Inverse Functions

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11.2 Extension

Recall that a *relation* pairs inputs with outputs. An **inverse relation** switches the input and output values of the original relation. For example, if a relation contains (a, b), then the inverse relation contains (b, a).

EXAMPLE 1 Finding Inverse Relations

a. $(-4, 7), (-2, 4), (0, 1), (2, -2), (4, -5)$

b.

Input	−1	0	1	2	3	4
Output	5	10	15	20	25	30

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Switch the coordinates of each ordered pair.

$(7, -4), (4, -2), (1, 0), (-2, 2), (-5, 4)$

b.

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b.

Input	−1	0	1	2	3	4
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Switch the inputs and outputs.

Inverse relation:

Input	5	10	15	20	25	30
Output	−1	0	1	2	3	4

Notice how the domain of the relation becomes the range of the inverse relation, and the range of the relation becomes the domain of the inverse relation.

When a relation and its inverse are functions, they are called **inverse functions**. The inverse of a function f is written as $f^{-1}(x)$.

Study Tip: -1 in $f^{-1}(x)$ is not an exponent. It is read as “f inverse” x.

To Find the Inverse of a Function:

- Change $f(x)$ to a y.
- Switch the x and y values.
- Solve the new equation for y.
- Replace y with $f^{-1}(x)$

Example: $f(x) = 2\text{x} - 5.$

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$y = 2x - 5$ Replace f(x) with y.

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Example: $f(x) = 2x - 5$.

$y = 2x - 5$	Replace *f*(*x*) with *y*.
$x = 2y - 5$	Switch *x* and *y*.
$x + 5 = 2y$	Add 5 to each side.

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$x = 2y - 5$	Switch *x* and *y*.
$x + 5 = 2y$	Add 5 to each side.
$\frac{1}{2}x + \frac{5}{2} = y$	Divide each side by 2.

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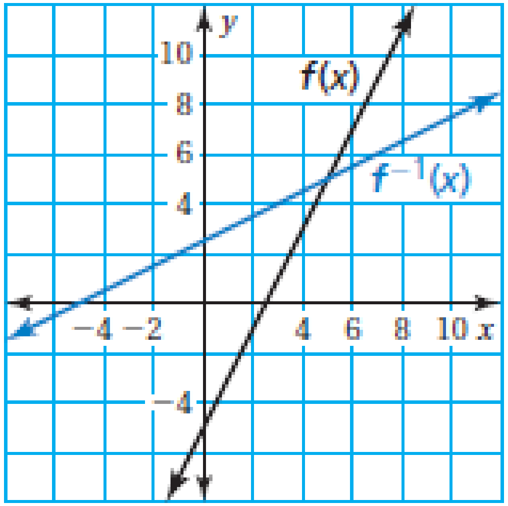
Example: $f(x) = 2x - 5$.

$y = 2x - 5$	Replace $f(x)$ with y.
$x = 2y - 5$	Switch x and y.
$x + 5 = 2y$	Add 5 to each side.
$\frac{1}{2}x + \frac{5}{2} = y$	Divide each side by 2.
$\frac{1}{2}x + \frac{5}{2} = f^{-1}(x)$	Replace y with $f^{-1}(x)$.



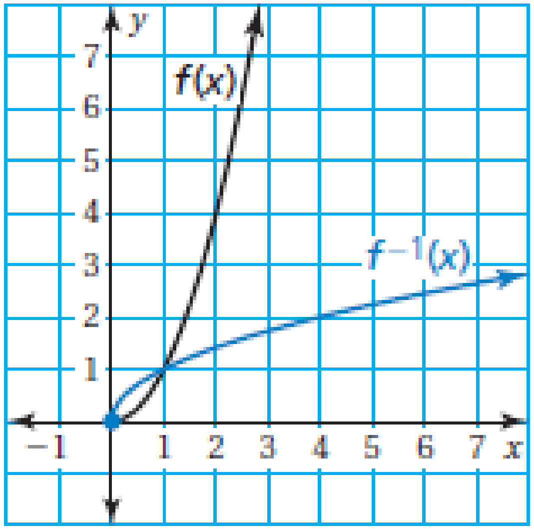
On Your Own

1. **Find the inverse of the relation: (-6, 4), (-3, 2), (0, 0), (3, -2), (6, -4).**

   (4, -6), (2, -3), (0, 0), (-2, 3), (-4, 6).

2. **Find the inverse of the function of $f(x) = x^2$, where $x \geq 0$. Graph the inverse function.**

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



HORIZONTAL LINE TEST

If no horizontal line intersects the graph of a function f more than once, then the inverse of f is itself a function.