Domain, Range and Intervals

1. Which domain would be the most appropriate set to use for a function that predicts the number of household online-devices in terms of the number of people in the household?

(1) integers

(2) whole numbers

(3) irrational numbers

(4) rational numbers

2. Officials in a town use a function, *C*, to analyze traffic patterns. C(n) represents the rate of traffic through an intersection where *n* is the number of observed vehicles in a specified time interval. What would be the most appropriate domain for the function?

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

3. Let f be a function such that f(x) = 2x - 4 is defined on the domain $2 \le x \le 6$. The range of this function is

(1) $0 \le y \le 8$ (2) $0 \le y < \infty$ (3) $2 \le y \le 6$ (4) $-\infty < y < \infty$

4. The function $h(t) = -16t^2 + 144$ represents the height, h(t), in feet, of an object from the ground at *t* seconds after it is dropped. A realistic domain for this function is

(1) $-3 \le t \le 3$ (2) $0 \le t \le 3$ (3) $0 \le h(t) \le 144$ (4) all real numbers

5. If $f(x) = \frac{1}{3}x + 9$, which statement is always true?

(1) f(x) < 0(2) f(x) > 0(3) If x < 0, then f(x) < 0.

(4) If x > 0, then f(x) > 0.

6. A ball is thrown into the air from the edge of a 48-foot-high cliff so that it eventually lands on the ground. The graph below shows the height, y, of the ball from the ground after x seconds.

For which interval is the ball's height always *decreasing*?

(1) $0 \le x \le 2.5$ (2) 0 < x < 5.5(3) 2.5 < x < 5.5(4) $x \ge 2$



Writing and Interpreting Equations

1. The owner of a small computer repair business has one employee, who is paid an hourly rate of \$22. The owner estimates his weekly profit using the function P(x) = 8600 - 22x. In this function, *x* represents the number of

- (1) computers repaired per week
- (2) hours worked per week
- (3) customers served per week
- (4) days worked per week

2. In 2013, the United States Postal Service charged \$0.46 to mail a letter weighing up to 1 oz. and \$0.20 per ounce for each additional ounce. Which function would determine the cost, in dollars, c(z), of mailing a letter weighing *z* ounces where *z* is an integer greater than 1?

(1) c(z) = 0.46z + 0.20(2) c(z) = 0.20z + 0.46(3) c(z) = 0.46(z - 1) + 0.20(4) c(z) = 0.20(z - 1) + 0.46

3. A satellite television company charges a one-time installation fee and a monthly service charge. The total cost is modeled by the function y = 40 + 90x. Which statement represents the meaning of each part of the function?

- (1) y is the total cost, x is the number of months of service, \$90 is the installation fee, and \$40 is the service charge per month.
- (2) y is the total cost, x is the number of months of service, \$40 is the installation fee, and \$90 is the service charge per month.
- (3) x is the total cost, y is the number of months of service, \$40 is the installation fee, and \$90 is the service charge per month.
- (4) x is the total cost, y is the number of months of service, \$90 is the installation fee, and \$40 is the service charge per month.

4. Sam and Jeremy have ages that are consecutive odd integers. The product of their ages is 783. Which equation could be used to find Jeremy's age, *j*, if he is the younger man?

(1) $j^2 + 2 = 783$ (2) $j^2 - 2 = 783$ (3) $j^2 + 2j = 783$ (4) $j^2 - 2j = 783$

5. During the 2010 season, football player McGee's earnings, m, were 0.005 million dollars more than those of his teammate Fitzpatrick's earnings, f. The two players earned a total of 3.95 million dollars. Which system of equations could be used to determine the amount each player earned, in millions of dollars?

(1) m + f = 3.95 m + 0.005 = f(2) m - 3.95 = f f + 0.005 = m(3) f - 3.95 = m m + 0.005 = f(4) m + f = 3.95f + 0.005 = m

6. A company that manufactures radios first pays a start-up cost, and then spends a certain amount of money to manufacture each radio. If the cost of manufacturing *r* radios is given by the function c(r) = 5.25r + 125, then the value 5.25 best represents

- (1) the start-up cost
- (2) the profit earned from the sale of one radio
- (3) the amount spent to manufacture each radio
- (4) the average number of radios manufactured

7. John has four more nickels than dimes in his pocket, for a total of 1.25. Which equation could be used to determine the number of dimes, *x*, in his pocket?

(1) 0.10(x + 4) + 0.05(x) = \$1.25(2) 0.05(x + 4) + 0.10(x) = \$1.25(3) 0.10(4x) + 0.05(x) = \$1.25(4) 0.05(4x) + 0.10(x) = \$1.25 8. A cell phone company charges 60.00 a month for up to 1 gigabyte of data. The cost of additional data is 0.05 per megabyte. If *d* represents the number of additional megabytes used and *c* represents the total charges at the end of the month, which linear equation can be used to determine a user's monthly bill?

(1) c = 60 - 0.05d(2) c = 60.05d(3) c = 60d - 0.05(4) c = 60 + 0.05d

Linear Inequalities

1. Given: y + x > 2 $y \le 3x - 2$

Which graph shows the solution of the given set of inequalities?



2. Given 2x + ax - 7 > -12, determine the largest integer value of *a* when x = -1.

3. What is one point that lies in the solution set of the system of inequalities graphed below?

- (1) (7,0)
- (2) (3,0)
- (3) (0,7)
- (4) (-3,5)



4. Solve the inequality below to determine and state the smallest possible value for x in the solution set.

 $3(x+3) \leq 5x-3$

5. The inequality $7 - \frac{2}{3}x < x - 8$ is equivalent to

(1) x > 9(2) $x > -\frac{3}{5}$ (3) x < 9(4) $x < -\frac{3}{5}$

6. Connor wants to attend the town carnival. The price of admission to the carnival is \$4.50, and each ride costs an additional 79 cents. If he can spend at most \$16.00 at the carnival, which inequality can be used to solve for r, the number of rides Connor can go on, and what is the maximum number of rides he can go on?

(1) $0.79 + 4.50r \le 16.00$; 3 rides (2) $0.79 + 4.50r \le 16.00$; 4 rides (3) $4.50 + 0.79r \le 16.00$; 14 rides (4) $4.50 + 0.79r \le 16.00$; 15 rides 7. Edith babysits for x hours a week after school at a job that pays \$4 an hour. She has accepted a job that pays \$8 an hour as a library assistant working y hours a week. She will work both jobs. She is able to work no more than 15 hours a week, due to school commitments. Edith wants to earn at least \$80 a week, working a combination of both jobs. Write a system of inequalities that can be used to represent the situation. Graph these inequalities on the set of axes below.



Determine and state one combination of hours that will allow Edith to earn *at least* \$80 per week while working *no more than* 15 hours.

8. The graph of an inequality is shown below.



a) Write the inequality represented by the graph.

b) On the same set of axes, graph the inequality x + 2y < 4.

c) The two inequalities graphed on the set of axes form a system. Oscar thinks that the point (2,1) is in the solution set for this system of inequalities. Determine and state whether you agree with Oscar. Explain your reasoning.

Exponential Functions

1. The table below represents the function F.

The equation that represents this function is

(1) $F(x) = 3^{x}$ (2) F(x) = 3x(3) $F(x) = 2^{x} + 1$ (4) F(x) = 2x + 3

2. The table below shows the average yearly balance in a savings account where interest is compounded annually. No money is deposited or withdrawn after the initial amount is deposited.

Year	Balance, in Dollars
0	380.00
10	562.49
20	832.63
30	1232.49
40	1824.39
50	2700.54

Which type of function best models the given data?

- (1) linear function with a negative rate of change
- (2) linear function with a positive rate of change
- (3) exponential decay function
- (4) exponential growth function

x	3	4	6	7	8
F(x)	9	17	65	129	257

3. The breakdown of a sample of a chemical compound is represented by the function $p(t) = 300(0.5)^t$, where p(t) represents the number of milligrams of the substance and *t* represents the time, in years. In the function p(t), explain what 0.5 and 300 represent.

4. A population that initially has 20 birds approximately doubles every 10 years. Which graph represents this population growth?



5. Rhonda deposited \$3000 in an account in the Merrick National Bank, earning 4.2% interest, compounded annually. She made no deposits or withdrawals. Write an equation that can be used to find B, her account balance after t years.

6. Krystal was given \$3000 when she turned 2 years old. Her parents invested it at a 2% interest rate compounded annually. No deposits or withdrawals were made. Which expression can be used to determine how much money Krystal had in the account when she turned 18?

- $(1) 3000(1+0.02)^{16}$
- $(2) \ 3000(1-0.02)^{16}$
- (3) $3000(1+0.02)^{18}$
- (4) $3000(1 0.02)^{18}$

6. Write an exponential equation for the graph shown below.

Explain how you determined the equation.



7. Some banks charge a fee on savings accounts that are left inactive for an extended period of time. The equation $y = 5000(0.98)^x$ represents the value, *y*, of one account that was left inactive for a period of *x* years. What is the *y*-intercept of this equation and what does it represent?

- (1) 0.98, the percent of money in the account initially
- (2) 0.98, the percent of money in the account after x years
- (3) 5000, the amount of money in the account initially
- (4) 5000, the amount of money in the account after x years

8. The value in dollars, v(x), of a certain car after x years is represented by the equation $v(x) = 25,000(0.86)^x$. To the *nearest dollar*, how much more is the car worth after 2 years than after 3 years?

- (1) 2589
- (2) 6510
- (3) 15,901
- (4) 18,490

Regression and Data Analysis

1. What is the correlation coefficient of the linear fit of the data shown below, to the *nearest hundredth*?

- (1) 1.00
- (2) 0.93
- (3) -0.93
- (4) -1.00



2. A nutritionist collected information about different brands of beef hot dogs. She made a table showing the number of Calories and the amount of sodium in each hot dog.

a) Write the correlation coefficient for the line of best fit. Round your answer to the *nearest hundredth*.

b) Explain what the correlation coefficient suggests in the context of this problem.

Calories per Beef Hot Dog	Milligrams of Sodium per Beef Hot Dog
186	495
181	477
176	425
149	322
184	482
190	587
158	370
139	322

3. The table below shows the number of grams of carbohydrates, *x*, and the number of Calories, *y*, of six different foods.

Which equation best represents the line of best fit for this set of data?

(1) y = 15x(2) y = 0.07x(3) y = 0.1x - 0.4(4) y = 14.1x + 5.8

Carbohydrates (x)	Calories (y)
8	120
9.5	138
10	147
6	88
7	108
4	62

4. The table below represents the residuals for a line of best fit.

x	2	3	3	4	6	7	8	9	9	10
Residual	2	1	-1	-2	-3	-2	-1	2	0	3

Plot these residuals on the set of axes below.



Using the plot, assess the fit of the line for these residuals and justify your answer.

5. Christopher looked at his quiz scores shown below for the first and second semester of his Algebra class.

Semester 1: 78, 91, 88, 83, 94 Semester 2: 91, 96, 80, 77, 88, 85, 92

Which statement about Christopher's performance is correct?

- (1) The interquartile range for semester 1 is greater than the interquartile range for semester 2.
- (2) The median score for semester 1 is greater than the median score for semester 2.
- (3) The mean score for semester 2 is greater than the mean score for semester 1.
- (4) The third quartile for semester 2 is greater than the third quartile for semester 1.

6. Isaiah collects data from two different companies, each with four employees. The results of the study, based on each worker's age and salary, are listed in the tables below.

Comp Worker's	any 1 Salary
Age in Years	in Dollars
25	30,000
27	32,000
28	35,000
33	38,000

Company	2
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Worker's Age in Years	Salary in Dollars
25	29,000
28	35,500
29	37,000
31	65,000

Which statement is true about these data?

- (1) The median salaries in both companies are greater than \$37,000.
- (2) The mean salary in company 1 is greater than the mean salary in company 2.
- (3) The salary range in company 2 is greater than the salary range in company 1.
- (4) The mean age of workers at company 1 is greater than the mean age of workers at company 2.

7. Corinne is planning a beach vacation in July and is analyzing the daily high temperatures for her potential destination. She would like to choose a destination with a high median temperature and a small inter-quartile range. She constructed box plots shown in the diagram below.



8. Robin collected data on the number of hours she watched television on Sunday through Thursday nights for a period of 3 weeks. The data are shown in the table below.

[Sun	Mon	Tues	Wed	Thurs
Week 1	4	3	3.5	2	2
Week 2	4.5	5	2.5	3	1.5
Week 3	4	3	1	1.5	2.5

Using an appropriate scale on the number line below, construct a box plot for the 15 values.

Quadratics

- 1. If $4x^2 100 = 0$, the roots of the equation are
- (1) -25 and 25
- (2) 25, only
- (3) 5 and 5
- (4) –5, only

2. When factored completely, the expression $p^4 - 81$ is equivalent to

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

3. Which expression is equivalent to $x^4 - 12x^2 + 36$?

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

- 4. Factor the expression $x^4 + 6x^2 7$ completely.
- 5. Which equation has the same solutions as $2x^2 + x 3 = 0$
- (1) (2x-1)(x+3) = 0(2) (2x+1)(x-3) = 0 (3) (2x-3)(x+1) = 0 (4) (2x+3)(x-1) = 0

6. Keith determines the zeros of the function f(x) to be -6 and 5. What could be Keith's function?

(1) f(x) = (x + 5)(x + 6)(2) f(x) = (x + 5)(x - 6)(3) f(x) = (x - 5)(x + 6)(4) f(x) = (x - 5)(x - 6)

7. In the equation $x^2 + 10x + 24 = (x + a)(x + b)$, *b* is an integer. Find algebraically *all* possible values of *b*.

8. Which point is *not* on the graph represented by $y = x^2 + 3x - 6$?

- (1) (-6,12)
- (2) (-4, -2)
- (3)(2,4)
- (4) (3,-6)
- 9. How does the graph of $f(x) = 3(x-2)^2 + 1$ compare to the graph of $g(x) = x^2$?
- (1) The graph of f(x) is wider than the graph of g(x), and its vertex is moved to the left 2 units and up 1 unit.
- (2) The graph of f(x) is narrower than the graph of g(x), and its vertex is moved to the right 2 units and up 1 unit.
- (3) The graph of f(x) is narrower than the graph of g(x), and its vertex is moved to the left 2 units and up 1 unit.
- (4) The graph of f(x) is wider than the graph of g(x), and its vertex is moved to the right 2 units and up 1 unit.

10. The graph of the equation $y = ax^2$ is shown below.

If a is multiplied by $-\frac{1}{2}$, the graph of the new equation is

- (1) wider and opens downward
- (2) wider and opens upward
- (3) narrower and opens downward
- (4) narrower and opens upward

11. The vertex of the parabola represented by $f(x) = x^2 - 4x + 3$ has coordinates (2, -1).

Find the coordinates of the vertex of the parabola defined by g(x) = f(x - 2).

Explain how you arrived at your answer.





[The use of the set of axes below is optional.]

12. A polynomial function contains the factors x, x - 2, and x + 5. Which graph(s) below could represent the graph of this function?

- (1) I, only
- (2) II, only
- (3) I and III
- (4) I, II, and III

13. What are the roots of the equation $x^2 + 4x - 16 = 0$?

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

 $(4) -2 \pm 4\sqrt{5}$



14. Which equation has the same solutions as $x^2 + 6x - 7 = 0$?

- (1) $(x+3)^2 = 2$ (2) $(x-3)^2 = 2$ (3) $(x-3)^2 = 16$
- (3) (x-3) = 10(4) (x+3)² = 16
- 15. Which equation has the same solution as $x^2 6x 12 = 0$?
- 1) $(x+3)^2 = 21$
- 2) $(x-3)^2 = 21$
- 3) $(x+3)^2 = 3$
- 4) $(x-3)^2 = 3$

16. The zeros of the function $f(x) = (x + 2)^2 - 25$ are

- (1) -2 and 5 (2) -3 and 7 (3) -5 and 2
- (4) 7 and 3
- 17. Given the function $f(x) = -x^2 + 8x + 9$.

a) State whether the vertex represents a maximum or minimum point for the function. Explain your answer.

b) Rewrite f(x) in vertex form by completing the square.

18. A student was given the equation $x^2 + 6x - 13 = 0$ to solve by completing the square. The first step that was written is shown below.

$$x^2 + 6x = 13$$

The next step in the student's process was $x^2 + 6x + c = 13 + c$. State the value of *c* that creates a perfect square trinomial.

Explain how the value of c is determined.

19. Write an equation that defines m(x) as a trinomial where $m(x) = (3x - 1)(3 - x) + 4x^2 + 19$. Solve for x when m(x) = 0.

20. Let f be the function represented by the graph below.

Let g be a function such that $g(x) = -\frac{1}{2}x^2 + 4x + 3$.

Determine which function has the larger maximum value. Justify your answer.



21. Solve the equation $4x^2 - 12x = 7$ algebraically for *x*.

Number Systems and Properties

1. Ms. Fox asked her class "Is the sum of 4.2 and $\sqrt{2}$ rational or irrational?" Patrick answered that the sum would be irrational. State whether Patrick is correct or incorrect. Justify your reasoning.

2. Which statement is *not* always true?

- (1) The product of two irrational numbers is irrational.
- (2) The product of two rational numbers is rational.
- (3) The sum of two rational numbers is rational.
- (4) The sum of a rational number and an irrational number is irrational.

3. Given:	$L = \sqrt{2}$
Which expression results in a rational number?	$M = 3\sqrt{3}$
(1) $L + M$	$N = \sqrt{16}$
(2) M + N	$\mathcal{P} = \sqrt{0}$
(3) $N+P$	$\Gamma = \sqrt{9}$

(4) P + L

4. When solving the equation $4(3x^2 + 2) - 9 = 8x^2 + 7$, Emily wrote $4(3x^2 + 2) = 8x^2 + 16$ as her first step. Which property justifies Emily's first step?

- (1) addition property of equality
- (2) commutative property of addition
- (3) multiplication property of equality
- (4) distributive property of multiplication over addition

Linear Functions

1. On the set of axes below, draw the graph of the equation $y = -\frac{3}{4}x + 3$.

Is the point (3,2) a solution to the equation? Explain your answer based on the graph drawn.

2. Caitlin has a movie rental card worth \$175. After she rents the first movie, the card's value is \$172.25. After she rents the second movie, its value is \$169.50. After she rents the third movie, the card is worth \$166.75.

a) Assuming the pattern continues, write an equation to define A(n), the amount of money on the rental card after *n* rentals.

b) Caitlin rents a movie every Friday night. How many weeks in a row can she afford to rent a movie, using her rental card only? Explain how you arrived at your answer.

3. The value of the *x*-intercept for the graph of 4x - 5y = 40 is

- (1) 10
- (2) $\frac{4}{5}$
- $(3)_{-\frac{4}{5}}$
- э (4) -8



- 4. Which situation could be modeled by using a linear function?
- (1) a bank account balance that grows at a rate of 5% per year, compounded annually
- (2) a population of bacteria that doubles every 4.5 hours
- (3) the cost of cell phone service that charges a base amount plus 20 cents per minute
- (4) the concentration of medicine in a person's body that decays by a factor of one-third every hour
- 5. Which graph shows a line where each value of y is three more than half of x?



6. Which table of values represents a linear relationship?

х	f(x)		x	f(x)		x	f(x)		x	f(x)	
-1	-3		-1	1/2		- 1	-3		-1	-1	
0	-2		0	1		0	-1		0	0	
1	1		1	2		1	1		1	1	
2	6		2	4		2	3		2	8	
3	13		3	8		3	5		3	27	
(1)		(2	2)		(.	3)		(4	4)	

7. The graph of a linear equation contains the points (3,11) and (-2,1). Which point also lies on the graph?

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

8. Which function has the same *y*-intercept as the graph below?

- (1) $y = \frac{12 6x}{4}$ (2) 27 + 3y = 6x
- (3) 6y + x = 18
- (4) y + 3 = 6x



Functions

1. A function is shown in the table below.

If included in the table, which ordered pair, (-4,1) or (1,-4), would result in a relation that is no longer a function? Explain your answer.

2. The function *f* has a domain of $\{1,3,5,7\}$ and a range of $\{2,4,6\}$. Could *f* be represented by $\{(1,2),(3,4),(5,6),(7,2)\}$? Justify your answer.

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

Which point could be used to find f(2)?

(1) A

- (2) *B*
- (3) *C*

(4) D

Average Rate of Change

1. The Jamison family kept a log of the distance they traveled during a trip, as represented by the graph below.

During which interval was their average speed the greatest?

- (1) the first hour to the second hour
- (2) the second hour to the fourth hour
- (3) the sixth hour to the eighth hour
- (4) the eighth hour to the tenth hour



Elapsed Time (hours)



x	f(x)
-4	2
-1	-4
0	-2
3	16

Age (years)	Average Pupil Diameter (mm)
20	4.7
30	4.3
40	3.9
50	3.5
60	3.1
70	2.7
80	2.3

2. The table below shows the average diameter of a pupil in a person's eye as he or she grows older.

What is the average rate of change, in millimeters per year, of a person's pupil diameter from age 20 to age 80?

- (1) 2.4(2) 0.04
- (2) 0.04(3) -2.4
- (3) 2.4 (4) -0.04

3. An astronaut drops a rock off the edge of a cliff on the Moon. The distance, d(t), in meters, the rock travels after *t* seconds can be modeled by the function $d(t) = 0.8t^2$. What is the average speed, in meters per second, of the rock between 5 and 10 seconds after it was dropped?

- (1) 12
- (2) 20
- (3) 60
- (4) 80

Operations with Polynomials

1. If $A = 3x^2 + 5x - 6$ and $B = -2x^2 - 6x + 7$, then A - B equals (1) $-5x^2 - 11x + 13$ (2) $5x^2 + 11x - 13$ (3) $-5x^2 - x + 1$ (4) $5x^2 - x + 1$

2. A company produces *x* units of a product per month, where C(x) represents the total cost and R(x) represents the total revenue for the month. The functions are modeled by C(x) = 300x + 250 and $R(x) = -0.5x^2 + 800x - 100$. The profit is the difference between revenue and cost where P(x) = R(x) - C(x). What is the total profit, P(x), for the month?

(1) $P(x) = -0.5x^2 + 500x - 150$ (2) $P(x) = -0.5x^2 + 500x - 350$ (3) $P(x) = -0.5x^2 - 500x + 350$ (4) $P(x) = -0.5x^2 + 500x + 350$

3. Express the product of $2x^2 + 7x - 10$ and x + 5 in standard form.

4. Subtract $5x^2 + 2x - 11$ from $3x^2 + 8x - 7$. Express the result as a trinomial.

5. Fred is given a rectangular piece of paper. If the length of Fred's piece of paper is represented by 2x - 6 and the width is represented by 3x - 5, then the paper has a total area represented by

(1) 5x - 11(2) $6x^2 - 28x + 30$ (3) 10x - 22(4) $6x^2 - 6x - 11$

Systems of Equations

1. Two functions, y = |x - 3| and 3x + 3y = 27, are graphed on the same set of axes. Which statement is true about the solution to the system of equations?

- (1) (3,0) is the solution to the system because it satisfies the equation y = |x 3|.
- (2) (9,0) is the solution to the system because it satisfies the equation 3x + 3y = 27.
- (3) (6,3) is the solution to the system because it satisfies both equations.
- (4) (3,0), (9,0), and (6,3) are the solutions to the system of equations because they all satisfy at least one of the equations.
- 2. Which system of equations has the same solution as the system below?

(1)
$$2x + 2y = 16$$

 $6x - 2y = 4$
(2) $2x + 2y = 16$
 $6x - 2y = 8$
(3) $x + y = 16$
 $3x - y = 4$
(4) $6x + 6y = 48$
 $6x + 2y = 8$

$$2x + 2y = 16$$
$$3x - y = 4$$

3. An animal shelter spends \$2.35 per day to care for each cat and \$5.50 per day to care for each dog. Pat noticed that the shelter spent \$89.50 caring for cats and dogs on Wednesday.

a)Write an equation to represent the possible numbers of cats and dogs that could have been at the shelter on Wednesday.

b)Pat said that there might have been 8 cats and 14 dogs at the shelter on Wednesday. Are Pat's numbers possible? Use your equation to justify your answer.

c) Later, Pat found a record showing that there were a total of 22 cats and dogs at the shelter on Wednesday. How many cats were at the shelter on Wednesday?

4. Jacob and Zachary go to the movie theater and purchase refreshments for their friends. Jacob spends a total of \$18.25 on two bags of popcorn and three drinks. Zachary spends a total of \$27.50 for four bags of popcorn and two drinks. Write a system of equations that can be used to find the price of one bag of popcorn and the price of one drink. Using these equations, determine and state the price of a bag of popcorn and the price of a drink, to the *nearest cent*.

5. Guy and Jim work at a furniture store. Guy is paid \$185 per week plus 3% of his total sales in dollars, *x*, which can be represented by g(x) = 185 + 0.03x. Jim is paid \$275 per week plus 2.5% of his total sales in dollars, *x*, which can be represented by f(x) = 275 + 0.025x. Determine the value of *x*, in dollars, that will make their weekly pay the same.

6. A gardener is planting two types of trees:

Type A is three feet tall and grows at a rate of 15 inches per year. Type B is four feet tall and grows at a rate of 10 inches per year.

Algebraically determine exactly how many years it will take for these trees to be the same height.

7. Let $f(x) = -2x^2$ and g(x) = 2x - 4. On the set of axes below, draw the graphs of y = f(x) and y = g(x).



Using this graph, determine and state *all* values of *x* for which f(x) = g(x).

8. A company is considering building a manufacturing plant. They determine the weekly production cost at site *A* to be $A(x) = 3x^2$ while the production cost at site *B* is B(x) = 8x + 3, where *x* represents the number of products, *in hundreds*, and A(x) and B(x) are the production costs, *in hundreds of dollars*. Graph the production cost functions on the set of axes below and label them site *A* and site *B*.



a) State the positive value(s) of x for which the production costs at the two sites are equal. Explain how you determined your answer.

b) If the company plans on manufacturing 200 products per week, which site should they use? Justify your answer.

Piecewise Functions

1. A function is graphed on the set of axes below.

Which function is related to the graph?

1)
$$f(x) = \begin{cases} x^2, x < 1 \\ x - 2, x > 1 \end{cases}$$

2)
$$f(x) = \begin{cases} x^2, x < 1 \\ \frac{1}{2}x + \frac{1}{2}, x > 1 \end{cases}$$

3)
$$f(x) = \begin{cases} x^2, x < 1 \\ 2x - 7, x > 1 \end{cases}$$

4)
$$f(x) = \begin{cases} x^2, x < 1 \\ \frac{3}{2}x - \frac{9}{2}, x > 1 \end{cases}$$



2. Graph the following function on the set of axes below.



Sequences

1. The diagrams below represent the first three terms of a sequence.

Assuming the pattern continues, which formula determines a_n , the number of shaded squares in the *n*th term?

(1) $a_n = 4n + 12$ (2) $a_n = 4n + 8$ (3) $a_n = 4n + 4$ (4) $a_n = 4n + 2$



2. A sunflower is 3 inches tall at week 0 and grows 2 inches each week. Which function(s) shown below can be used to determine the height, f(n), of the sunflower in *n* weeks?

(1) I and II (2) II, only (3) III, only (4) I and III (5) III, only (6) III, only (7) III, f(n) = 2n + 3 f(n) = 2n + 3(n - 1)III. f(n) = f(n - 1) + 2 where f(0) = 3

3. If a sequence is defined recursively by f(0) = 2 and f(n+1) = -2f(n) + 3 for $n \ge 0$, f(2) is equal to

- (1) 1 (2) -11
- (3) 5
- (4) 17

4. If f(1) = 3 and f(n) = -2f(n-1) + 1, then f(5) =

(1) -5 (2) 11 (3) 21 (4) 43

5. The third term in an arithmetic sequence is 10 and the fifth term is 26. If the first term is a_1 , which is an equation for the *n*th term of this sequence?

(1) $a_n = 8n + 10$ (2) $a_n = 8n - 14$ (3) $a_n = 16n + 10$ (4) $a_n = 16n - 38$

Literal Equations

1. The equation for the volume of a cylinder is $V = \pi r^2 h$. The positive value of *r*, in terms of *h* and *V*, is

 $(1) r = \sqrt{\frac{V}{\pi h}}$ $(2) r = \sqrt{V\pi h}$ $(3) r = 2V\pi h$ $(4) r = \frac{V}{2\pi}$

- 2. The formula for the area of a trapezoid is $A = \frac{1}{2}h(b_1 + b_2)$.
- a) Express b_1 in terms of A, h, and b_2 .

b) The area of a trapezoid is 60 square feet, its height is 6 ft, and one base is 12 ft. Find the number of feet in the other base.

3. The formula for the volume of a cone is $V = \frac{1}{3} \pi r^2 h$. The radius, *r*, of the cone may be expressed as



Fractional Equations

1. Which value of x satisfies the equation $\frac{7}{3}\left(x + \frac{9}{28}\right) = 20?$

- (1) 8.25
- (2) 8.89
- (3) 19.25
- (4) 44.92

2. What is the value of x in the equation $\frac{x-2}{3} + \frac{1}{6} = \frac{5}{6}$?

- (1) 4
- (2) 6
- (3) 8
- (4) 11

Graphs of Functions

1. On the axes below, graph f(x) = |3x|.

If g(x) = f(x) - 2, how is the graph of f(x) translated to form the graph of g(x)?

If h(x) = f(x - 4), how is the graph of f(x) translated to form the graph of h(x)?

2. Draw the graph of $y = \sqrt{x} - 1$ on the set of axes below.



