3.3 Start Thinking

The range (y) of a function is the result of performing one or more operations on all possible domain (x) values. In the equation $y = -4x + 13$, the input (x) is multiplied by -4 and then added to 13. The value of y depends on the value of x. What is the function of the x-values -4, 0, 1, and 3 in the equation?

Make up a new function and describe how to find the y-values.

3.3 Warm Up

Evaluate the expression for $x = -12$, 0, and 3.

1. $-x - 3$

2. $2x + 2$

3. $3x^2 - \left(2x - x^3\right)$

4. $x^2\left(3x - 5\right) + x$

5. $8x - x$

6. $x + 6x\left(2x + 3x\right) \div 4$

3.3 Cumulative Review Warm Up

Solve the inequality.

1. $5 + m < 8 + 2m$

2. $-d + 1 > 4d - 7$

3. $9g + 4g + 5 \geq -4 - 4g$

4. $2 - \dfrac{m}{2} \geq 7$

5. $4 - \dfrac{r}{-5} \geq 7$

6. $19 \geq 2\left(b + 5\right)$

Name _____ Date _____

3.3 Practice A

In Exercises 1–3, evaluate the function when $x = -2$, 0, and 5.

1. $f(x) = x - 3$ **2.** $g(x) = -2x$ **3.** $h(x) = 5 - 3x$

4. Let $c(t)$ be the number of customers in a department store t hours after 8 A.M. Explain the meaning of each statement.
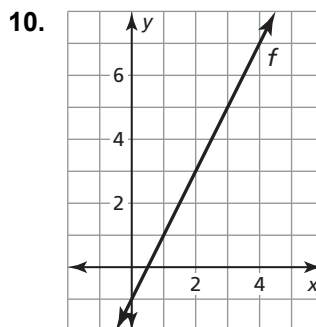
    a. $c(0) = 10$ **b.** $c(6) = c(7)$ **c.** $c(k) = 0$ **d.** $c(4) > c(3)$

In Exercises 5–8, find the value of x so that the function has the given value.

5. $f(x) = 6x;\ f(x) = -24$ **6.** $g(x) = -10x;\ g(x) = 15$

7. $f(x) = 3x - 5;\ f(x) = 4$ **8.** $h(x) = 14 - 8x;\ h(x) = -2$

In Exercises 9 and 10, find the value of x so that $f(x) = 7$.

9.

10.
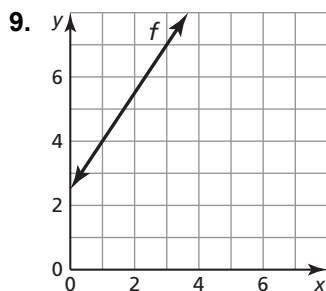
11. The function $C(x) = 29x + 54.5$ represents the cost (in dollars) of cable for x months, including the \$54.50 installation fee.

    a. How much would you have spent on cable after 6 months?

    b. How many months of cable service can you have for \$344.50?

In Exercises 12–15, graph the linear function.

12. $r(x) = 2$ **13.** $q(x) = -3x$

14. $g(x) = \frac{2}{5}x - 3$ **15.** $j(x) = -\frac{1}{3}x + 5$

16. Let f be a function. Use each statement to find the coordinates of a point on the graph of f.

    a. $f(-2)$ is equal to 7.   **b.** A solution of the equation $f(t) = 4$ is 2.

Name_____ Date _____

3.3 Practice B

In Exercises 1–3, evaluate the function when $x = -2$, 0, and 5.

1. $f(x) = 1.5x + 1$ **2.** $g(x) = 11 - 3x + 2$ **3.** $h(x) = -3 - x - 2$

4. Let $g(x)$ be the percent of your friends with a landline phone x years after 2000. Explain the meaning of each statement.

  a. $g(0) = 100$ **b.** $g(5) = g(6)$

  c. $g(10) = m$ **d.** $g(11) > g(12)$

In Exercises 5–8, find the value of x so that the function has the given value.

5. $f(x) = 8x - 7; f(x) = 17$ **6.** $g(x) = -4x + 7; g(x) = 27$

7. $f(x) = \frac{1}{3}x - 1; f(x) = 9$ **8.** $h(x) = 6 - \frac{2}{3}x; h(x) = -2$

In Exercises 9 and 10, find the value of x so that $f(x) = 7$.

9.

10.

In Exercises 11–14, graph the linear function.

11. $h(x) = -\frac{3}{2}x + 4$ **12.** $p(x) = \frac{1}{4}x - 1$

13. $v(x) = -5 + 2x$ **14.** $k(x) = 4 - 3x$

15. The function $C(x) = 35x + 75$ represents the labor cost (in dollars) for Bob's Auto Repair to replace your alternator, where x is the number of hours. The table shows sample labor costs from its main competitor, Budget Auto Repair. The alternator is estimated to take 5 hours of labor. Which company would you hire? Explain.

Hours	1	2	3
Cost	$90	$130	$170

Name _____ Date _____

Composition of Functions

Function Composition, $f(g(x))$ or $(f \circ g)(x)$, is applying the results of one function to the results of another. To perform a composition, you must combine the functions so that the output of one function becomes the input of another.

Example: If $f(x) = -x - 3$ and $g(x) = 2x + 7$, find $f(g(x))$ and $g(f(x))$.

$$f(g(x)) = -(2x + 7) - 3 \qquad\qquad g(f(x)) = 2(-x - 3) + 7$$
$$f(g(x)) = -2x - 7 - 3 \qquad\qquad g(f(x)) = -2x - 6 + 7$$
$$f(g(x)) = -2x - 10 \qquad\qquad g(f(x)) = -2x + 1$$

In Exercises 1–6, perform the indicated operation if $g(x) = 3x + 1$, $h(x) = -4x - 5$, and $p(x) = x^2$.

1. $h(g(x))$
2. $(g \circ g)(x)$
3. $h(g(p(x)))$

4. $h(x) + g(x)$
5. $g(p(-5))$
6. $h(x) - g(x)$

7. You work 40 hours a week at a high-end clothing store. You make $180 every week plus 3% commission on sales over $600. Assume you sell enough this week to earn a commission. Given the functions $f(x) = 0.03x$ and $g(x) = x - 600$, which composition of $(f \circ g)(x)$ or $(g \circ f)(x)$ represents your commission?

8. You make a purchase at a local furniture store, but the furniture you buy is too big to bring home yourself, so you have to have it delivered for a small fee. You pay for your purchase plus the sales tax and the fee. The sales tax is 7% while the fee is $40.

   a. Write a function $p(x)$ for the total purchase, including only the delivery fee.

   b. Write a function $t(x)$ for the total purchase, including only tax and not the delivery fee.

   c. Calculate $(p \circ t)(x)$ and $(t \circ p)(x)$. Then interpret both. Which results in a lower cost?

   d. If the furniture store is not allowed to tax the delivery fee, which is the appropriate composition for your situation?

Name_____   Date_____

3.3 Puzzle Time

How Does A Bee Get To School?

Circle the letter of each correct answer in the boxes below. The circled letters will spell out the answer to the riddle.

Evaluate the function for the given value of *x*.

1. $g(x) = x - 7; x = 4$

2. $f(x) = -2x; x = -6$

3. $k(x) = -\dfrac{3}{4}x - 11; x = -12$

4. $t(x) = 9x + 10; x = -\dfrac{1}{6}$

5. $g(x) = 15 - \dfrac{7}{8}x; x = 24$

6. $c(x) = 0.25x - 3; x = 10$

7. $w(x) = 21 - 6x - 13; x = \dfrac{1}{2}$

8. $p(x) = -\dfrac{1}{4}(x + 36) - 14; x = -8$

Find the value of *x* so that the function has the given value.

9. $b(x) = 8x; b(x) = -56$

10. $h(x) = -\dfrac{5}{6}x; h(x) = 10$

11. $n(x) = 16 - 0.5x; n(x) = 48$

12. $r(x) = \dfrac{8}{9}x - 17; r(x) = 15$

13. $s(x) = -3\left(x - \dfrac{2}{3}\right) + 19; s(x) = 0$

14. The local cable company charges $90 per month for basic cable and $12 per month for each additional premium cable channel. The function $c(x) = 90 + 12x$ represents the monthly charge (in dollars), where *x* represents the number of additional premium channels. How many additional premium channels would you have ordered if your bill was $114 per month?

B	I	V	T	K	T	C	A	J	E	K	I	G	E	O	S
4	5	−10	$\dfrac{17}{2}$	15	36	3	12	9	0	−21	−4	−13	−7	20	−6

M	T	N	H	S	E	D	B	R	U	F	A	Z	Q	P	Z
13	−0.5	25	2	−9	−2	−1	7	10	−12	−15	−25	−3	1	26	−64