

## Mid-Chapter Quiz: Lessons 6-1 through 6-4

Given  $f(x) = 2x^2 + 4x - 3$  and  $g(x) = 5x - 2$ , find each function.

1.  $(f + g)(x)$

**SOLUTION:**

$$\begin{aligned}(f + g)(x) &= 2x^2 + 4x - 3 + 5x - 2 \\ &= 2x^2 + 9x - 5\end{aligned}$$

2.  $(f - g)(x)$

**SOLUTION:**

$$\begin{aligned}(f - g)(x) &= 2x^2 + 4x - 3 - (5x - 2) \\ &= 2x^2 + 4x - 3 - 5x + 2 \\ &= 2x^2 - x - 1\end{aligned}$$

3.  $(f \cdot g)(x)$

**SOLUTION:**

$$\begin{aligned}(f \cdot g)(x) &= (2x^2 + 4x - 3)(5x - 2) \\ &= 10x^3 - 4x^2 + 20x^2 - 8x - 15x + 6 \\ &= 10x^3 + 16x^2 - 23x + 6\end{aligned}$$

4.  $\left(\frac{f}{g}\right)(x)$

**SOLUTION:**

$$\left(\frac{f}{g}\right)(x) = \frac{2x^2 + 4x - 3}{5x - 2}, x \neq \frac{2}{5}$$

5.  $[f \circ g](x)$

**SOLUTION:**

$$\begin{aligned}[f \circ g](x) &= f(g(x)) \\ &= f(5x - 2) \\ &= 2(5x - 2)^2 + 4(5x - 2) - 3 \\ &= 2(25x^2 + 4 - 20x) + 20x - 8 - 3 \\ &= 50x^2 + 8 - 40x + 20x - 11 \\ &= 50x^2 - 20x - 3\end{aligned}$$

6.  $[g \circ f](x)$

**SOLUTION:**

$$\begin{aligned}[g \circ f](x) &= g(f(x)) \\ &= g(2x^2 + 4x - 3) \\ &= 5(2x^2 + 4x - 3) - 2 \\ &= 10x^2 + 20x - 15 - 2 \\ &= 10x^2 + 20x - 17\end{aligned}$$

7. **SHOPPING** Mrs. Ross is shopping for her children's school clothes. She has a coupon for 25% off her total. The sales tax of 6% is added to the total after the coupon is applied.

a. Express the total price after the discount and the total price after the tax using function notation. Let  $x$  represent the price of the clothing,  $p(x)$  represent the price after the 25% discount, and  $g(x)$  represent the price after the tax is added.

b. Which composition of functions represents the final price,  $p[g(x)]$  or  $g[p(x)]$ ? Explain your reasoning.

**SOLUTION:**

a. The total price after the discount is  $p(x) = 0.75x$ .

The total price after the tax is  $g(x) = 1.06x$ .

b. Since  $g[p(x)] = g[p(x)]$ ; either function represents the price.

**Mid-Chapter Quiz: Lessons 6-1 through 6-4**

Determine whether each pair of functions are inverse functions. Write *yes* or *no*.

$$f(x) = 2x + 16$$

8.  $g(x) = \frac{1}{2}x - 8$

**SOLUTION:**

$$\begin{aligned} [f \circ g](x) &= f(g(x)) \\ &= f\left(\frac{1}{2}x - 8\right) \\ &= 2\left(\frac{1}{2}x - 8\right) + 16 \\ &= x - 16 + 16 \\ &= x \end{aligned}$$

$$\begin{aligned} [g \circ f](x) &= g(f(x)) \\ &= g(2x + 16) \\ &= \frac{1}{2}(2x + 16) - 8 \\ &= x + 8 - 8 \\ &= x \end{aligned}$$

$$[g \circ f](x) = [f \circ g](x) = x$$

Therefore, they are inverse functions.

$$g(x) = 4x + 15$$

9.  $h(x) = \frac{1}{4}x - 15$

**SOLUTION:**

$$\begin{aligned} [h \circ g](x) &= h(g(x)) \\ &= h(4x + 15) \\ &= \frac{1}{4}(4x + 15) - 15 \\ &= x + \frac{15}{4} - 15 \\ &= x - \frac{45}{4} \end{aligned}$$

$$\begin{aligned} [g \circ f](x) &= g(h(x)) \\ &= g\left(\frac{1}{4}x - 15\right) \\ &= 4\left(\frac{1}{4}x - 15\right) + 15 \\ &= x - 60 + 15 \\ &= x - 45 \end{aligned}$$

$$[g \circ h](x) \neq [h \circ g](x)$$

Therefore, they are *not* inverse functions.

**Mid-Chapter Quiz: Lessons 6-1 through 6-4**

10.  $f(x) = x^2 - 5$   
 $g(x) = 5 + x^{-2}$

**SOLUTION:**

$$\begin{aligned} [f \circ g](x) &= f(g(x)) \\ &= f(5 + x^{-2}) \\ &= (5 + x^{-2})^2 - 5 \\ &= 25 + x^{-4} + 10x^{-2} - 5 \\ &= x^{-4} + 10x^{-2} + 20 \end{aligned}$$

$$\begin{aligned} [g \circ f](x) &= g(f(x)) \\ &= g(x^2 - 5) \\ &= 5 + (x^2 - 5)^{-2} \\ &= 5 + \frac{1}{(x^2 - 5)^2} \\ &= 5 + \frac{1}{x^4 + 25 - 10x^2} \\ &= \frac{5x^4 - 50x^2 + 126}{x^4 + 25 - 10x^2} \end{aligned}$$

$$[g \circ f](x) \neq [f \circ g](x)$$

Therefore, they are *not* inverse functions.

11.  $g(x) = -6x + 8$   
 $h(x) = \frac{8-x}{6}$

**SOLUTION:**

$$\begin{aligned} [h \circ g](x) &= h(g(x)) \\ &= h(-6x + 8) \\ &= \frac{8 - (-6x + 8)}{6} \\ &= \frac{8 + 6x - 8}{6} \\ &= x \end{aligned}$$

$$\begin{aligned} [g \circ f](x) &= g(h(x)) \\ &= g\left(\frac{8-x}{6}\right) \\ &= -6\left(\frac{8-x}{6}\right) + 8 \\ &= -8 + x + 8 \\ &= x \end{aligned}$$

$$[g \circ h](x) = [h \circ g](x) = x$$

Therefore, they are inverse functions.

## Mid-Chapter Quiz: Lessons 6-1 through 6-4

Find the inverse of each function, if it exists.

12.  $h(x) = \frac{2}{5}x + 8$

**SOLUTION:**

$$h(x) = \frac{2}{5}x + 8$$

Substitute  $h^{-1}(x)$  for  $x$  and  $x$  for  $h(x)$ .

$$x = \frac{2}{5}h^{-1}(x) + 8$$

Solve for  $h^{-1}(x)$ .

$$\frac{2}{5}h^{-1}(x) = x - 8$$

$$h^{-1}(x) = \frac{5}{2}(x - 8)$$

13.  $f(x) = \frac{4}{9}(x - 3)$

**SOLUTION:**

$$f(x) = \frac{4}{9}(x - 3)$$

Substitute  $f^{-1}(x)$  for  $x$  and  $x$  for  $f(x)$ .

$$x = \frac{4}{9}(f^{-1}(x) - 3)$$

Solve for  $f^{-1}(x)$ .

$$f^{-1}(x) - 3 = \frac{9}{4}x$$

$$f^{-1}(x) = \frac{9}{4}x + 3$$

14.  $h(x) = -\frac{10}{3}(x + 5)$

**SOLUTION:**

$$h(x) = -\frac{10}{3}(x + 5)$$

Substitute  $h^{-1}(x)$  for  $x$  and  $x$  for  $h(x)$ .

$$x = -\frac{10}{3}(h^{-1}(x) + 5)$$

Solve for  $h^{-1}(x)$ .

$$h^{-1}(x) + 5 = -\frac{3}{10}x$$

$$h^{-1}(x) = -\frac{3}{10}x - 5$$

15.  $f(x) = \frac{x + 12}{7}$

**SOLUTION:**

$$f(x) = \frac{x + 12}{7}$$

Substitute  $f^{-1}(x)$  for  $x$  and  $x$  for  $f(x)$ .

$$x = \frac{f^{-1}(x) + 12}{7}$$

Solve for  $f^{-1}(x)$ .

$$f^{-1}(x) + 12 = 7x$$

$$f^{-1}(x) = 7x - 12$$

## Mid-Chapter Quiz: Lessons 6-1 through 6-4

16. **JOBS** Louise runs a lawn care service. She charges \$25 for supplies plus \$15 per hour. The function  $f(h) = 15h + 25$  gives the cost  $f(h)$  for  $h$  hours of work.

a. Find  $f^{-1}(h)$ . What is the significance of  $f^{-1}(h)$ ?

b. If Louise charges a customer \$85, how many hours did she work?

**SOLUTION:**

a.  $f(h) = 15h + 25$

Substitute  $f^{-1}(h)$  for  $h$  and  $h$  for  $f(h)$ .

$$h = f^{-1}(h)15 + 25$$

Solve for  $f^{-1}(h)$ .

$$15f^{-1}(h) = h - 25$$

$$\begin{aligned} f^{-1}(h) &= \frac{h - 25}{15} \\ &= \frac{h}{15} - \frac{5}{3} \end{aligned}$$

$f^{-1}(h)$  represents the number of hours worked.

b. Substitute 85 for  $f(x)$  in the given function and solve for  $h$ .

$$85 = 15h + 25$$

$$15h = 85 - 25$$

$$15h = 60$$

$$h = 4$$

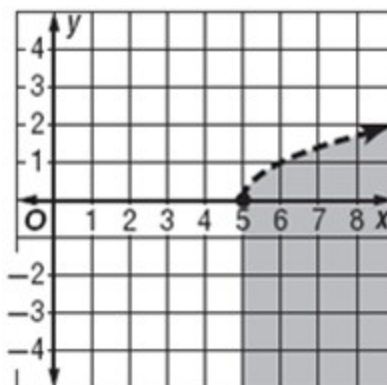
She worked for 4 hours.

**Graph each inequality.**

17.  $y < \sqrt{x-5}$

**SOLUTION:**

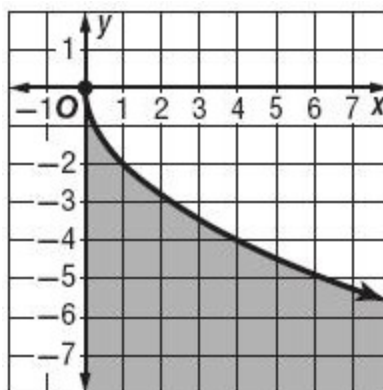
Graph the inequality  $y < \sqrt{x-5}$ .



18.  $y \leq -2\sqrt{x}$

**SOLUTION:**

Graph the inequality  $y \leq -2\sqrt{x}$ .

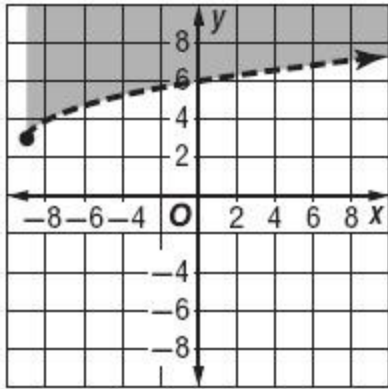


**Mid-Chapter Quiz: Lessons 6-1 through 6-4**

19.  $y > \sqrt{x+9} + 3$

**SOLUTION:**

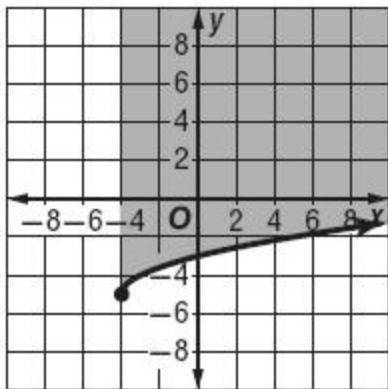
Graph the inequality  $y > \sqrt{x+9} + 3$ .



20.  $y \geq \sqrt{x+4} - 5$

**SOLUTION:**

Graph the inequality  $y \geq \sqrt{x+4} - 5$ .

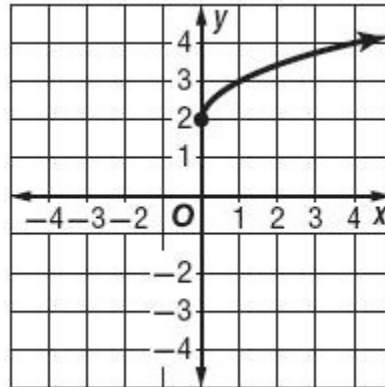


**Graph each function. State the domain and range of each function.**

21.  $y = 2 + \sqrt{x}$

**SOLUTION:**

Graph the function  $y = 2 + \sqrt{x}$ .



$D = \{x \mid x \geq 0\}$

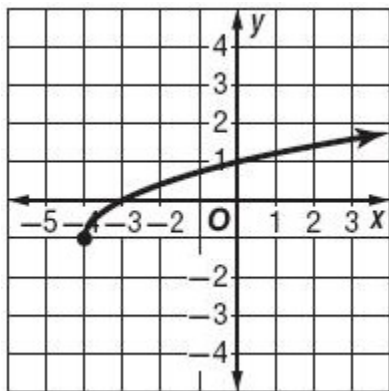
$R = \{y \mid y \geq 2\}$

**Mid-Chapter Quiz: Lessons 6-1 through 6-4**

22.  $y = \sqrt{x+4} - 1$

**SOLUTION:**

Graph the function  $y = \sqrt{x+4} - 1$ .



$$D = \{x \mid x \geq -4\}$$

$$R = \{y \mid y \geq -1\}$$

23. **MULTIPLE CHOICE** What is the domain of

$$f(x) = \sqrt{2x+5} ?$$

A.  $\left\{x \mid x > \frac{5}{2}\right\}$

B.  $\left\{x \mid x > -\frac{5}{2}\right\}$

C.  $\left\{x \mid x \geq \frac{5}{2}\right\}$

D.  $\left\{x \mid x \geq -\frac{5}{2}\right\}$

**SOLUTION:**

$$2x + 5 \geq 0$$

$$2x \geq -5$$

$$x \geq -\frac{5}{2}$$

$$D = \left\{x \mid x \geq -\frac{5}{2}\right\}$$

Option D is the correct answer.

**Simplify.**

24.  $\pm\sqrt{121a^4b^{18}}$

**SOLUTION:**

$$\begin{aligned} \pm\sqrt{121a^4b^{18}} &= \pm\sqrt{11^2(a^2)^2(b^9)^2} \\ &= \pm 11a^2|b^9| \end{aligned}$$

**Mid-Chapter Quiz: Lessons 6-1 through 6-4**

25.  $\sqrt{(x^4 + 3)^{12}}$

**SOLUTION:**

$$\begin{aligned}\sqrt{(x^4 + 3)^{12}} &= \sqrt{\left((x^4 + 3)^6\right)^2} \\ &= (x^4 + 3)^6\end{aligned}$$

26.  $\sqrt[3]{27(2x - 5)^{15}}$

**SOLUTION:**

$$\begin{aligned}\sqrt[3]{27(2x - 5)^{15}} &= \sqrt[3]{3^3 \left((2x - 5)^5\right)^3} \\ &= 3(2x - 5)^5\end{aligned}$$

27.  $\sqrt[5]{-(y - 6)^{20}}$

**SOLUTION:**

$$\begin{aligned}\sqrt[5]{-(y - 6)^{20}} &= \sqrt[5]{(-1)^5 \left((y - 6)^4\right)^5} \\ &= -1(y - 6)^4 \\ &= -(y - 6)^4\end{aligned}$$

28.  $\sqrt[3]{8(x + 4)^6}$

**SOLUTION:**

$$\begin{aligned}\sqrt[3]{8(x + 4)^6} &= \sqrt[3]{2^3 \left((x + 4)^2\right)^3} \\ &= 2(x + 4)^2\end{aligned}$$

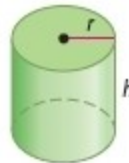
29.  $\sqrt[4]{16(y + x)^8}$

**SOLUTION:**

$$\begin{aligned}\sqrt[4]{16(y + x)^8} &= \sqrt[4]{2^4 \left((y + x)^2\right)^4} \\ &= 2(y + x)^2\end{aligned}$$

30. **MULTIPLE CHOICE** The radius of the cylinder below is equal to the height of the cylinder. The radius  $r$  can be found using the formula  $r = \sqrt[3]{\frac{V}{\pi}}$ .

Find the radius of the cylinder if the volume is 500 cubic inches.



- F** 2.53 inches
- G** 5.42 inches
- H** 7.94 inches
- J** 24.92 inches

**SOLUTION:**

Substitute 500 for  $V$  in the function and simplify.

$$\begin{aligned}r &= \sqrt[3]{\frac{500}{\pi}} \\ &= \sqrt[3]{\frac{125 \times 4}{\pi}} \\ &= \sqrt[3]{\frac{5^3 \times 4}{\pi}} \\ &= 5 \sqrt[3]{\frac{4}{\pi}} \\ &\approx 5.42\end{aligned}$$

Option G is the correct answer.

### Mid-Chapter Quiz: Lessons 6-1 through 6-4

31. **PRODUCTION** The cost in dollars of producing  $x$  cell phones in a factory is represented by  $C(p) = 5p + 60$ . The number of cell phones produced in  $h$  hours is represented by  $P(h) = 40h$ .

- a. Find the composition function.
- b. Determine the cost of producing cell phones for 8 hours.

**SOLUTION:**

a.

$$\begin{aligned}[C \circ P](h) &= C(P(h)) \\ &= 5(40h) + 60 \\ &= 200h + 60\end{aligned}$$

- b. Substitute 8 for  $h$  and simplify.

$$\begin{aligned}C \circ P(8) &= 200(8) + 60 \\ &= 1600 + 60 \\ &= 1660\end{aligned}$$

The cost of producing cell phones for 8 hours is \$1660.