

Find the inverse of each relation and state the domain and range of the inverse.

1. $\{(1, -3), (-2, 3), (5, 1), (6, 4)\}$
 Inverse: $\{(-3, 1), (3, -2), (1, 5), (4, 6)\}$
 Domain: $\{-3, 1, 3, 4\}$
 Range: $\{-2, 1, 5, 6\}$

2. $\{(-5, 7), (-6, -8), (1, -2), (10, 3)\}$
 $f^{-1}(x) = \{(7, -5), (-8, -6), (-2, 1), (3, 10)\}$
 Domain: $\{-8, -2, 3, 7\}$
 Range: $\{-6, -5, 1, 10\}$

Find an equation for the inverse for each of the following relations and state the domain.

3. $f(x) = 3x + 2$
 $f^{-1}(x) = ?$
 $y = 3x + 2$
 $x = 3y + 2$
 $x - 2 = 3y$
 $y = \frac{x-2}{3}$

$f^{-1}(x) = \frac{1}{3}x - \frac{2}{3}$ $D: \mathbb{R}$

4. $g(x) = -5x - 7$
 $g^{-1}(x) = ?$
 $y = -5x - 7$
 $x = -5y - 7$
 $x + 7 = -5y$
 $y = \frac{x+7}{-5}$

$g^{-1}(x) = -\frac{1}{5}x - \frac{7}{5}$ $D: \mathbb{R}$

5. $h(x) = 12x - 3$
 $h^{-1}(x) = ?$
 $y = 12x - 3$
 $x = 12y - 3$
 $x + 3 = 12y$
 $y = \frac{x+3}{12}$

$h^{-1}(x) = \frac{1}{12}x + \frac{1}{4}$ $D: \mathbb{R}$

6. $f(x) = \frac{2}{3}x - 5$
 $f^{-1}(x) = ?$
 $y = \frac{2}{3}x - 5$
 $x = \frac{2}{3}y - 5$
 $x + 5 = \frac{2}{3}y$
 $y = \frac{3}{2}(x+5)$

$f^{-1}(x) = \frac{3}{2}x + \frac{15}{2}$ $D: \mathbb{R}$

7. $g(x) = -\frac{3}{4}x + 5$
 $g^{-1}(x) = ?$
 $y = -\frac{3}{4}x + 5$
 $x = -\frac{3}{4}y + 5$
 $x - 5 = -\frac{3}{4}y$
 $y = -\frac{4}{3}(x-5)$

$g^{-1}(x) = -\frac{4}{3}x + \frac{20}{3}$ $D: \mathbb{R}$

8. $h(x) = x^2 - 4, x \geq 0$ ← restricts parabola
 $h^{-1}(x) = ?$
 $y = x^2 - 4$
 $x = y^2 - 4$
 $x + 4 = y^2$
 $y = \pm\sqrt{x+4}$
 $f^{-1}(x) = \sqrt{x+4}$ $D: [-4, \infty)$

← don't use \pm because of the restriction at the beginning

$$9. \quad f(x) = (x+3)^2, \quad x \geq -3 \leftarrow$$

$$f^{-1}(x) = ?$$

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

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

$$\pm\sqrt{x} = y+3$$

$$y = \pm\sqrt{x} + 3$$

$$f^{-1}(x) = \sqrt{x} + 3 \quad D: [0, \infty)$$

$$10. \quad g(x) = (x-6)^2 + 3, \quad x \geq 6 \leftarrow$$

$$g^{-1}(x) = ?$$

$$y = (x-6)^2 + 3$$

$$x = (y-6)^2 + 3$$

$$x-3 = (y-6)^2$$

$$\pm\sqrt{x-3} = y-6$$

$$g^{-1}(x) = \sqrt{x-3} + 6 \quad D: [3, \infty)$$

$$11. \quad f(x) = \sqrt{x-2}, \quad y \geq 0 \leftarrow$$

$$f^{-1}(x) = ?$$

$$y = \sqrt{x-2}$$

$$x = \sqrt{y-2}$$

$$x^2 = y-2$$

$$f^{-1}(x) = x^2 + 2 \quad D: [0, \infty)$$

$$\text{or } x \geq 0$$

$$12. \quad g(x) = \sqrt{x+5}, \quad y \geq 0 \leftarrow$$

$$g^{-1}(x) = ?$$

$$y = \sqrt{x+5}$$

$$x = \sqrt{y+5}$$

$$x^2 = y+5$$

$$y = x^2 - 5$$

$$g^{-1}(x) = x^2 - 5 \quad D: [0, \infty)$$

$$\text{or } x \geq 0$$

$$13. \quad h(x) = \sqrt{x} + 8, \quad y \geq 8 \leftarrow$$

$$h^{-1}(x) = ?$$

$$y = \sqrt{x} + 8$$

$$x = \sqrt{y} + 8$$

$$x-8 = \sqrt{y}$$

$$(x-8)^2 = y$$

$$h^{-1}(x) = (x-8)^2 \quad D: [8, \infty)$$

$$14. \quad f(x) = x^3 - 2$$

$$f^{-1}(x) = ?$$

$$y = x^3 - 2$$

$$x = y^3 - 2$$

$$x+2 = y^3$$

$$y = \sqrt[3]{x+2}$$

$$f^{-1}(x) = \sqrt[3]{x+2} \quad D: \mathbb{R}$$

Verify that f and g are inverse functions.

$$15. \quad f(x) = x + 6, \quad g(x) = x - 6$$

$$f(g(x)) = x \quad g(f(x)) = x$$

$$\begin{array}{l} x-6+6 \\ x \end{array} \qquad \begin{array}{l} x+6-6 \\ x \end{array}$$

inverses

$$16. \quad f(x) = 5x + 2, \quad g(x) = \frac{x-2}{5}$$

$$f(g(x)) = x \quad g(f(x)) = x$$

$$\begin{array}{l} 5 \left(\frac{x-2}{5} \right) + 2 \\ x-2+2 \\ x \end{array} \qquad \begin{array}{l} \frac{5x+2-2}{5} \\ x \end{array}$$

inverses

$$17. \quad f(x) = -3x - 9, \quad g(x) = -\frac{1}{3}x - 3$$

$$f(g(x)) = x \quad g(f(x)) = x$$

$$\begin{array}{l} -3 \left(-\frac{1}{3}x - 9 \right) \\ x+9-9 \\ x \end{array} \qquad \begin{array}{l} -\frac{1}{3} \left(-3x - 9 \right) - 3 \\ x+3-3 \\ x \end{array}$$

inverses

$$18. \quad f(x) = (x+2)^3 - 3, \quad g(x) = \sqrt[3]{x+3} - 2$$

$$f(g(x)) = x \quad g(f(x)) = x$$

$$\begin{array}{l} \left(\sqrt[3]{x+3} - 2 + 2 \right)^3 - 3 \\ \left(\sqrt[3]{x+3} \right)^3 - 3 \\ x+3-3 \\ x \end{array} \qquad \begin{array}{l} \sqrt[3]{(x+2)^3 - 3 + 3} - 2 \\ \sqrt[3]{(x+2)^3} - 2 \\ x+2-2 \\ x \end{array}$$

inverses

Verify that f and g are inverse functions.

19. $f(x) = -4x + 8$, $g(x) = -\frac{1}{4}x + 2$
 $f(g(x)) = x$ $g(f(x)) = x$

$$-4\left(-\frac{1}{4}x + 2\right) + 8$$

$$x - 8 + 8$$

$$x$$

$$-\frac{1}{4}(-4x + 8) + 2$$

$$x - 2 + 2$$

$$x$$

inverses

20. $f(x) = \frac{1}{2}x - 7$, $g(x) = 2x + 14$

$$f(g(x)) = x \quad g(f(x)) = x$$

$$\frac{1}{2}(2x + 14) - 7$$

$$x + 7 - 7$$

$$x$$

$$2\left(\frac{1}{2}x - 7\right) + 14$$

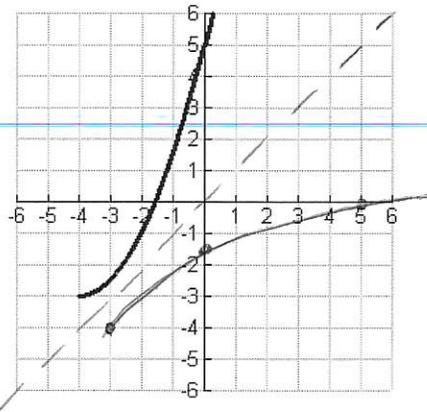
$$x - 14 + 14$$

$$x$$

inverses

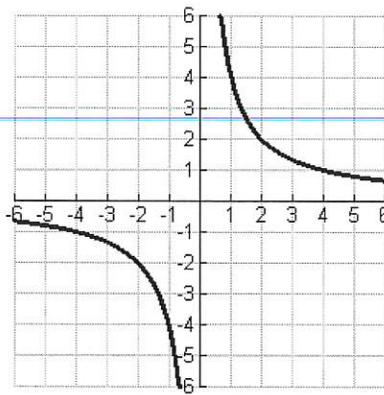
Draw the inverse of each graph, if the function is its own inverse write 'Own inverse'

21.



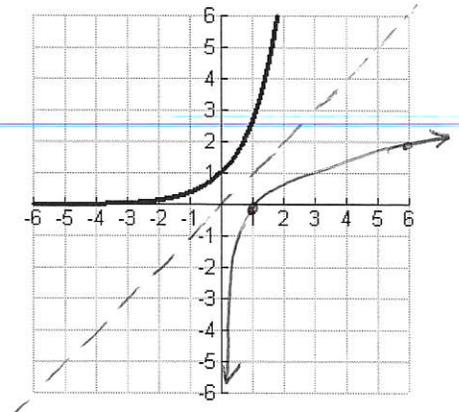
22.

own inverse

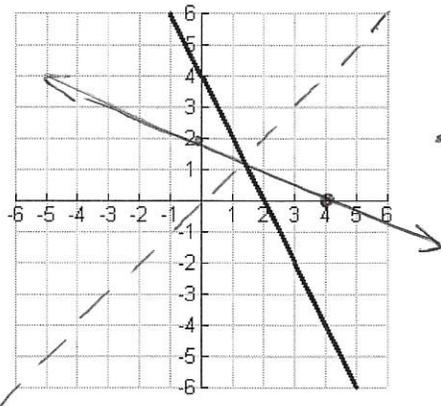


o

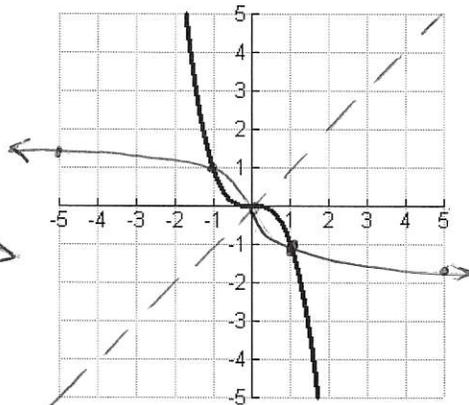
23.



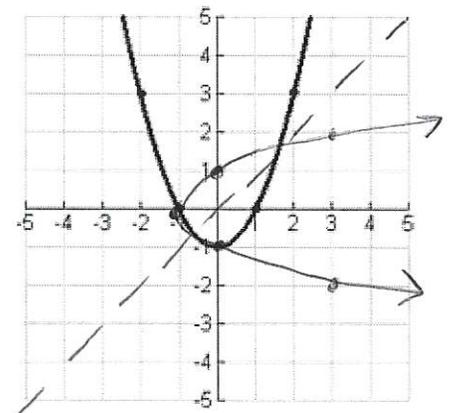
24.



25.



26.



Perform the indicated operation, given the following:

Let $f(x) = 2x + 3$, $g(x) = 2x^2 + 1$ and $h(x) = x - 4$

27. $(f - h)(x) =$
 $f(x) - h(x)$
 $(2x + 3) - (x - 4)$
 $2x + 3 - x + 4$
 $x + 7$

28. $(h + f^{-1})(x) =$
 $h(x) + f^{-1}(x) =$
 $(x - 4) + \left(\frac{1}{2}x - \frac{3}{2}\right)$
 $\frac{3}{2}x - \frac{11}{2}$

$f(x) = 2x + 3$
 $y = 2x + 3$
 $x = \frac{y - 3}{2}$
 $x - 3 = 2y$
 $\frac{1}{2}x - \frac{3}{2} = y$
 $f^{-1}(x) = \frac{1}{2}x - \frac{3}{2}$

29. $(g \circ h)(-2) =$
 $g(h(-2)) =$
 $g(-6) =$
 $2(-6)^2 + 1 =$
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30. $g(x) \cdot f(x) =$
 $(2x^2 + 1)(2x + 3) =$
 $4x^3 + 6x^2 + 2x + 3$

31. $f^{-1}(f(x))$
 $f^{-1}(2x + 3) =$
 $\frac{1}{2}(2x + 3) - \frac{3}{2} =$
 $x + \frac{3}{2} - \frac{3}{2} =$
 x

32. $(f \circ h)(x) =$
 $f(h(x)) =$
 $f(x - 4) =$
 $2(x - 4) + 3 =$
 $2x - 8 + 3 =$
 $2x - 5$

Solve.

33. $2|x + 4| - 3 = 5$
 $2|x + 4| = 8$
 $|x + 4| = 4$
 $x + 4 = 4 \quad x + 4 = -4$
 $x = 0 \quad \text{or} \quad x = -8$

34. $|x - 6| - 4 = 36$
 $|x - 6| = 40$
 $x - 6 = 40 \quad \text{or} \quad x - 6 = -40$
 $x = 46 \quad \text{or} \quad x = -34$