

# Inverses

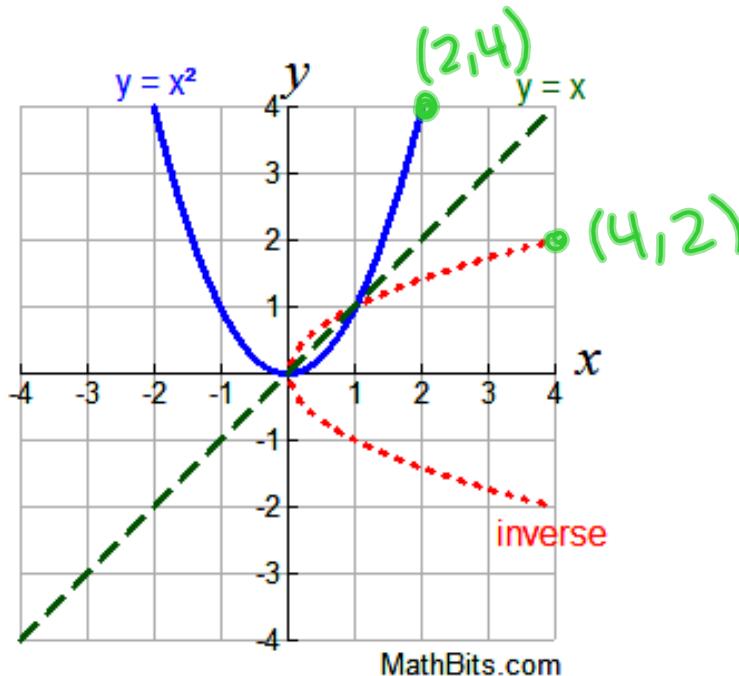
## Essential Question

How do I find the domain of the inverse of a function?

# Inverses

**EQ:** How do I find the domain of the inverse of a function?

If a point  $(x,y)$  is on the graph of  $f(x)$ , then the point  $(\underline{y}, \underline{x})$  is on the graph of  $f^{-1}(x)$ . Therefore, the inverse of the graph of  $f(x)$  will reflect over the line  $y=x$ .



# Inverses

**EQ:** How do I find the domain of the inverse of a function?

To find an inverse algebraically, switch x and y and solve for y.  
 The domain of  $f(x)$  will be the range of  $f^{-1}(x)$  and vice versa.

Example 1. Find the inverse of  $y = \frac{1}{2}x^3 - 4$   $f^{-1}(x) = \sqrt[3]{2x+8}$   $g(x)$   
 domain  $(-\infty, \infty)$

$$\begin{aligned} x &= \frac{1}{2}y^3 - 4 \\ +4 &\quad +4 \\ x+4 &= \left(\frac{1}{2}y^3\right)2 \\ 2(x+4) &= (\frac{1}{2}y^3)2 \\ \sqrt[3]{2x+8} &= \sqrt[3]{y^3} \end{aligned}$$

$$y = \sqrt[3]{2x+8}$$

$$\begin{aligned} f(g(x)) &= \frac{1}{2}(\sqrt[3]{2x+8})^3 - 4 \\ &= \frac{1}{2}(2x+8) - 4 = x+4-4 = x \checkmark \\ g(f(x)) &= \sqrt[3]{2(\frac{1}{2}x^3-4)+8} \\ &= \sqrt[3]{x^3-8+8} = \sqrt[3]{x^3} = x \checkmark \end{aligned}$$

\*\*\*\* If  $f(g(x)) = g(f(x)) = x$ , then  $f(x)$  and  $g(x)$  are inverses. \*\*\*\*

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## One-to-One Functions

If a function is one-to-one, then the inverse is also a function.

- Every  $y$  has one  $x$ .
- Passes the horizontal line test.

