

## 1.5 Inverses

### Quick Review

Solve the equation for  $y$ .

$$1. x = 0.1y + 10$$

$$2. x = y^2 - 1$$

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

$$4. x = \frac{y+1}{y+2}$$

$$5. x = \sqrt{y+2}, y \geq -2$$

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### Quick Review Solutions

Solve the equation for  $y$ .

$$1. x = 0.1y + 10 \quad y = 10x - 100$$

$$2. x = y^2 - 1 \quad y = \pm\sqrt{x+1}$$

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

$$4. x = \frac{y+1}{y+2} \quad y = \frac{1-2x}{x-1}$$

$$5. x = \sqrt{y+2}, y \geq -2 \quad y = x^2 - 2, y \geq -2 \text{ and } x \geq 0$$

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## Horizontal Line Test

The inverse of a relation is a function if and only if each horizontal line intersects the graph of the original relation in at most one point.

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## How to Find an Inverse Function Algebraically

- Determine if the function is one-to-one.
- Replace  $f(x)$  with  $y$
- Switch the  $x$  and  $y$
- Solve for  $y$  in terms of  $x$
- Replace  $y$  with  $f^{-1}(x)$

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example: Find the inverse for

$$f(x) = 2x + 5$$

$$y = 2x + 5$$

$$x = 2y + 5$$

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

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

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

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example: Find the inverse of

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

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

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

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

$$xy - 2x = y + 3$$

$$xy - y = 2x + 3$$

$$y(x-1)$$

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

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

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example:

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

Find  
inverse

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



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

$$x^2 = y+2$$

$$x^2 - 2 = y$$

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

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Check to see if functions are inverses by finding

$$f(f^{-1}(x)) = x \quad \text{and} \quad f^{-1}(f(x)) = x$$

ex

$$f(x) = 2x+5$$

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

$$f(f^{-1}(x)) = f\left(\frac{x-5}{2}\right) = 2\left(\frac{x-5}{2}\right) + 5$$

$$= x-5+5$$

$$= x$$

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

$$= \frac{2x}{2}$$

$$= x$$

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example:

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

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

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

$$= \frac{\cancel{2x}+3+\cancel{3x}-3}{\cancel{2x}+3-\cancel{2x}+2}$$

$$= \frac{5x}{5} = x \quad \checkmark$$
  

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

$$= \frac{2(x+3)+3(x-2)}{x+3-(x-2)}$$

$$= \frac{\cancel{2x}+6+\cancel{3x}-6}{\cancel{x}+3-\cancel{x}+2}$$

$$= \frac{5x}{5}$$

$$= x \quad \checkmark$$

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# HW

p135

# 13-21 odd

check all

# 27-31 odd

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