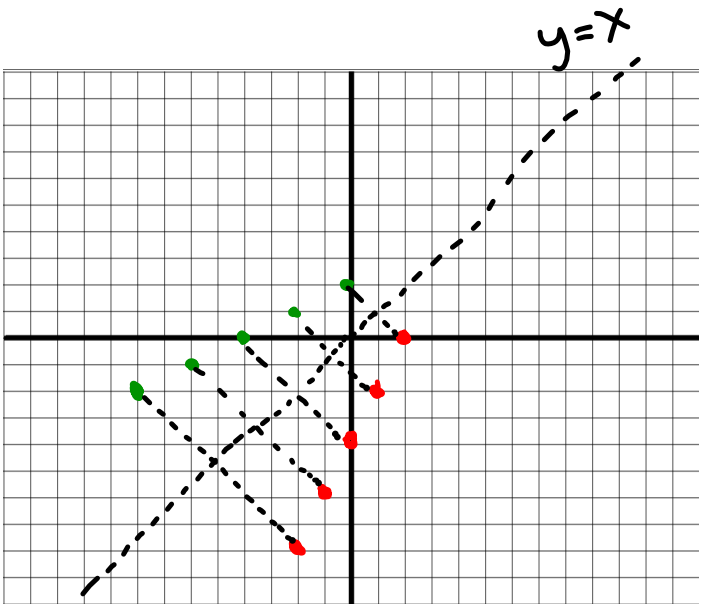
6.4 Use Inverse Functions

$y = 2x - 4$

X	Y
-2	-8
-1	-6
0	-4
1	-2
2	0

X	Y
-8	-2
-6	-1
-4	0
-2	1
0	2



EXAMPLE 1 **Find an inverse relation**

Find an equation for the inverse of the relation $y = 3x - 5$.

$y = 3x - 5$

$x = 3y - 5$

$+5 \quad +5$

$x + 5 = 3y$

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

$y = \frac{x+5}{3}$ or $y = \frac{1}{3}x + \frac{5}{3}$

EXAMPLE 2 Verify that functions are inverses

Verify that $f(x) = 3x - 5$ and $f^{-1}(x) = \frac{1}{3}x + \frac{5}{3}$ are inverse functions.

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

$3\left(\frac{1}{3}x + \frac{5}{3}\right) - 5$

$1x + 5 - 5$

X

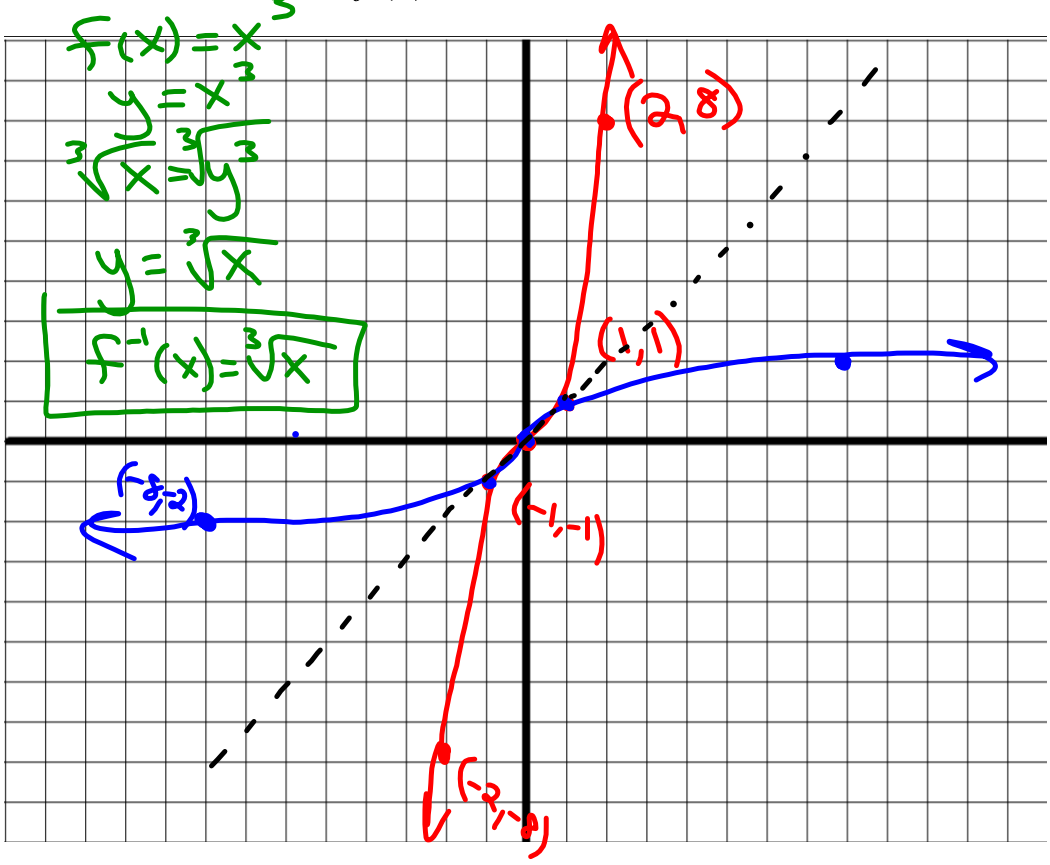
$f^{-1}(f(x))$

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

$1x - \frac{5}{3} + \frac{5}{3}$

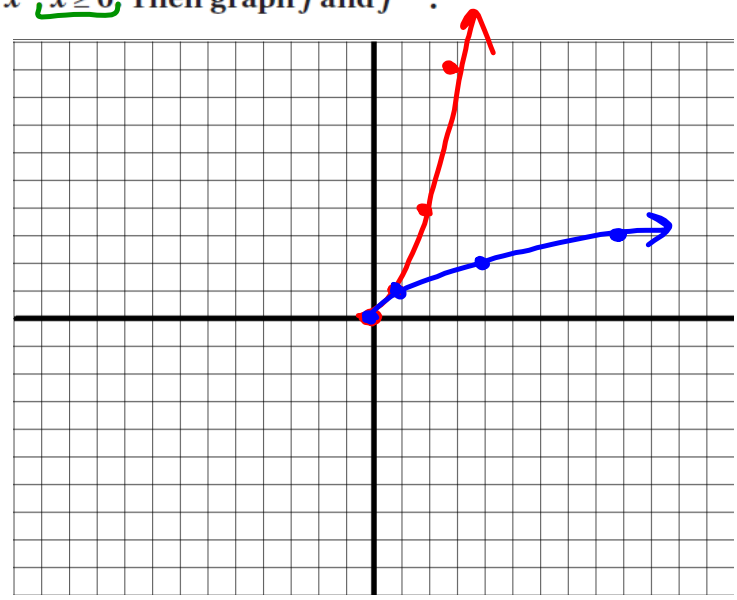
X

Graph $f(x) = x^3$, then find it's inverse.



EXAMPLE 4 **Find the inverse of a power function**

Find the inverse of $f(x) = x^2, x \geq 0$. Then graph f and f^{-1}.



$f(x) = x^2$

$y = x^2$

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

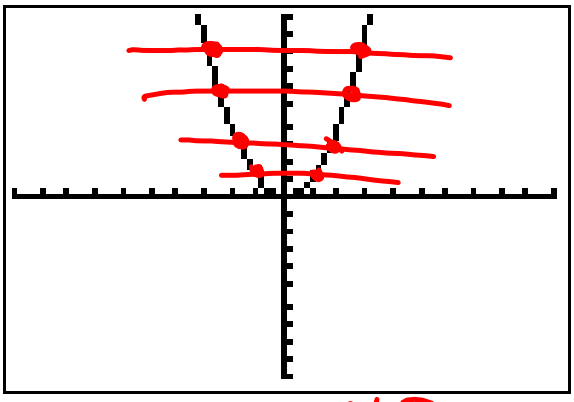
$y = \pm\sqrt{x}$

$y = \sqrt{x}$

$f^{-1}(x) = \sqrt{x}$

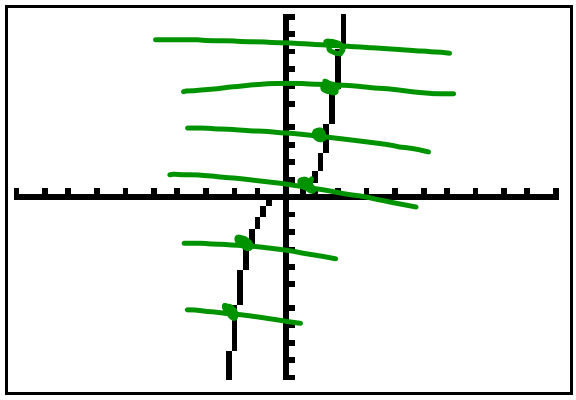
Horizontal Line Test

$f(x) = x^2$



Inv. NOT a func

$f(x) = x^3$



Inv. IS a func

EXAMPLE 5 **Find the inverse of a cubic function**

Consider the function $f(x) = 2x^3 + 1$. Determine whether the inverse of f is a function. Then find the inverse.

x	y
-2	-15
-1	-1
0	1
1	3
2	17

$f(x) = 2x^3 + 1$

$y = 2x^3 + 1$

$x = 2y^3 + 1$

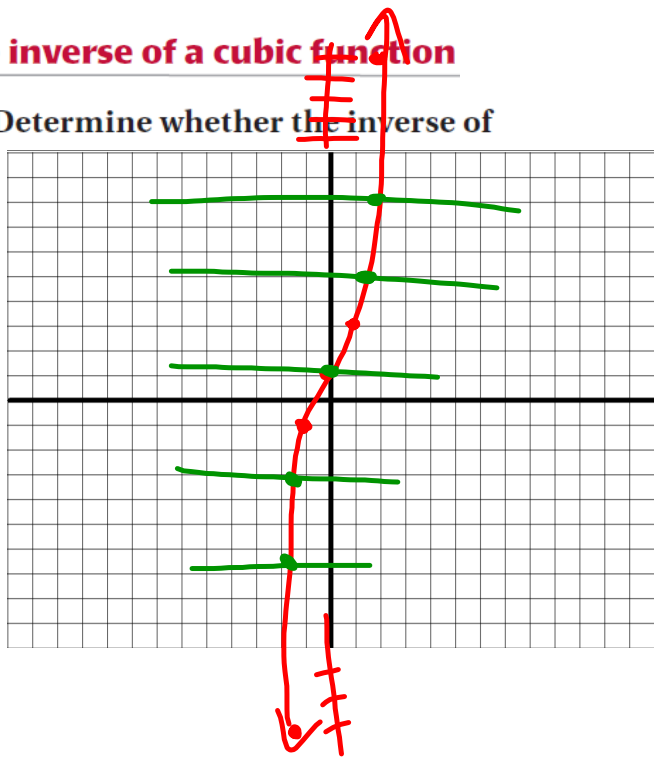
$-1 \quad -1$

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

$\sqrt[3]{\frac{x-1}{2}} = \sqrt[3]{y^3}$

$y = \sqrt[3]{\frac{x-1}{2}}$

$f^{-1}(x) = \sqrt[3]{\frac{x-1}{2}}$



VERIFYING INVERSE FUNCTIONS Verify that f and g are inverse functions.

18. $f(x) = \frac{1}{5}x - 1, g(x) = 5x + 5$

$g(f(x))$

$5\left(\frac{1}{5}x - 1\right) + 5$

$1x - 5 + 5$

x

$f(g(x))$

$\frac{1}{5}(5x + 5) - 1$

$1x + 1 - 1$

x

INVERSES OF POWER FUNCTIONS Find the inverse of the power function.

24. $f(x) = -10x^6, x \leq 0$

$y = -10x^6$

$\frac{x}{-10} = \frac{-10y^6}{-10}$

$\sqrt[6]{y^6} = \sqrt[6]{\frac{x}{-10}}$

$y = \pm\sqrt[6]{\frac{x}{-10}}$ negative

$y = -\sqrt[6]{\frac{x}{-10}}$

$f^{-1}(x) = -\sqrt[6]{\frac{x}{-10}}$