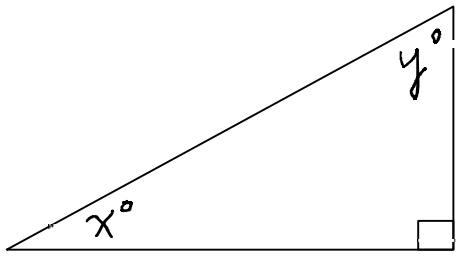
Max has three chains of different lengths. They are all attached together, end to end, to make a chain that is 8 feet long. The second longest chain is twice as long as the shortest one, and the longest chain is three times as long as the shortest one. What is the length of the shortest chain, in inches?

17.

$$x^3 - 6x^2 + 6x - 36 = 0$$

For what real value of x is the equation above true and $x > 3$?

18.



Note: Not drawn to scale.

In the triangle above, the cosine of $x°$ is 0.4. What is the sine of $y°$?

19.

$$-2x + 5y = 20$$
$$4x + y = 15$$

If (x, y) is the solution to the systems of equations above, what is the value of x?

20.

Alberto works in an Italian restaurant. To make a small pot of sauce he must use 3 ounces of parmesan cheese with 10 cans of tomatoes. If makes a big pot of sauce he must use 8 ounces of parmesan with 24 cans of tomatoes. For every additional 21 cans of tomatoes he must use n ounces of parmesan. What is the value of n?

1.

The monthly membership fee for an online movie service is $9.50 but there is an additional fee of $1.20 to rent each movie online. For one month, Kayla's membership and movie rental fees were $13.10. How many movies did Kayla rent online that month?

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

2.

To become the fastest typist in his class, a student has to be able to type 250 words per minute. Kai can currently type 135 words per minute and believes that with practice, he can increase his typing speed by 10 words per minute each month. Which of the following represents the number of words per minute Kai believes he will be able to type m months from now?

A) $135 + 10m$
B) $250 - 10m$
C) $115 - 10m$
D) $250 + 10m$

3.

If a 6-pound cake is sliced into thirds and each third is sliced into halves, what is the weight, in ounces, of each of the slices? (1 pound = 16 ounces)

A) 4
B) 6
C) 8
D) 16

4.

Yana surveyed a random sample of Band students at her school to determine whether they thought the piano counted as a legitimate band instrument or not. Of the 80 students surveyed, 35.3% said yes. Based on this information, about how many of the 225 total Band students in the entire school would be expected to also agree that the piano counts as a legitimate band instrument?

A) 55
B) 65
C) 70
D) 80

5.

The density of an object is equal to the mass of the object divided by the volume of the object. What is the volume, in milliliters, of an object with a mass of 60 grams and a density of 5 grams per milliliter?

A) 300
B) $\frac{1}{12}$
C) 12
D) 560

6.

Last week, Nina studied for 13 more hours than Larry did. If they studied for a combined total of 63 hours, how many hours did Larry study last week?

A) 35
B) 20
C) 25
D) 50

7.

Movies with Greatest Ticket Sales in 2012

MPAA Rating	Action	Animated	Comedy	Drama	Total
PG	2	7	2	5	16
PG-13	9	0	5	5	19
R	7	0	2	6	15
Total	18	7	9	16	50

The table above represents the 50 movies that had the greatest ticket sales in 2012, categorized by movie genre and Motion Picture Association of America (MPAA) rating. What proportion of the movies are dramas with a R rating?

A) $\frac{2}{25}$
B) $\frac{3}{25}$
C) $\frac{3}{50}$
D) $\frac{16}{50}$

8.

Line ℓ in the xy-plane contains points from each of Quadrants I, III, and IV, but no points from Quadrant II. Which of the following must be true?

A) The slope of line ℓ is undefined.
B) The slope of line ℓ is zero.
C) The slope of line ℓ is positive.
D) The slope of line ℓ is negative.

9.

Number of Registered Voters in the United States in 2012, in thousands

Region	Age 18 to 24	Age 25 to 44	Age 45 to 64	Age 65 to 74	75 & Older	Total
Northeast	2,713	8,159	10,986	3,342	2,775	27,975
Midwest	3,453	11,237	13,865	4,221	3,350	36,126
South	5,210	18,072	21,346	7,272	4,969	56,869
West	3,390	10,428	11,598	3,785	2,986	32,187
Total	14,766	47,896	57,795	18,620	14,080	153,157

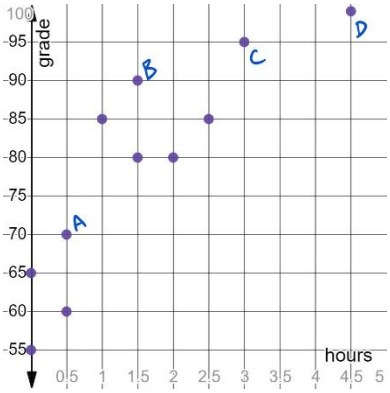
The table above shows the number of registered voters in 2012, in thousands, in four geographic regions and five age groups. Based on the table, if a registered voter who was 45 to 64 years old in 2012, is chosen at random, which of the following is closest to the probability that the registered voter was from the South region?

A) 0.29
B) 0.30
C) 0.35
D) 0.37

∇

Questions 10 and 11 refer to the following information.

A teacher plotted the test results of 11 students against the number of hours spent studying for the test by each student.



10.

Of the 11 students represented in the above, what was the longest number of hours spent studying?

A) 99
B) 5
C) 4.5
D) 3

11.

Of the labeled points, which represents the student for which the ratio of grade to time spent studying is greatest?

A) A
B) B
C) C
D) D

Δ

12.

In the xy-plane, the graph of function f has x-intercepts at $-4, -2$, and 1. Which of the following could define f?

A) $f(x) = (x + 4)(x + 2)(x - 1)$
B) $f(x) = (x - 4)(x - 1)(x + 2)$
C) $f(x) = (x + 4)(x - 2)(x + 1)$
D) $f(x) = (x - 4)(x - 2)(x - 1)$

13.

The population of rabbits in a meadow is estimated over the course of 20 weeks, as shown in the table.

Time (weeks)	Population
0	5
5	25
10	125
15	625
20	3125

Which of the following best describes the relationship between time and the estimated population of rabbits during the twenty weeks?

A) Increasing linear
B) Decreasing linear
C) Exponential growth
D) Exponential decay

4

14.

$1{,}000(1 + \frac{r}{1{,}200})^{12}$

The expression above gives the amount of money, in dollars, generated in a year by $1,000 deposit in a bank account that pays an annual interest rate of r%, compounded monthly. Which of the following expressions shows how much additional money is generated at an interest rate of 10% than at an interest rate of 6%?

A) $1{,}000\left(1 + \frac{10-6}{1{,}200}\right)^{12}$

B) $1{,}000\left(1 + \frac{\frac{10}{6}}{1{,}200}\right)^{12}$

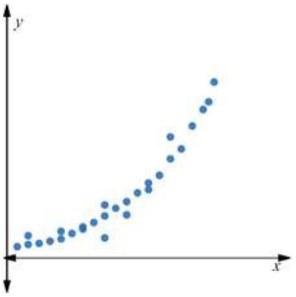
C) $\frac{1{,}000\left(1+\frac{10}{1{,}200}\right)^{12}}{1{,}000\left(1+\frac{6}{1{,}200}\right)^{12}}$

D) $1{,}000(1 + \frac{10}{1{,}200})^{12} - 1{,}000(1 + \frac{6}{1{,}200})^{12}$

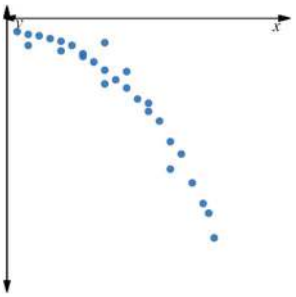
15.

Which of the following scatterplots shows a relationship that is appropriately modeled with the equation $y = ax^b$, where a is negative and b is positive?

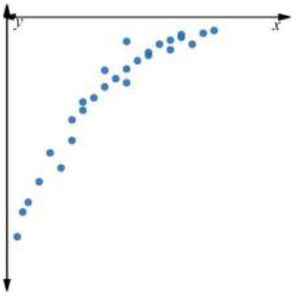
A)



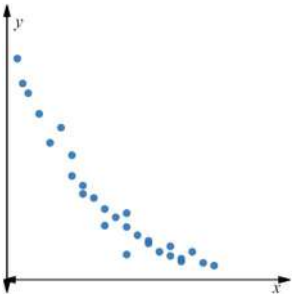
B)



C)



D)



∇

Questions 16 and 17 refer to the following information.

Mr. Wilson is building a concrete patio in his backyard and is deciding where to buy the materials and rent the tools needed for the project. The table below shows the materials' cost and daily rental costs for three different stores.

Store	Materials' Cost, M (dollars)	Rental cost of wheelbarrow, W (dollars per day)	Rental cost of concrete mixer, K (dollars per day)
A	750	15	65
B	600	25	80
C	700	20	70

The total cost, y, for buying the materials and renting the tools in terms of the number of days, x, is given by $y = M + (W + K)x$.

16.

For what number of days, x, will the total cost of buying the materials and renting the tools from Store B be greater than or equal to the total cost of buying the materials and renting the tools from Store A?

A) $x \geq 6$
B) $x \leq 6$
C) $x \leq 7.3$
D) $x \geq 7.3$

17.

If the relationship between the total cost, y, of buying the materials and renting the tools at Store C, and the number of days, x, for which the tools are rented is graphed in the xy-plane, what does the y-intercept of the line represent?

A) The total cost of the project
B) The total cost of materials
C) The total daily cost of the project
D) The total daily rental costs of the tools

Δ

18.

Sara has identical drinking glasses each in the shape of a right circular cylinder with an internal diameter of 4 inches. She pours milk from a gallon jug into each glass until it is full. If the height of milk in each glass is about 9 inches, what is the largest number of full milk glasses he can pour from one gallon of milk? (Note: There are 231 cubic inches in 1 gallon)

A) 2
B) 4
C) 5
D) 6

19.

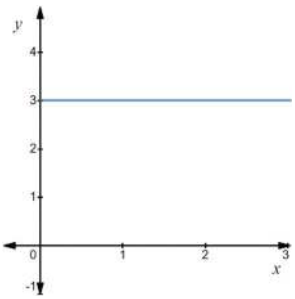
If $4p - 5 \geq 3$, what is the least possible value of $4p + 2$?

A) 5
B) 8
C) 10
D) 12

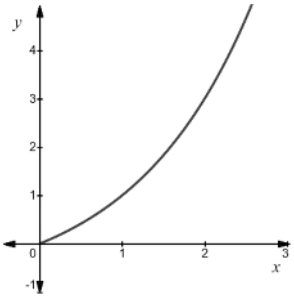
20.

A species has been introduced to an environment where there aren't any natural predators. An environmentalist predicts that the population will triple each year. Which of the following graphs could morel the population, y, of the species as a function of time, x?

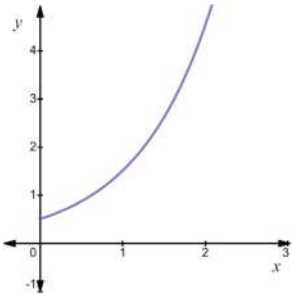
A)



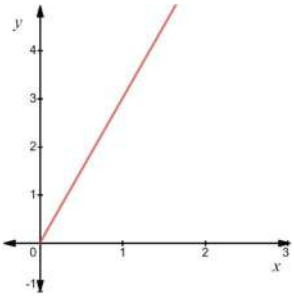
B)



C)

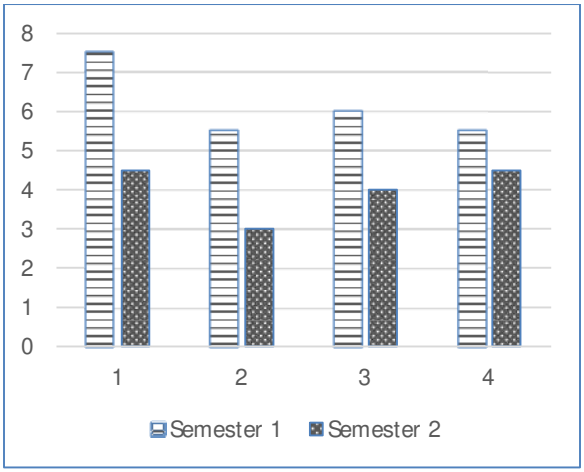


D)



Questions 21 and 22 refer to the following information.

Average Daily Hours Spent on Phone



A teacher recorded the average daily hours spent by her students on their phones during Semester 1 and Semester 2. The bar graph above shows the results for the four classes: Class 1, Class 2, Class 3, and Class 4. The students in the class made a conscious effort to reduce the amount of time they spend on the phone each day during Semester 2.

21.

In a scatterplot of this data, where Semester 1 is plotted along the x-axis and Semester 2 is plotted along the y-axis, for each of the classes, how many data points would be above the line $y = x$?

A) 0
B) 1
C) 3
D) 4

22.

Which of the four classes had the greatest percent change in the average daily number of hours spent on phone from Semester 1 to Semester 2?

A) Class 1
B) Class 2
C) Class 3
D) Class 4

_____Δ_____

23.

Students in two classes were tested to see how many US presidents they could name. The results are shown below.

Class A

Number of Presidents	Frequency
2	6
3	3
4	4
5	2
6	3
7	4

Class B

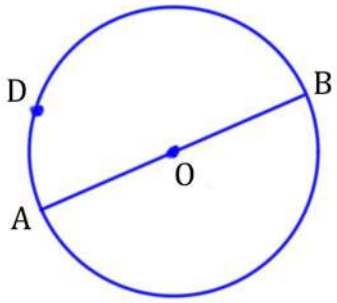
Number of Presidents	Frequency
2	1
3	5
4	10
5	4
6	1
7	1

Which of the following is true about the data shown regarding these students?

A) The standard deviation of number of presidents named is the same for both classes.
B) The standard deviation of number of presidents named is the greater for Class A than for Class B.
C) The standard deviation of number of presidents named is greater for Class B than for Class A
D) Since both classes had students who names 2 presidents and 7 presidents there is no standard deviation

4

24.



In the circle above, segment AB is a diameter. If the length of arc ADB is 10π, what is the length of the radius of the circle?

A) 6
B) 2
C) 10
D) 20

25.

$f(x) = 2x^3 + 5x^2$
$g(x) = x + 2$

The polynomials $f(x)$ and $g(x)$ are defined above. Which of the following polynomials is divisible by $x^2 + 4$?

A) $h(x) = f(x) + g(x)$
B) $p(x) = f(x) + 8g(x)$
C) $r(x) = 2f(x) + 3g(x)$
D) $s(x) = 3(x) = 4g(x)$

26.

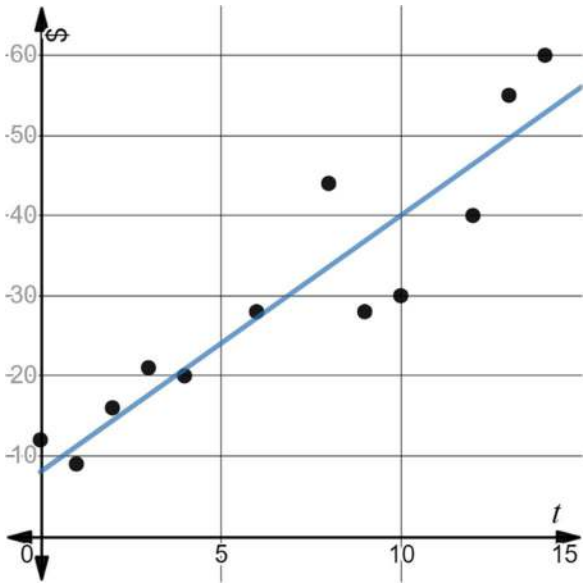
Let x and y be number such that $-y < x < y$. Which of the following must be true?

I. $|x| < y$
II. $x = 0$
III. $y > 0$

A) I only
B) I and II only
C) I and III only
D) I, II, and III

27.

Josie plotted the value of a stock each year since 2000. The scatterplot below reflects the price of the stock t years after 2000.



The line of best fit is also shown and has equation $y = 3.2t + 8$. Which of the following best explains the number 8 in the equation as it relates to the scatterplot.

A) In the year 2000, the price of the stock was $8.
B) Since the year 2000, the price of the stock increased by approximately $8 per year.
C) $8 is the price Josie would have paid for the stock if she purchased it in 2000.
D) The estimated price of the stock in 2000 is $8, but the actual price was over $10.

28.

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

Which of the following is an equivalent form of the function f above in which the minimum value of f appears as a constant or coefficient?

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

B) $f(x) = (x - 1)^2 - 5$

C) $f(x) = x(x + 2) + 2$

D) $f(x) = (x + 1)^2 - 9$

29.

If x is the average (arithmetic mean) of m and 8, y is the average of $2m$ and 16, and z is the average of $3m$ and 20, what is the average of x, y, and z in terms of m?

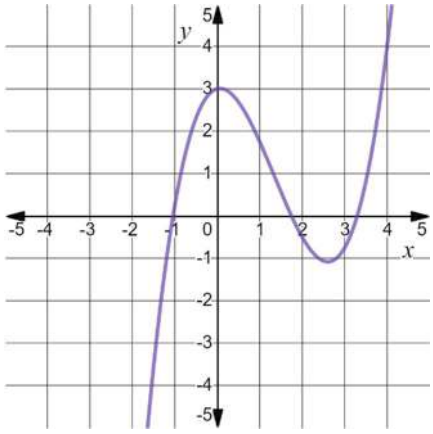
A) $m + 8$

B) $m + \frac{14}{3}$

C) $6m + 22$

D) $m + \frac{22}{3}$

30.



The function $f(x) = \frac{1}{2}x^2 - 2x^2 + \frac{1}{4}x + 3$ is graphed in the xy-plane above. If k is a constant such that $f(x) = k$ has exactly 2 real solutions, which of the following could be the value of k?

A) -2

B) 0

C) 1

D) 3

31.

A partially filled pool contains 530 gallons of water. A hose is turned on, and water flows into the pool at the rate of 6 gallons per minute. How many gallons of water will be in the pool after 70 minutes?

32.

The normal blood pressure, P, in milliliters for iron, for an adult male x years old can be modeled by the equation $P = \frac{x + 420}{3}$. According to the model, for every increase of 1 year in age, by how many milliliters of iron will the normal blood pressure for an adult male increase?

33.

The pes, a Roman measure of length, is approximately equal to 11.65 inches. It is also equivalent to 16 smaller Roman units called digits. Based on these relationships, 92 Roman digits is equivalent to how many feet, to the nearest hundredth? (12 inches = 1 foot)

34.

In a study of bat migration habits, 320 male bats and 180 female bats have been tagged. If 100 more female bats are tagged, how many more male bats must be tagged so that ⅗ of the total number of bats in the study are male?

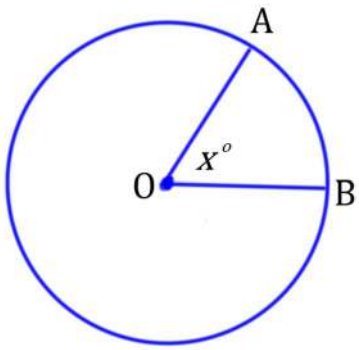
4

35.

$q = \frac{1}{2}nv^2$

The dynamic pressure q generated by a fluid moving with velocity v can be found using the formula above, where n is the constant density of the fluid. An aeronautical engineer uses the formula to find the dynamic pressure of a fluid moving with velocity v and the same fluid moving with velocity $2v$. What is the ratio of the dynamic pressure of the faster fluid to the dynamic pressure of the slower fluid?

36.



Note: Figure not drawn to scale

In the figure above, the circle has center O and has a radius 8. If the length of arc AB is between 3 and 4, what is one possible integer value of x?

∇

Questions 37 and 38 refer to the following information.

The stock price of one share in a certain company is worth $430 today. A stock analyst believes that the stock will lose 26 percent of its value each week for the next 3 weeks. The analyst uses the equation $V = 430(r)^t$ to model the value, V, of the stock after t weeks.

37.

What value should the analyst use for r?

38.

To the nearest dollar, what does the analyst believe the value of the stock will be at the end of three weeks? (Note: Disregard the $ sign when gridding your answer.)

Δ