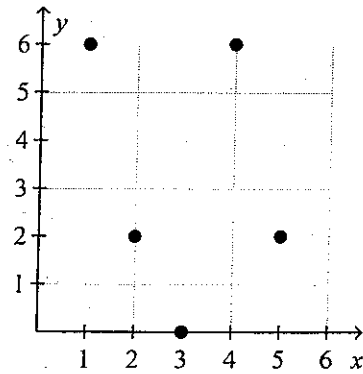


### Chapter 3 Study Guide

1. Which of the following relations or graphs are functions?

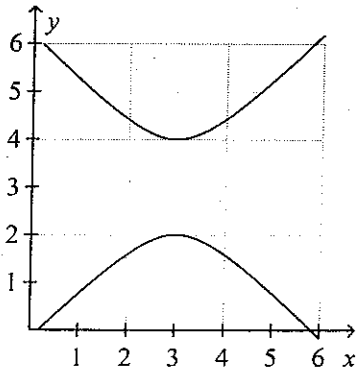
a.



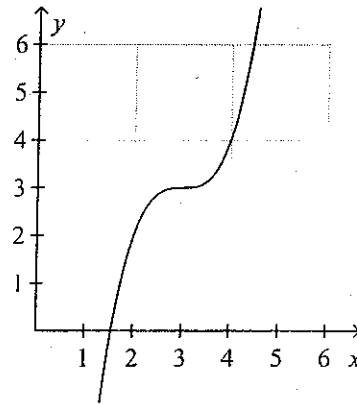
d.

Input, $x$	-5	-1	2	7
Output, $y$	9	7	6	4

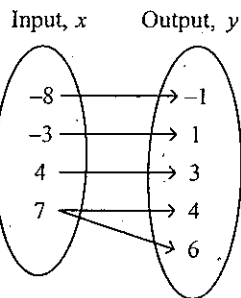
~~b.~~



e.



~~c.~~



f.

$(-3, -6), (-2, -4), (-1, -2), (0, 0), (2, 4)$

Determine whether the relation is a function and justify your decision. If the relation is a function, determine whether the function is *linear* or *nonlinear* and justify your choice.

2.

$x$	0	2	4	6
$y$	-8	-3	3	7

Handwritten annotations: Above the x-values, arrows indicate differences of +2 between 0 and 2, 2 and 4, and 4 and 6. Below the y-values, arrows indicate differences of +5 between -8 and -3, +6 between -3 and 3, and +4 between 3 and 7.

The table does represent a function because each input has exactly one output. It does not represent a linear function because it does not have constant rate of change.

3.

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

Handwritten annotations: Above the x-values, arrows indicate differences of +1 between 0 and 1, 1 and 2, and 2 and 3. Below the y-values, arrows indicate differences of +2 between -4 and -2, -2 and 0, and 0 and 2.

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

Yes, the table represents a function because each input has exactly one output. It is a linear function because the function has a CONSTANT average rate of change.

4.  $2y - 4 = 10$

$$\begin{array}{r} +4 \quad +4 \\ \hline 2y = 14 \\ \hline y = 7 \end{array}$$

Yes, it is a function. All inputs have exactly one output (the output of 7).

It is also a linear function because you can write it in slope-intercept form  $\rightarrow y = 0x + 7$ .

5.  $2xy = -8$

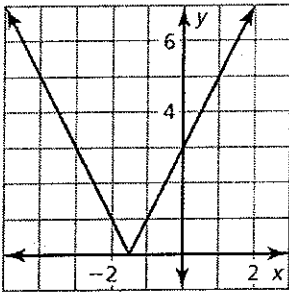
$$y = \frac{-8}{2x}$$

Yes, it is a function because each  $x$  would only have 1  $y$ .

However, it is not linear because you cannot write the equation in slope-intercept form.

Find the domain and range of the function represented by the graph. Determine whether the domain is *discrete* or *continuous*.

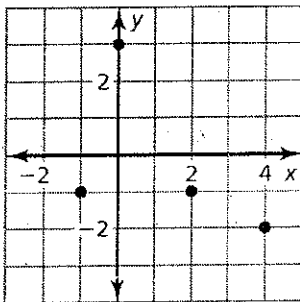
6.



Continuous domain:  $\{-\infty < x < \infty\}$  or  $\mathbb{R}$

Range:  $\{y \geq 0\}$

7.



Discrete domain:  $\{-1, 0, 2, 4\}$

Range:  $\{-2, -1, 3\}$

Evaluate the function when  $x = -3$  and  $1$ . Show your substitution.

$$8. \quad h(x) = |-2x + 6| \quad h(-3) = |-2(-3) + 6| \quad h(1) = |-2(1) + 6|$$

$$h(-3) = |6 + 6| \quad h(1) = |-2 + 6|$$

$$h(-3) = |12| \quad h(1) = |4|$$

$$\boxed{h(-3) = 12} \quad \boxed{h(1) = 4}$$

$$9. \quad f(x) = \frac{1}{2}x - 1$$

$$f(-3) = \frac{1}{2}(-3) - 1$$

$$= -\frac{3}{2} - 1$$

$$= -\frac{3}{2} - \frac{2}{2}$$

$$\boxed{f(-3) = -\frac{5}{2}}$$

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

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

$$\boxed{f(1) = -\frac{1}{2}}$$

Find the value of  $x$  so that the function has the given value. Show your substitution.

10.  $j(x) = 3 - x$ ;  $j(x) = -5$

$$-5 = 3 - x$$

$$-3 \quad -3$$

$$-8 = -x$$

$$\boxed{8 = x}$$

11.  $k(x) = \frac{3}{2}x - 1$ ;  $k(x) = -4$

$$-4 = \frac{3}{2}x - 1$$

$$\frac{2}{2} \cdot \frac{-1}{3} = \frac{2}{2} \cdot \frac{3}{2}x \cdot \frac{2}{3}$$

$$\boxed{-2 = x}$$

Find the  $x$ - and  $y$ -intercepts of the graph of the linear equation. Be sure to show work and to identify and list the intercepts as ordered pairs.

12.  $2x + 5y = -8$

$x$ -int. let  $y = 0$

$$2x = -8$$

$$x = -4$$

$$\boxed{(-4, 0)}$$

$y$ -int. let  $x = 0$

$$5y = -8$$

$$y = \frac{-8}{5} = -1.6$$

$$\boxed{(0, \frac{-8}{5}) \text{ or } (0, -1.6)}$$

13.  $-67 + 3x = 14 - 9y$

$$+9y \quad +9y$$

$$3x + 9y - 67 = 14$$

$$+67 \quad +67$$

$$3x + 9y = 81$$

$x$ -int. let  $y = 0$

$$3x = 81$$

$$x = 27$$

$$\boxed{(27, 0)}$$

$y$ -int. let  $x = 0$

$$9y = 81$$

$$y = 9$$

$$\boxed{(0, 9)}$$

The points represented by the table lie on a line. Give the formula for slope then find the slope of the line.

14.

$x$	$x_1$	-4	-3	$x_2$
$y$	$y_1$	3	3	$y_2$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{3 - 3}{2 - 1} = \frac{0}{1} = \boxed{0}$$

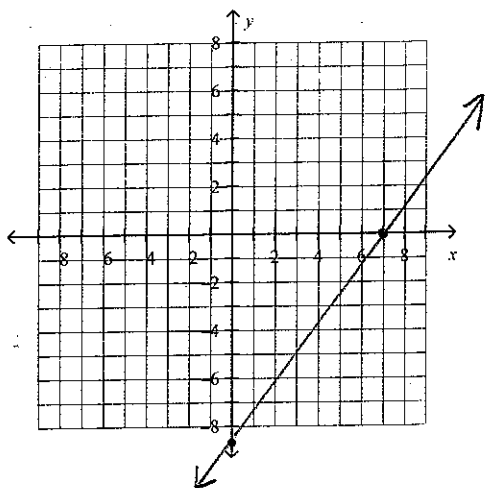
15.

$x$	$x_1$	3	7	-1
$y$	$y_1$	-1	8	-4

$$m = \frac{2 - (-1)}{3 - 1} = \boxed{\frac{3}{2}}$$

Graph the linear equation.

16.  $9x - 7y = 63$

x-int. let  $y = 0$ 

$$9x = 63$$

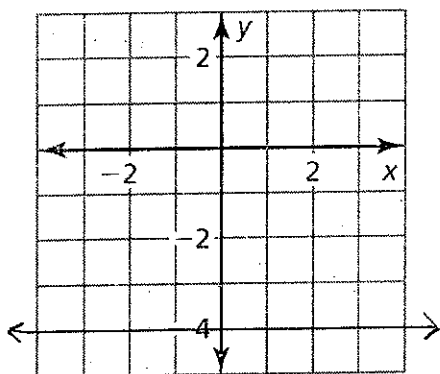
$$x = 7 \quad (7, 0)$$

y-int. let  $x = 0$ 

$$-7y = 63$$

$$y = -9 \quad (0, -9)$$

17.  $-2y - 4 = 4$



$$\begin{array}{r} -2y - 4 = 4 \\ +4 \quad +4 \end{array}$$

$$\begin{array}{r} -2y = 8 \\ -2 \quad -2 \end{array}$$

$$y = -4 \rightarrow \text{horizontal line}$$

18. Let  $s(t)$  be the speed (in meters per second) of an object after  $t$  seconds of motion. Explain the meaning of each statement.

a.  $s(0) = 9$

At time zero the object is moving 9 meters/second.  
(Before timing)

b.  $s(9) = k$

After 9 seconds of motion, the object is moving  $k$  meters per second.

c.  $s(10) > s(20)$

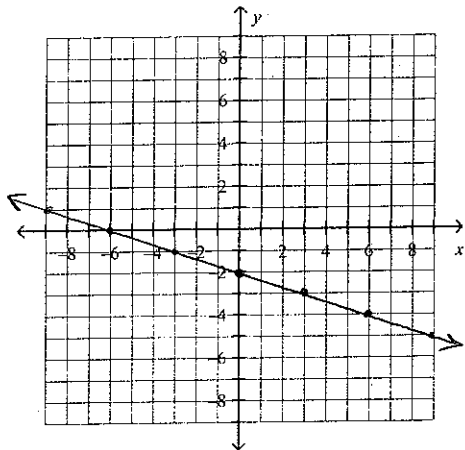
The object is moving slower after 20 seconds than after 10 seconds.

Identify the slope, y-intercept, and x-intercept of the graph of the linear equation.

19.  $y = -x + 3$   
 $m = -\frac{1}{1}$   $y$ -int.  $(0, 3)$   
 $x$ -int. let  $y = 0$   
 $0 = -x + 3$   
 $-3 = -x$   
 $3 = x$   $(3, 0)$   $x$ -int.
20.  $4x - 6y = 14$   
 $x$ -int. let  $y = 0$   
 $4x = 14$   
 $x = \frac{14}{4} = \frac{7}{2}$   
 $x$ -int.  $(\frac{7}{2}, 0)$  or  $(3.5, 0)$   
 $y$ -int. let  $x = 0$   
 $-6y = 14$   
 $y = -\frac{14}{6} = -\frac{7}{3}$   
 $y$ -int.  $(0, -\frac{7}{3})$   
 $4x - 6y = 14$   
 $-6y = -4x + 14$   
 $y = -\frac{4}{6}x - \frac{14}{6}$   
 $y = -\frac{2}{3}x - \frac{7}{3}$   
 $m = \frac{2}{3}$
21.  $3y + 4 = -10$   
 $-4 -4$   
 $3y = -14$   
 $y = -\frac{14}{3}$  horizontal line  
 $(0, -\frac{14}{3})$   $y$ -int.  
 $m = 0$  no  $x$ -intercept

Graph the linear function.

22.  $g(x) = -\frac{1}{3}x - 2$   
 $m = -\frac{1}{3}$   $b = -2$   
 $y$ -int.  $(0, -2)$



23. A submersible that is exploring the ocean floor begins to descend to the ocean floor. The elevation  $h$  (in feet) of the submersible is modeled by the function  $h(t) = -650t + 13,000$ , where  $t$  is the time (in minutes) since the submersible began to descend.

a. Identify the independent and dependent variables.

independent variable = time (in minutes)  
dependent variable = elevation (in feet)

b. How far down will the sub be after 4 minutes?

$$h(4) = -650(4) + 13,000$$

$$h(4) = -2600 + 13,000$$

$$h(4) = 10,400$$

The sub will have descended  
10,400 feet after 4 seconds.

c. How long will it take for the sub to have descended 6,500 feet?

$$\begin{array}{r} 6,500 = -650x + 13,000 \\ -13,000 \quad \quad \quad -13,000 \\ \hline -6,500 = -650x \end{array}$$

$$\begin{array}{r} -6,500 = -650x \\ \hline -650 \quad \quad -650 \\ \hline 10 = x \end{array}$$

It will take 10 seconds  
for the sub to descend 6,500 feet.

Use the graphs or the equations of  $f$  and  $g$  to describe the transformation from the graph of  $f$  to the graph of  $g$ .

24.  $f(x) = 2x - 4$ ;  $g(x) = 8f(x)$

$g(x)$  is a vertical stretch by a factor of 8 of  $f(x)$ .

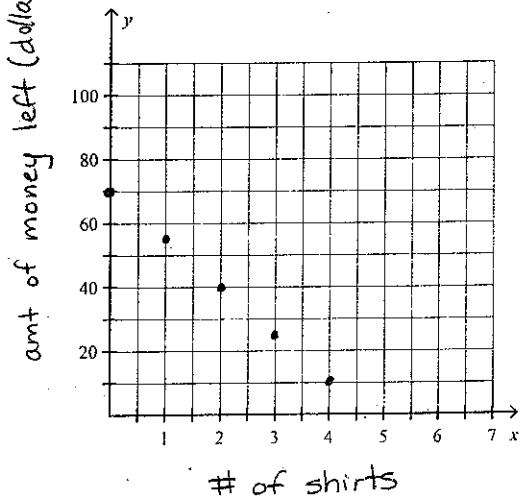
25. Let  $f(x) = x - 3$  and  $g(x) = \frac{1}{3}f(x) + 5$ . Describe the transformation from the graph of  $f$  to the graph of  $g$ .

$g(x)$  is a vertical compression and shift up 5 of  $f(x)$ .

26. The function  $a = 70 - 14.99n$  represents the amount  $a$  of money (in dollars) that you have after buying  $n$  shirts.

a. Find the domain of the function. Is the domain discrete or continuous? Explain.

b. Graph the function using its domain.



$$D: \{0, 1, 2, 3, 4\}$$

The domain is discrete because you cannot buy a part of a shirt.

$$a = -14.99n + 70$$

$n$	$a$
0	70
1	55.01
2	40.02
3	25.03
4	

$$a = -14.99(1) + 70$$

$$a = 55.01$$

$$a = -14.99(2) + 70$$

$$a = 40.02$$

$$a = -14.99(3) + 70$$

$$a = 25.03$$

$$a = -14.99(4) + 70$$

$$a = 10.04$$

$$a = -14.99(5) + 70$$

$$a = -4.95 \rightarrow \text{not possible}$$



27. You are the baseball team captain and T-shirts are to be ordered for your season. T-shirts with a number on the back cost \$10. T-shirts with a name and number cost \$15. You have \$180 to spend on T-shirts for the team.

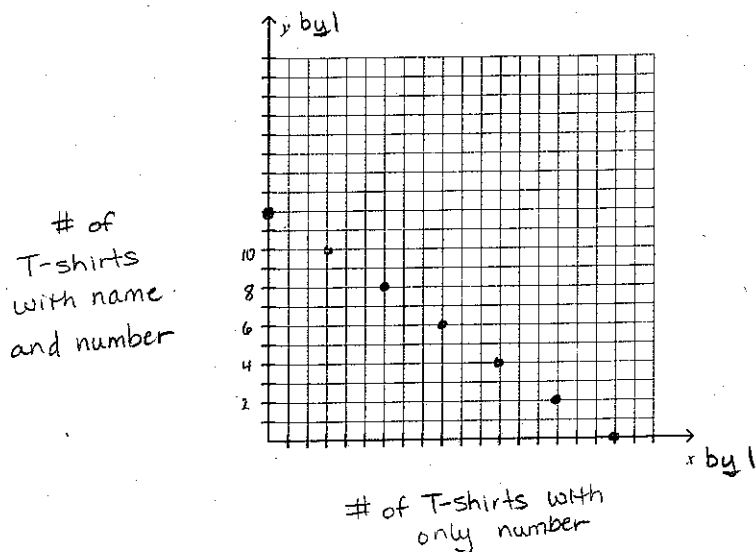
a. Write an equation that models the total cost of the T-shirts. Explain the meaning of each variable.

$$10x + 15y = 180$$

$x$  = # of shirts with just a number

$y$  = # of shirts with a name and number

b. Create a graph of the equation and interpret the intercepts.



x-int. let  $y = 0$

$$10x = 180$$

$$x = 18 \quad (18, 0)$$

y-int. let  $x = 0$

$$15y = 180$$

$$y = 12 \quad (0, 12)$$

$$15y = -10x + 180$$

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

- c. There are 7 members of the team who want their names and numbers on the back of their T-shirts. If you accommodate all of them, will you have enough money to get everyone on the 15 person team a T-shirt? Explain.

$$7 = y \quad \text{so that means } 8 = x$$

$$10(8) + 15(7) \stackrel{?}{=} 180$$

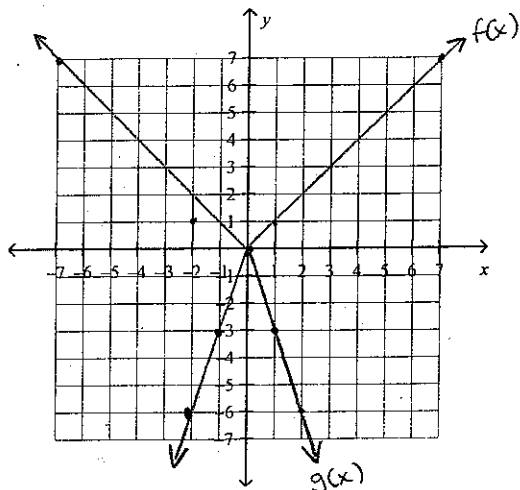
$$80 + 105 \stackrel{?}{=} 180$$

$$185 \neq 180$$

No, if you order 7 members a name and number shirt, you will not have enough money to buy the other 8 members a T-shirt.

Graph the function. Compare the graph to the graph of  $f(x) = |x|$ . Describe the domain and range.

28.  $g(x) = -3|x|$



x	g(x)
-2	-6
-1	-3
0	0
1	-3
2	-6

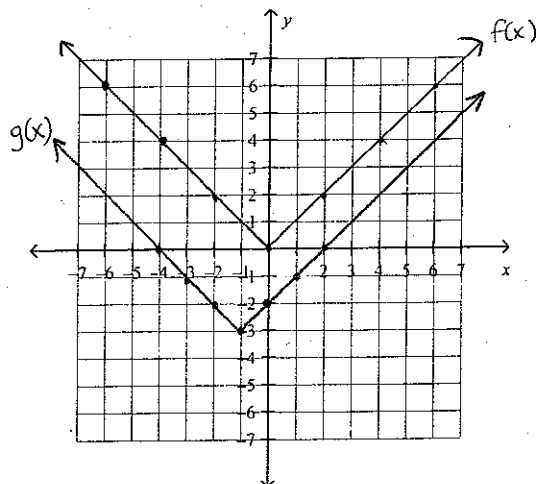
$g(x)$  is a reflection over the x-axis and a vertical stretch by a factor of 3 of  $f(x)$ .

D:  $\mathbb{R}$

R:  $\{y \leq 0\}$

Describe the transformations from the graph of  $f(x) = |x|$  to the graph of the given function. Then graph the given function.

29.  $g(x) = |x+1| - 3$       Vertex  $(-1, -3)$



$g(x)$  is a shift left 1 and a shift down 3 of  $f(x)$ .

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