

Algebra 1 4.7

Find the inverse of a relation

Find the inverse of a linear function

relation

inverse

function

inverse function

domain

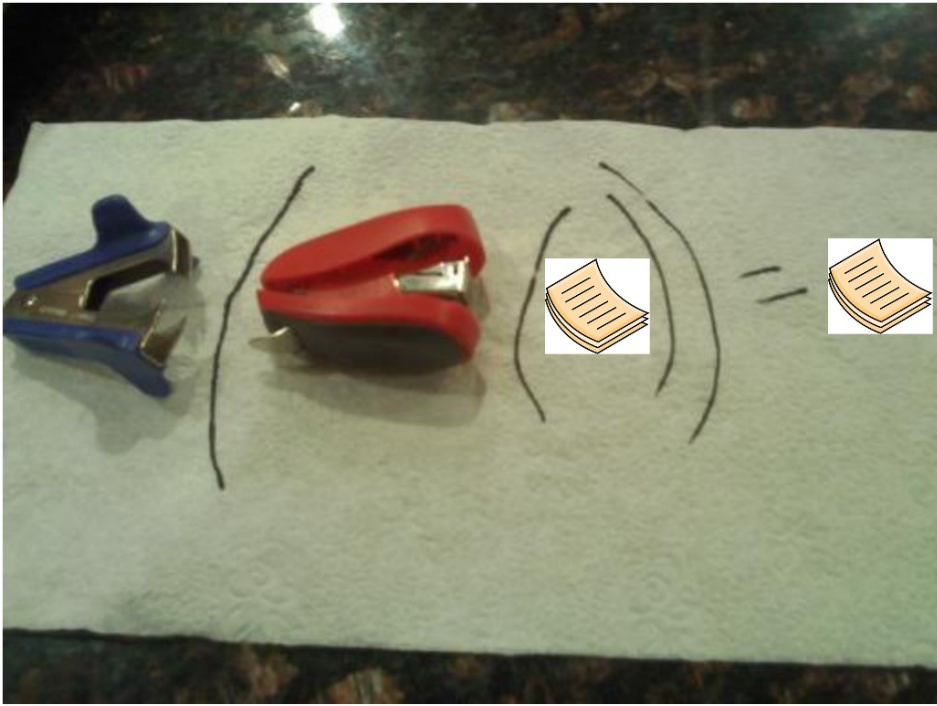
range

whiteboards

$$(x, y) \rightarrow (y, x)$$

$$y = 2x + 5 \quad x = 2y + 5$$

Quiz 4.5-4.6 (Graphing calculators)



They do the opposite **thing**.... like multiplying and dividing

KeyConcept Inverse Relations

Words If one relation contains the element (a, b) , then the inverse relation will contain the element (b, a) .

Example A and B are inverse relations.

A		B
$(-3, -16)$	$\longrightarrow$	$(-16, -3)$
$(-1, 4)$	$\longrightarrow$	$(4, -1)$
$(2, 14)$	$\longrightarrow$	$(14, 2)$
$(5, 32)$	$\longrightarrow$	$(32, 5)$

Example 1 Inverse Relations

Find the inverse of each relation.

a. $\{(4, -10), (7, -19), (-5, 17), (-3, 11)\}$

$(-10, 4) (-19, 7) (17, -5) (11, -3)$

b.

x	-4	-1	5	9
y	-13	-8.5	0.5	6.5

$$\begin{array}{c|c} & \\ -4 & -13 \\ -1 & -8.5 \\ & \vdots \end{array}$$

Guided Practice

1A. $\{(-6, 8), (-15, 11), (9, 3), (0, 6)\}$

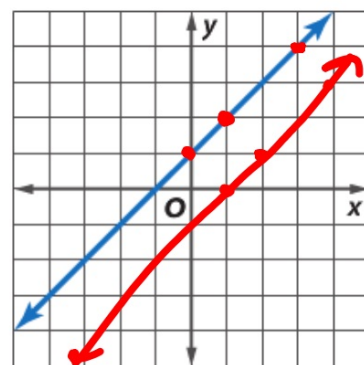
1B.

x	-10	-4	-3	0
y	5	11	12	15

Example 2 Graph Inverse Relations

Graph the inverse of the relation.

$(1, 2)$
 $(0, 1)$
 $(3, 4)$



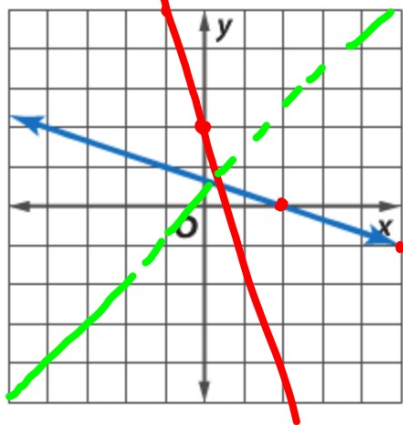
Exchange ordered pairs
How can I get some from the graph?

Line of symmetry

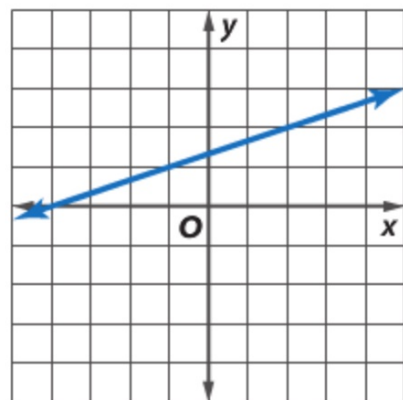
Guided Practice

Graph the inverse of each relation.

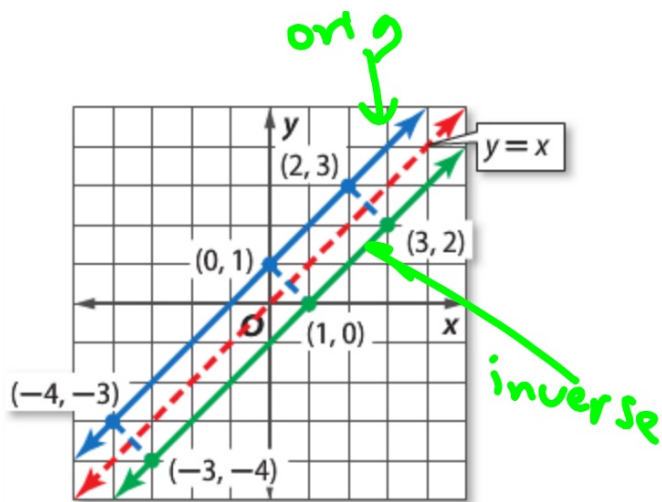
2A.



2B.



where is $y = x$?



inverse: reflection over $y=x$

Writing equations:
slope-intercept form

$$y = mx + b$$

function form

$$f(x) = mx + b$$

KeyConcept Finding Inverse Functions

To find the inverse function $f^{-1}(x)$ of the linear function $f(x)$, complete the following steps.

Step 1 Replace $f(x)$ with y in the equation for $f(x)$.

Step 2 Interchange y and x in the equation.

Step 3 Solve the equation for y .

Step 4 Replace y with $f^{-1}(x)$ in the new equation.

Remember: x and y trade places...

To consider: "What is happening to x? What would be the opposite thing?"
...so I should expect to see....

Example 3 Find Inverse Linear Functions

Find the inverse of each function.

a. $f(x) = 4x - 8$

$$y = 4x - 8$$

$$f^{-1}(x) = \frac{1}{4}x + 2$$

$$\begin{array}{r} x = 4y - 8 \\ +8 \quad +8 \\ \hline x + 8 = 4y \\ \quad \quad \quad \frac{\quad}{4} \end{array}$$

$$\frac{x+8}{4} = y = \underline{\underline{\frac{1}{4}x + 2}}$$

b. $f(x) = -\frac{1}{2}x + 11$

$$f^{-1}(x) = -2x + 22$$

$$\begin{array}{r}
 x = -\frac{1}{2}y + 11 \\
 \hline
 x - 11 = -\frac{1}{2}y \quad \cdot -2 \\
 -2x + 22 = y
 \end{array}$$

Guided Practice

3A. $f(x) = 4x - 12$

$$y = 4x - 12$$

$$\begin{array}{r} x = 4y - 12 \\ +12 \quad +12 \end{array}$$

$$\frac{x+12}{4} = \frac{4y}{4}$$

$$\boxed{f^{-1}(x) = \frac{1}{4}x + 3}$$

3B. $f(x) = \frac{1}{3}x + 7$

$$\begin{array}{r} x = \frac{1}{3}y + 7 \\ -7 \quad -7 \end{array}$$

$$(x-7 = \frac{1}{3}y)^3$$

$$3x - 21 = y$$

$$f^{-1}(x) = 3x - 21$$

