

Study Guide and Review - Chapter 6

Find $[f \circ g](x)$ and $[g \circ f](x)$.

10. $f(x) = 2x + 1$
 $g(x) = 4x - 5$

SOLUTION:

$$\begin{aligned} f[g(x)] &= 2(4x - 5) + 1 \\ &= 8x - 10 + 1 \\ &= 8x - 9 \\ g[f(x)] &= 4(2x + 1) - 5 \\ &= 8x + 4 - 5 \\ &= 8x - 1 \end{aligned}$$

ANSWER:

$$\begin{aligned} [f \circ g](x) &= 8x - 9 \\ [g \circ f](x) &= 8x - 1 \end{aligned}$$

13. $f(x) = 4x$
 $g(x) = 5x - 1$

SOLUTION:

$$\begin{aligned} f[g(x)] &= 4(5x - 1) \\ &= 20x - 4 \\ g[f(x)] &= 5(4x) - 1 \\ &= 20x - 1 \end{aligned}$$

ANSWER:

$$\begin{aligned} [f \circ g](x) &= 20x - 4 \\ [g \circ f](x) &= 20x - 1 \end{aligned}$$

Find the inverse of each function. Then graph the function and its inverse.

17. $f(x) = 5x - 6$

SOLUTION:

Rewrite $f(x)$ as $y = 5x - 6$. Interchange the variables and solve for y .

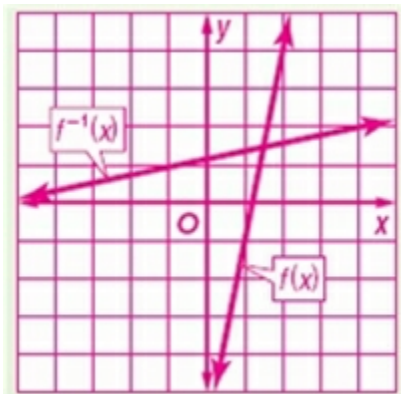
$$\begin{aligned} x &= 5y - 6 \\ -5y &= -x - 6 \\ y &= \frac{x + 6}{5} \end{aligned}$$

Replace y with $f^{-1}(x)$.

$$f^{-1}(x) = \frac{x + 6}{5}$$

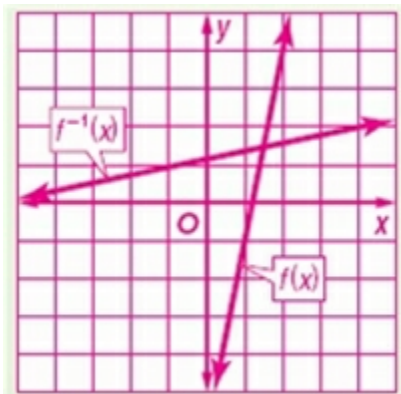
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Graph the function and its inverse in the same coordinate plane.



ANSWER:

$$f^{-1}(x) = \frac{x+6}{5}$$



18. $f(x) = -3x - 5$

SOLUTION:

Rewrite $f(x)$ as $y = -3x - 5$. Interchange the variables and solve for y .

$$x = -3y - 5$$

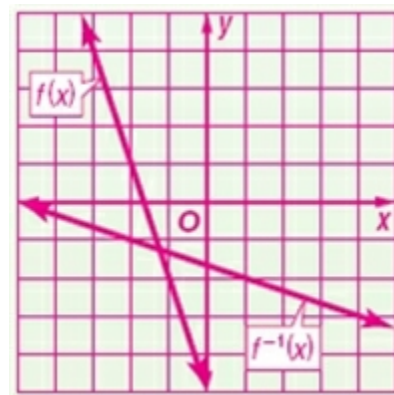
$$3y = -x - 5$$

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

Replace y with $f^{-1}(x)$.

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

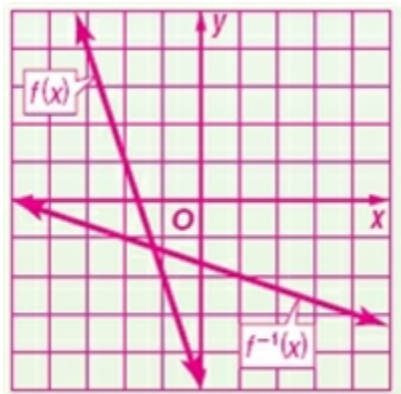
Graph the function and its inverse in the same coordinate plane.



ANSWER:

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

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19. $f(x) = \frac{1}{2}x + 3$

SOLUTION:

Rewrite $f(x)$ as $y = \frac{1}{2}x + 3$. Interchange the variables and solve for y .

$$x = \frac{1}{2}y + 3$$

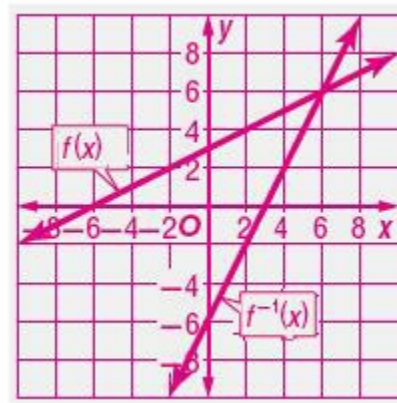
$$-\frac{1}{2}y = -x + 3$$

$$y = 2x - 6$$

Replace y with $f^{-1}(x)$.

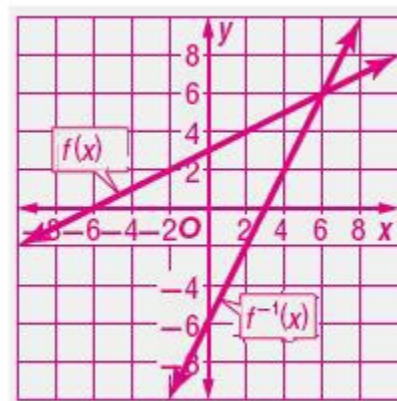
$$f^{-1}(x) = 2x - 6$$

Graph the function and its inverse in the same coordinate plane.



ANSWER:

$$f^{-1}(x) = 2x - 6$$



Graph each function. State the domain and range.

33. $f(x) = \sqrt{x - 7}$

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SOLUTION:

Identify the domain.

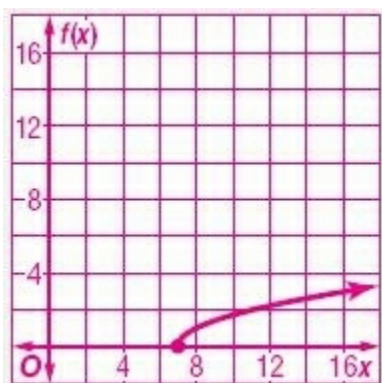
Write the radicand as greater than or equal to 0.

$$x - 7 \geq 0$$

$$x \geq 7$$

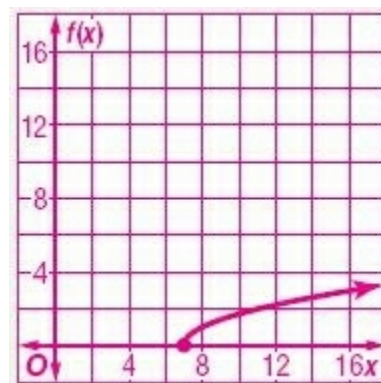
Make a table of values for $x \geq 7$ and graph the function.

x	y
7	0
8	1
9	1.41
10	1.73
11	2
12	2.23



The domain is $\{x | x \geq 7\}$, and the range is $\{f(x) | f(x) \geq 0\}$.

ANSWER:



$$D = \{x | x \geq 7\}; R = \{f(x) | f(x) \geq 0\}$$

34. $f(x) = \sqrt{x+5} - 3$

SOLUTION:

Identify the domain.

Write the radicand as greater than or equal to 0.

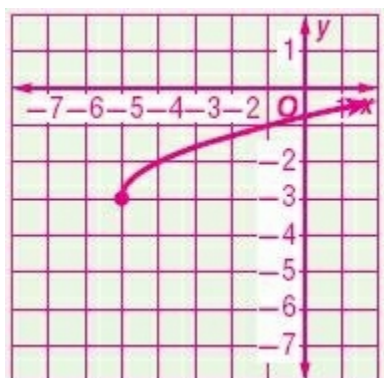
$$x + 5 \geq 0$$

$$x \geq -5$$

Make a table of values for $x \geq -5$ and graph the function.

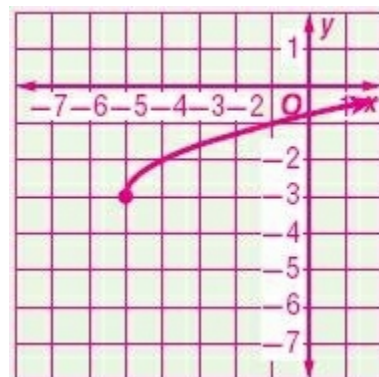
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x	y
-5	-3
-4	-2
-3	-1.59
-2	-1.27
-1	-1
0	-0.76



The domain is $\{x \mid x \geq -5\}$, and the range is $\{f(x) \mid f(x) \geq -3\}$.

ANSWER:



$$D = \{x \mid x^3 - 5\}; R = \{f(x) \mid f(x)^3 - 3\}$$

$$35. f(x) = \frac{3}{4}\sqrt{x-1} + 5$$

SOLUTION:

Identify the domain.

Write the radicand as greater than or equal to 0.

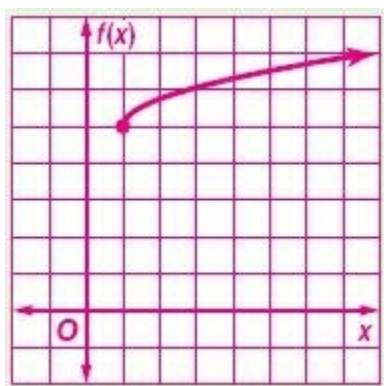
$$x - 1 \geq 0$$

$$x \geq 1$$

Make a table of values for $x \geq 1$ and graph the function.

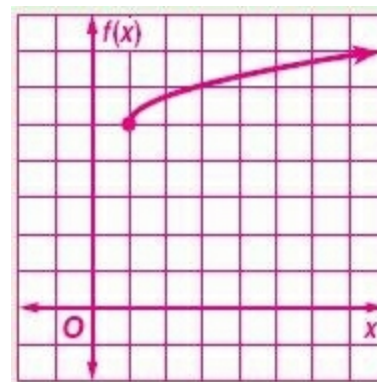
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x	y
1	5
2	5.75
3	6.06
4	6.30
5	6.5
6	6.68



The domain is $\{x \mid x \geq 1\}$, and the range is $\{f(x) \mid f(x) \geq 5\}$.

ANSWER:



$$D = \{x \mid x \geq 1\}; R = \{f(x) \mid f(x) \geq 5\}$$

36. $f(x) = -\frac{1}{3}\sqrt{x+4} - 1$

SOLUTION:

Identify the domain.

Write the radicand as greater than or equal to 0.

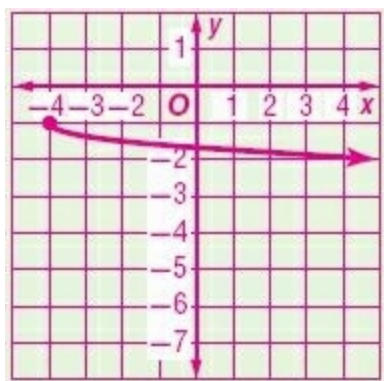
$$x + 4 \geq 0$$

$$x \geq -4$$

Make a table of values for $x \geq -4$ and graph the function.

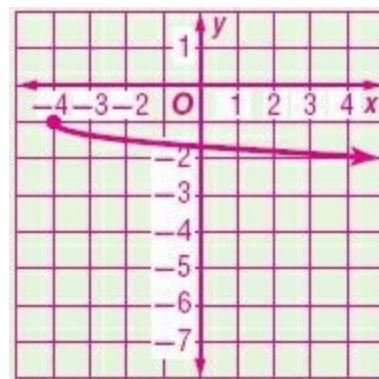
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x	y
-4	-1
-3	-1.33
-2	-1.47
-1	-1.58
0	-1.67
1	-1.75



The domain is $\{x \mid x \geq -4\}$, and the range is $\{f(x) \mid f(x) \leq -1\}$.

ANSWER:



$$D = \{x \mid x \geq -4\}; R = \{f(x) \mid f(x) \leq -1\}$$

Simplify.

$$45. \sqrt[6]{(x^2 + 2)^{18}}$$

SOLUTION:

$$\begin{aligned} \sqrt[6]{(x^2 + 2)^{18}} &= (x^2 + 2)^{\frac{18}{6}} \\ &= (x^2 + 2)^3 \end{aligned}$$

ANSWER:

$$(x^2 + 2)^3$$

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46. $\sqrt[3]{27(x+3)^3}$

SOLUTION:

$$\begin{aligned}\sqrt[3]{27(x+3)^3} &= \sqrt[3]{3^3(x+3)^3} \\ &= 3(x+3)\end{aligned}$$

ANSWER:

$$3(x+3)$$

47. $\sqrt[4]{a^8b^{12}}$

SOLUTION:

$$\begin{aligned}\sqrt[4]{a^8b^{12}} &= \sqrt[4]{(a^2)^4(b^3)^4} \\ &= a^2|b^3|\end{aligned}$$

ANSWER:

$$a^2|b^3|$$

48. $\sqrt[5]{243x^{10}y^{25}}$

SOLUTION:

$$\begin{aligned}\sqrt[5]{243x^{10}y^{25}} &= \sqrt[5]{3^5(x^2)^5(y^5)^5} \\ &= 3x^2y^5\end{aligned}$$

ANSWER:

$$3x^2y^5$$

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49. **PHYSICS** The velocity v of an object can be defined as $v = \sqrt{\frac{2K}{m}}$, where m is the mass of an object and K is the kinetic energy in joules. Find the velocity in meters per second of an object with a mass of 17 grams and a kinetic energy of 850 joules.

SOLUTION:

Substitute 17 for m and 850 for K in the formula and solve for v :

$$\begin{aligned} v &= \sqrt{\frac{2(850)}{17}} \\ &= \sqrt{100} \\ &= 10 \end{aligned}$$

The velocity of the object is 10 m/s.

ANSWER:

10 m/s

Simplify.

50. $\sqrt[3]{54}$

SOLUTION:

$$\begin{aligned} \sqrt[3]{54} &= \sqrt[3]{3^3(2)} \\ &= 3\sqrt[3]{2} \end{aligned}$$

ANSWER:

$$3\sqrt[3]{2}$$

51. $\sqrt{144a^3b^5}$

SOLUTION:

$$\begin{aligned} \sqrt{144a^3b^5} &= \sqrt{(12ab^2)^2 ab} \\ &= 12ab^2\sqrt{ab} \end{aligned}$$

ANSWER:

$$12ab^2\sqrt{ab}$$

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52. $4\sqrt{6y} \cdot 3\sqrt{7x^2y}$

SOLUTION:

$$\begin{aligned}4\sqrt{6y} \cdot 3\sqrt{7x^2y} &= 12\sqrt{6y(7x^2y)} \\&= 12\sqrt{42x^2y^2} \\&= 12|x|y\sqrt{42}\end{aligned}$$

ANSWER:

$$12|x|y\sqrt{42}$$

53. $6\sqrt{72} + 7\sqrt{98} - \sqrt{50}$

SOLUTION:

$$\begin{aligned}6\sqrt{72} + 7\sqrt{98} - \sqrt{50} &= 6\sqrt{36 \cdot 2} + 7\sqrt{49 \cdot 2} - \sqrt{25 \cdot 2} \\&= 36\sqrt{2} + 49\sqrt{2} - 5\sqrt{2} \\&= (36 + 49 - 5)\sqrt{2} \\&= 80\sqrt{2}\end{aligned}$$

ANSWER:

$$80\sqrt{2}$$

54. $(6\sqrt{5} - 2\sqrt{2})(3\sqrt{5} + 4\sqrt{2})$

SOLUTION:

$$\begin{aligned}(6\sqrt{5} - 2\sqrt{2})(3\sqrt{5} + 4\sqrt{2}) &= 18 \cdot 5 + 24\sqrt{10} - 6\sqrt{10} - 8 \cdot 2 \\&= 74 + 18\sqrt{10}\end{aligned}$$

ANSWER:

$$74 + 18\sqrt{10}$$

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Simplify each expression.

59. $x^{\frac{1}{2}} \cdot x^{\frac{2}{3}}$

SOLUTION:

$$\begin{aligned}x^{\frac{1}{2}} \cdot x^{\frac{2}{3}} &= x^{\frac{1}{2} + \frac{2}{3}} \\&= x^{\frac{3+4}{6}} \\&= x^{\frac{7}{6}}\end{aligned}$$

ANSWER:

$$x^{\frac{7}{6}}$$

60. $m^{-\frac{3}{4}}$

SOLUTION:

$$\begin{aligned}m^{-\frac{3}{4}} &= \frac{1}{m^{\frac{3}{4}}} \cdot \frac{m^{\frac{1}{4}}}{m^{\frac{1}{4}}} \\&= \frac{m^{\frac{1}{4}}}{m}\end{aligned}$$

ANSWER:

$$\frac{m^{\frac{1}{4}}}{m}$$

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61. $\frac{d^{\frac{1}{6}}}{d^{\frac{3}{4}}}$

SOLUTION:

$$\begin{aligned}\frac{d^{\frac{1}{6}}}{d^{\frac{3}{4}}} &= d^{\frac{1}{6} - \frac{3}{4}} \\ &= d^{-\frac{7}{12}} \\ &= \frac{1}{d^{\frac{7}{12}}} \cdot \frac{d^{\frac{5}{12}}}{d^{\frac{5}{12}}} \\ &= \frac{d^{\frac{5}{12}}}{d}\end{aligned}$$

ANSWER:

$$\frac{d^{\frac{5}{12}}}{d}$$

Simplify each expression.

62. $\frac{1}{y^{\frac{1}{4}}}$

SOLUTION:

$$\begin{aligned}\frac{1}{y^{\frac{1}{4}}} &= \frac{1}{y^{\frac{1}{4}}} \cdot \frac{y^{\frac{3}{4}}}{y^{\frac{3}{4}}} \\ &= \frac{y^{\frac{3}{4}}}{y}\end{aligned}$$

ANSWER:

$$\frac{y^{\frac{3}{4}}}{y}$$

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63. $\sqrt[3]{\sqrt{729}}$

SOLUTION:

$$\begin{aligned}\sqrt[3]{\sqrt{729}} &= \sqrt[3]{27} \\ &= \sqrt[3]{3^3} \\ &= 3\end{aligned}$$

ANSWER:

3

64. $\frac{x^{\frac{2}{3}} - x^{\frac{1}{3}}y^{\frac{2}{3}}}{x^{\frac{1}{3}}}$

SOLUTION:

$$\begin{aligned}\frac{x^{\frac{2}{3}} - x^{\frac{1}{3}}y^{\frac{2}{3}}}{x^{\frac{1}{3}}} &= x^{\frac{2}{3}}x^{-\frac{1}{3}} - x^{\frac{1}{3}}x^{-\frac{1}{3}}y^{\frac{2}{3}} \\ &= x^{\frac{1}{3}} - y^{\frac{2}{3}}\end{aligned}$$

ANSWER:

$$x^{\frac{1}{3}} - y^{\frac{2}{3}}$$

Solve each equation.

66. $\sqrt{x-3} + 5 = 15$

SOLUTION:

$$\begin{aligned}\sqrt{x-3} + 5 &= 15 \\ (\sqrt{x-3})^2 &= 10^2 \\ x-3 &= 100 \\ x &= 103\end{aligned}$$

ANSWER:

103

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68. $4 + \sqrt{3x-1} = 8$

SOLUTION:

$$\begin{aligned}4 + \sqrt{3x-1} &= 8 \\(\sqrt{3x-1})^2 &= 4^2 \\3x-1 &= 16 \\3x &= 17 \\x &= \frac{17}{3}\end{aligned}$$

ANSWER:

$$\frac{17}{3}$$

70. $\sqrt{2x+3} = 3$

SOLUTION:

$$\begin{aligned}(\sqrt{2x+3})^2 &= 3^2 \\2x+3 &= 9 \\x &= 3\end{aligned}$$

ANSWER:

$$3$$

71. $(x+1)^{\frac{1}{4}} = -3$

SOLUTION:

$$\begin{aligned}(x+1)^{\frac{1}{4}} &= -3 \\((x+1)^{\frac{1}{4}})^4 &= (-3)^4 \\x+1 &= 81\end{aligned}$$

$$x = 80$$

CHECK:

$$\begin{aligned}(x+1)^{\frac{1}{4}} &= -3 \\(80+1)^{\frac{1}{4}} &\stackrel{?}{=} -3 \\\sqrt[4]{81} &\stackrel{?}{=} -3 \\3 &\neq -3\end{aligned}$$

no solution

ANSWER:

no solution

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72. $a^{\frac{1}{3}} - 4 = 0$

SOLUTION:

$$a^{\frac{1}{3}} - 4 = 0$$

$$\left(a^{\frac{1}{3}}\right)^3 = 4^3$$

$$a = 64$$

ANSWER:

64

73. $3(3x-1)^{\frac{1}{3}} - 6 = 0$

SOLUTION:

$$3(3x-1)^{\frac{1}{3}} - 6 = 0$$

$$3(3x-1)^{\frac{1}{3}} = 6$$

$$\left((3x-1)^{\frac{1}{3}}\right)^3 = 2^3$$

$$3x - 1 = 8$$

$$x = 3$$

ANSWER:

3