Section 1.1

1. Find the value of y that corresponds to $x=3$ in $y=-2+4(x-3)$.

$y=-2$

2. Find the value of x that corresponds to $y=3$ in $y=3-2(x+1)$.

$3=3-2(x+1) \rightarrow 0=-2(x+1)$

$x=-1$

In Exercises 3 and 4, find the value of m that corresponds to the values of x and y.

3. $x=5, \quad y=2, \qquad m=\dfrac{y-3}{x-4}$ $= \dfrac{-1}{1} = -1$

4. $x=-1, y=-3, \quad m=\dfrac{2-y}{3-x}$ $= \dfrac{5}{4}$

$$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

In exercises 5 and 6, determine whether the ordered pair is a solution to the equation.

5. $3x-4y=5$

a) $\left(2, \frac{1}{4}\right)$ Yes

b) $(3,-1)$ No

6. $y=-2x+5$

a) $(-1,7)$ Yes

b) $(-2,1)$ No

In exercises 7 and 8, find the distance between the points.

7. $(1,0)$ and $(0,1)$

$$d = \sqrt{(0-1)^2+(1-0)^2}$$

$$= \sqrt{1+1}$$

$$= \sqrt{2}$$

8. $(2,1)$ and $\left(1, -\frac{1}{3}\right)$

$$d = \sqrt{(2-1)^2+(1--1/3)^2}$$

$$= \sqrt{1+16/9}$$

$$= \sqrt{\frac{25}{9}} = 5/3$$

In Exercises 9 and 10, solve for y in terms of x.

9. $4x - 3y = 7$

$-3y = 7 - 4x$

$y = -\frac{7}{3} + \frac{4}{3}x$

10. $-2x + 5y = -3$

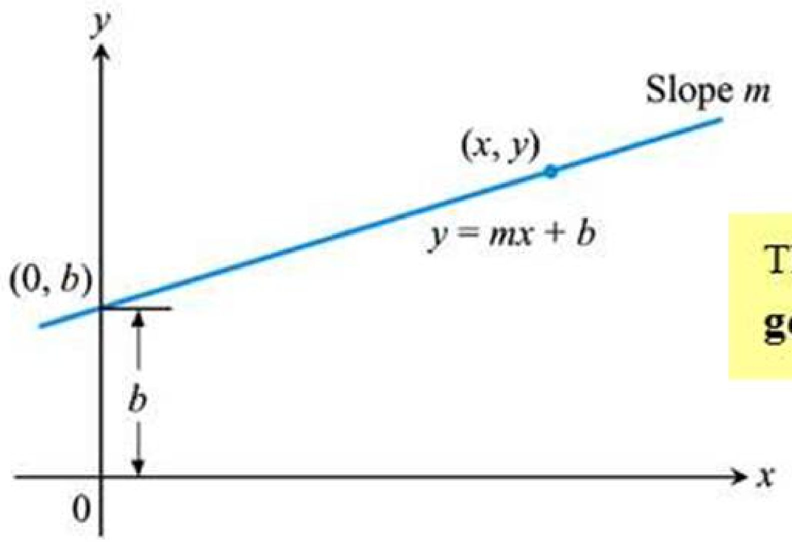
$5y = 2x - 3$

$y = \frac{2}{5}x - \frac{3}{5}$

The equation $y = m(x - x_1) + y_1$ is the **point - slope equation** of the line through the point (x_1, y_1) with slope m.

$y - y_0 = m(x - x_0)$

The equation $y = mx + b$ is the **slope - intercept equation** of the line with slope m and y-intercept b.



The equation $Ax + By = C$ (A and B not both 0) is a **general linear equation** in x and y.

Section 1.2

Functions and Graphs

In Exercises 1 – 6, solve for x.

1. $3x-1 \le 5x+3$
2. $x(x-2) > 0$
3. $|x-3| \le 4$
4. $|x-2| \ge 5$
5. $x^2 < 16$
6. $9-x^2 \ge 0$

(1)

$3x-1 \le 5x+3$

$-5x \quad +1 \quad -5x \quad +1$

$-2x \le 4$

$/-2 \quad /-2$

$x \ge -2$

Interval: $[-2, \infty)$

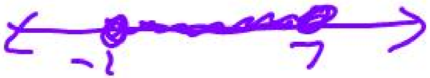
Graph

(3)

$-4 \le x-3 \le 4$

$+3 \quad +3 \quad +3$

$-1 \le x \le 7$



$x-2 \ge 5$ or $x-2 \le -5$

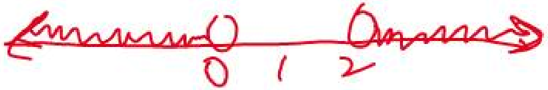
$x \ge 7$ or $x \le -3$

(2)

x	$-$		$+$		$+$
$x-2$	$-$		$-$		$+$
	$+$	0	$-$	2	$+$

$x < 0$ or $x > 2$

$(-\infty, 0) \cup (2, \infty)$



In Exercises 7 and 8, describe how the graph of f can be transformed to the graph of g.

7. $f(x)=x^2$, $g(x)=(x+2)^2-3$

8. $f(x)=|x|$, $g(x)=|x-5|+2$

7. translate f 2 units left and 3 units down
8. translate f(x) 5 right and 2 units up

In Exercises 9 – 12, find all real solutions to the equations.

9. $f(x) = x^2 - 5$

(a) $f(x) = 4$

(b) $f(x) = -6$

9a

$x^2 - 5 = 4$

$x^2 = 9$

$x = \pm 3$

9b

$x^2 - 5 = -6$

$x^2 = -1$

$x = \pm i$

$\nexists$

No real SOLUTION

10. $f(x) = \dfrac{1}{x}$

(a) $f(x) = -5$

(b) $f(x) = 0$

10a

$\dfrac{1}{x} = -5$

$x = -1/5$

$\dfrac{1}{x} = 0$

$\nexists$

NO SOLUTION

11. $f(x)=\sqrt{x+7}$

(a) $f(x)=4$; $x=9$ (b) $f(x)=1$ $x={}^{-}6$

12. $f(x)=\sqrt[3]{x-1}$

(a) $f(x)=-2$ (b) $f(x)=3$

$\sqrt[3]{x-1}=-2$

$x-1=-8$

$x={}^{-}7$

$\sqrt[3]{x-1}=3$

$x-1=27$

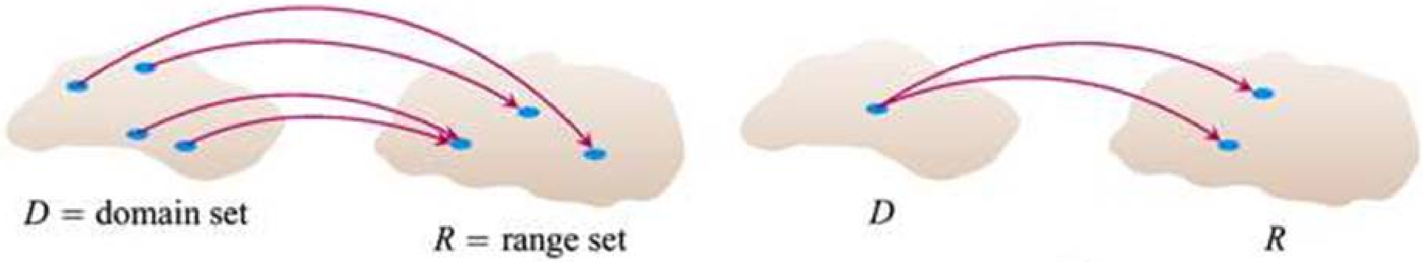
$x=28$

Functions

A rule that assigns to each element in one set a unique element in another set is called a *function.* A function is like a machine that assigns a unique output to every allowable input. The inputs make up the *domain* of the function; the outputs make up the *range*.

A ***function*** from a set D to a set R is a rule that assigns a unique element in R to each element in D.

In this definition, D is the domain of the function and R is a set containing the range.



(a) (b)

Not a function

- The domains and ranges of many real-valued functions of a real variable are intervals or combinations of intervals. The intervals may be **open**, **closed** or **half-open, finite** or **infinite.**

- The endpoints of an interval make up the interval's **boundary** and are called **boundary points**.

- The remaining points make up the interval's **interior** and are called **interior points**.

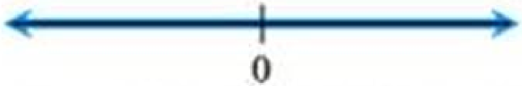
- **Closed intervals** contain their boundary points.
- **Open intervals** contain no boundary points

Name: Open interval ab
Notation: $a < x < b$ or (a, b)

Closed at a and open at b
Notation: $a \leq x < b$ or $[a, b)$

Name: Closed interval ab
Notation: $a \leq x \leq b$ or $[a, b]$

Open at a and closed at b
Notation: $a < x \leq b$ or $(a, b]$



Name: The set of all real numbers
Notation: $-\infty < x < \infty$ or $(-\infty, \infty)$

Name: The set of numbers greater than a
Notation: $a < x$ or (a, ∞)

Name: The set of numbers greater than or equal to a
Notation: $a \leq x$ or $[a, \infty)$

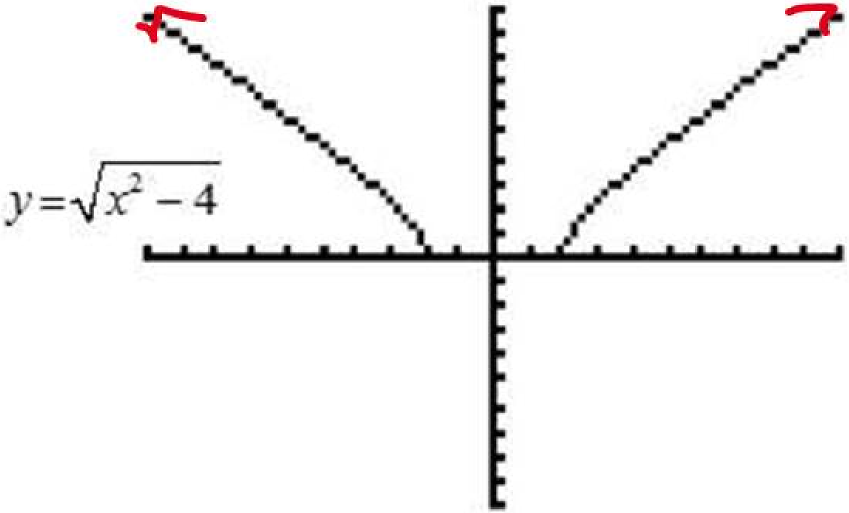
Name: The set of numbers less than b
Notation: $x < b$ or $(-\infty, b)$

Name: The set of numbers less than or equal to b
Notation: $x \leq b$ or $(-\infty, b]$

Identify the domain and range and use a grapher to graph the function $y=\sqrt{x^2-4}$

Domain: The function gives a real value of y for each value of $|x| \geq 2$ so the domain is $(-\infty,-2] \cup [2,\infty)$.

Range: Every value of the domain, x, gives a real, positive value of y so the range is $[0,\infty)$.



[−10, 10] by [−10, 10]

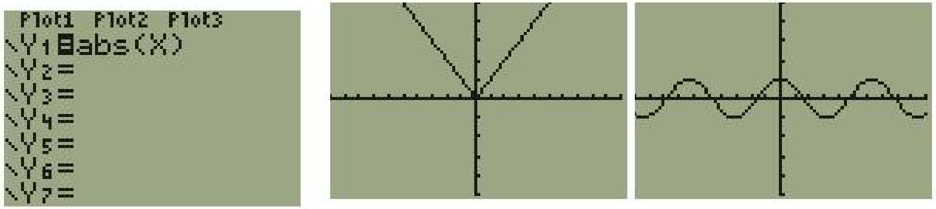
- The graphs of *even* and *odd* functions have important symmetry properties.

A function $y = f(x)$ is a

even function of x if $f(-x) = f(x)$

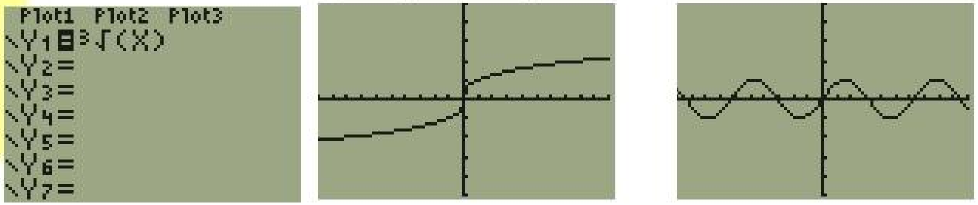
odd function of x if $f(-x) = -f(x)$

for every x in the function's domain.



Even functions have y-axis symmetry

Odd functions have origin symmetry.

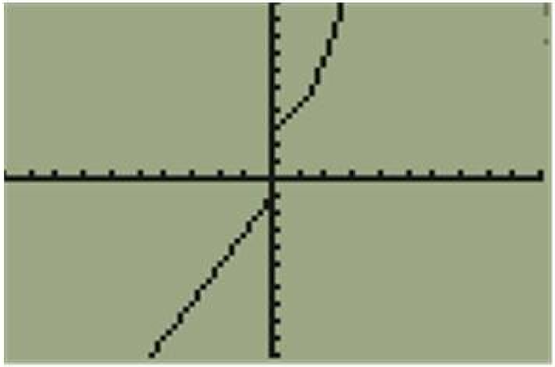


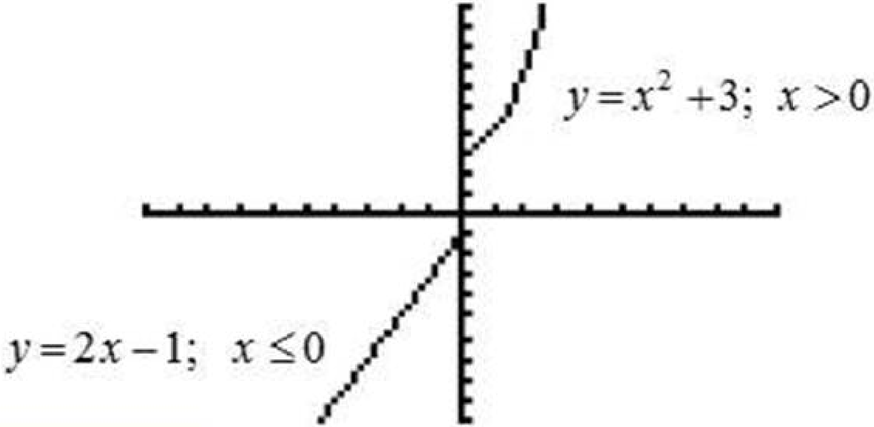
- The graph of an **even** function is **symmetric about the *y*-axis**. A point (x,y) lies on the graph if and only if the point $(-x,y)$ lies on the graph.

- The graph of an **odd** function is **symmetric about the origin.** A point (x,y) lies on the graph if and only if the point $(-x,-y)$ lies on the graph.

Use a grapher to graph the following piecewise function:

$$f(x)=\begin{cases}2x-1 & x\le 0\\ x^2+3 & x>0\end{cases}$$





[−10, 10] by [−10, 10]

The absolute value function $y=|x|$ is defined piecewise by the formula

$$|x|=\begin{cases}-x, & x<0\\ x, & x\ge 0\end{cases}$$

Given $f(x)=2x-3$ and $g(x)=5x$, find $f\circ g$. $= f(g(x))$

$$= f(5x)$$

$$= 2(5x)-3$$

$$= 10x-3$$

$$\underbrace{f\circ f\circ g}\circ f(2) =$$

$$f\circ f\circ g(2(2)-3) = f\circ f\circ g(1) = f\circ f(5)$$

$$= f(2(5)-3) = f(7) = 2(7)-3 = 11$$

Standardized Test Questions

False, because $m = \Delta y / \Delta x$ and $\Delta x = 0$ in a vertical line making m undefined

47. True or False The slope of a vertical line is zero. Justify your answer.

False, because $m\left(\frac{1}{m}\right) = 1 \neq -1$

48. True or False The slope of a line perpendicular to the line $y = mx + b$ is $1/m$. Justify your answer.

49. Multiple Choice Which of the following is an equation of the line through $(-3, 4)$ with slope $1/2$?

(A) $y - 4 = \frac{1}{2}(x + 3)$ (B) $y + 3 = \frac{1}{2}(x - 4)$

(C) $y - 4 = -2(x + 3)$ (D) $y - 4 = 2(x + 3)$

(E) $y + 3 = 2(x - 4)$

50. Multiple Choice Which of the following is an equation of the vertical line through $(-2, 4)$?

(A) $y = 4$ (B) $x = 2$ (C) $y = -4$

(D) $x = 0$ (E) $x = -2$

51. Multiple Choice Which of the following is the x-intercept of the line $y = 2x - 5$?

(A) $x = -5$ (B) $x = 5$ (C) $x = 0$

(D) $x = 5/2$ (E) $x = -5/2$

52. Multiple Choice Which of the following is an equation of the line through $(-2, -1)$ parallel to the line $y = -3x + 1$?

(A) $y = -3x + 5$ (B) $y = -3x - 7$ (C) $y = \frac{1}{3}x - \frac{1}{3}$

(D) $y = -3x + 1$ (E) $y = -3x - 4$

$y - {}^-1 = -3(x - {}^-2)$

$y = -3x - 6 - 1$

59. Multiple Choice Which of the following gives the domain of $f(x) = \dfrac{x}{\sqrt{9 - x^2}}$?

(A) $x \neq \pm 3$ (B) $(-3, 3)$ (C) $[-3, 3]$

(D) $(-\infty, -3) \cup (3, \infty)$ (E) $(3, \infty)$

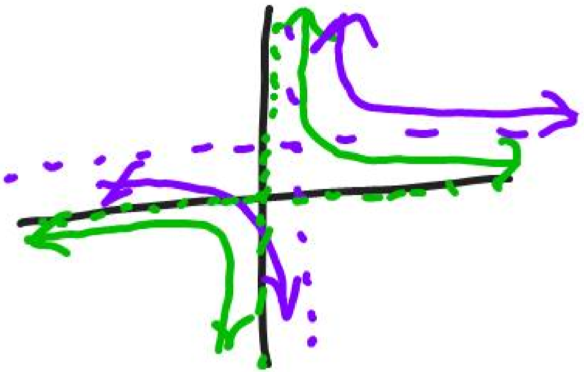
60. Multiple Choice Which of the following gives the range of

* $f(x) = 1 + \dfrac{1}{x - 1}$?

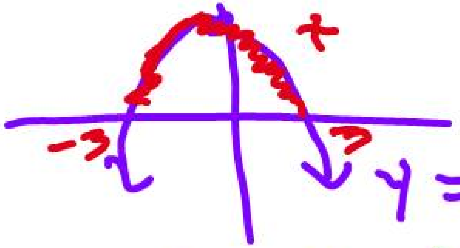
(A) $(-\infty, 1) \cup (1, \infty)$ (B) $x \neq 1$ (C) all real numbers

(D) $(-\infty, 0) \cup (0, \infty)$ (E) $x \neq 0$

$g(x) = 1/x$



$9 - x^2 > 0$



$y = 9 - x^2$

$9 - x^2 = (3+x)(3-x)$

		-3		3	
$3+x$	$-$		$+$		$+$
$3-x$	$+$		$+$		$-$
	$(-)$		$(+)$		$(-)$

61. Multiple Choice If $f(x) = 2x - 1$ and $g(x) = x + 3$, which of the following gives $(f \circ g)(2)$?

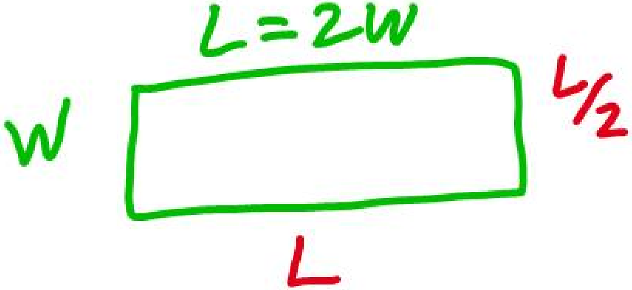
$f(g(2)) = f(5) = 10 - 1 = 9$

(A) 2 (B) 6 (C) 7 (D) 9 (E) 10

62. Multiple Choice The length L of a rectangle is twice as long as its width W. Which of the following gives the area A of the rectangle as a function of its width?

(A) $A(W) = 3W$ (B) $A(W) = \frac{1}{2}W^2$ (C) $A(W) = 2W^2$

(D) $A(W) = W^2 + 2W$ (E) $A(W) = W^2 - 2W$



$A(w) = 2w^2$

$P(L) = 2L + 2\left(\frac{L}{2}\right) = 3L$