Explore: Inverse Functions

Explore inverse functions by doing the following problems.

You are going to take a trip to Europe and want to know how much your money is worth in euros (the European currency). The function **e =0.78d**, *where d is dollars and e is euros*, converts dollars into euros (€

1. Use the function **e =0.78d** to complete the table below to figure out what certain values of dollars are worth in euros.

d (dollars)	e (euros)
$5.00	3.90 €
$10.00	7.80 €
$15.00	11.70 €
$75.00	58.50 €

5(.78)

2. After you arrive in Europe, you use your debit card everywhere you go and all of the items you purchase are priced in euros. You realize that you need to know how much money you are spending in dollars, not in euros, so that you will know how much money you have remaining in your bank account (since your bank reports your balance in dollars).

a. ***Explain*** how can transform the function **e =0.78d**, so that it will convert euros to dollars and help you figure out how much money you are spending in dollars. Then write the new function.

to cancel x by .78, divide

$\frac{e}{.78} = \frac{.78d}{.78}$

d = e/.78

b. Use the function you wrote in #2a to complete the table below to convert euros (€) into dollars ($).

e (Euros)	d (dollars)
3.50€	$ 4.49
5.00€	$ 6.41
15.00€	$ 19.23
25.00€	$ 32.05

3.50/.78

3. A quarter pounder with cheese meal costs 5.95 € in Spain and $6.29 in the United States. Is the meal a better deal in the U.S. or in Spain? Explain.

5.95/.78 = $7.63

Spain's is $7.63 vs U.S. at $6.29 so the U.S. has the better deal.

In Europe, the temperatures are reported in Celsius degrees. However, you are used to seeing the temperature reported in Fahrenheit. The function $C = \frac{5}{9}(F-32)$ converts Fahrenheit into Celsius.

4. Complete the table below to figure out what certain Fahrenheit temperatures would be in Celsius degrees.

F (Fahrenheit)	C (Celsius)
50^0	10
70^0	21.1
85^0	29.5
90^0	32.2

$\frac{5}{9}(50-32)$

5. Before arriving in Europe, you check the weather report to decide what clothing to pack. The temperatures are reported in Celsius and you're not sure exactly how warm or cold it will be. You realize that you need to know what the temperature is in Fahrenheit, not in Celsius, so you will know how to pack accordingly.

a. ***Explain*** how can transform the function $C = \frac{5}{9}(F-32)$, so that it will convert Celsius to Fahrenheit and help you figure out how warm or cold it will be. Then write the new function.

$\frac{9}{5}C = F-32$ $+32$ $+32$

$F = \frac{9}{5}C + 32$ *Hint: To solve for F you have to multiply by 9/5 first.

b. Use the function you wrote in #5a to complete the table below to convert Celsius (C) into Fahrenheit (F).

C (Celsius)	F (Fahrenheit)
15^0	59
17^0	62.6
20^0	68
37^0	98.6

6. If the temperature in France is an average of 25^0 Celsius, what types of clothing would you pack for the trip? Explain.

summer

7. How is the function that converts dollars to euros related to the function that converts euros to dollars? reverse = INVERSE

8. How is the function that converts Celsius to Fahrenheit related to the function that converts Fahrenheit to Celsius? inverse

Fahrenheit and celsius continued…

9. $F = \frac{9}{5}c + 32$ $C = \frac{5}{9}(f - 32)$

a. Rewrite these equations just using typical inputs and outputs x and y.

y= $\frac{9}{5}x+32$ y= $\frac{5}{9}(x-32)$

b. We already saw inputting temperatures in one scale and converting it to the other but what would happen if we put the WHOLE equation inside the other one?

Simplify:

F(c) y= $\frac{9}{5}(\frac{5}{9}(x-32))+32$ C(f) y= $\frac{5}{9}(\frac{9}{5}x+32-32)$

$x-32+32$

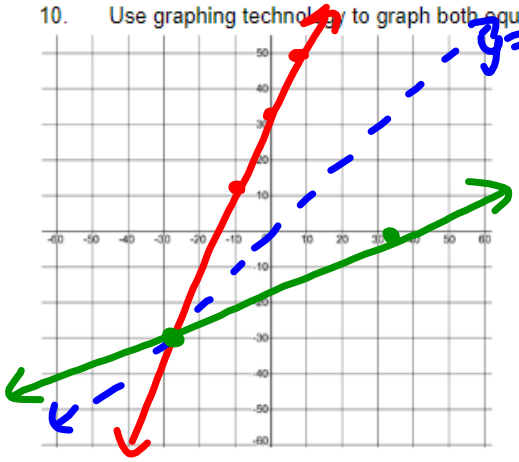
What do you notice? canceled, just x

Why does this work? opposites perfectly

Will it always work with inverse equations? yes

So what do you know about two equations if this works? they are inverses

10. Use graphing technology to graph both equations and sketch them here.



What do you notice?

flips over y=x

What transformations would put one graph directly over the other one?

reflection y=x

INVERSE CHECK

What is the inverse of:

Cold	_____	Add	$-$
Go	_____	Multiply	$\div$
Up	_____	x^2	$\sqrt{}$

In your own words summarize the meaning of *inverse*:

riverse, opposites

11. **Steps for finding inverse functions:** $f(x) = 7(x+4)$

1. Rewrite with y=
2. Switch x and y
3. Solve for y
4. Rewrite with $f^{-1}(x) =$

$y = 7(x+4)$

$x = 7(y+4)$

$\frac{x}{7} = y + 4$

$-4 \quad -4$

$\frac{x}{7} - 4 = y = f^{-1}(x)$

Assignment 1.1 Inverses

State if the given functions are inverses.

Test by putting one equation in the other

1) $g(x) = -3x$
$f(x) = -\frac{1}{3}x$

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

$= x$ yes inverses

2) $g(x) = -x + 2$
$f(x) = -x + 2$

3) $g(x) = 9x - 13$
$f(x) = \frac{1}{9}x + \frac{13}{9}$

4) $f(x) = -x - 4$
$g(x) = -x - 4$

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

Find the inverse of each function. Switch and solve!
↳ find the equation that reverses this one.

6) $g(x) = \frac{-12 - 5x}{4}$ $= y$

$\frac{-12 - 5y}{4} = x$ ~good too

$-12 - 5y = 4x$

$+12 \quad +12$

$\frac{-5y}{-5} = \frac{4x + 12}{-5}$

$g^{-1}(x) = y = \frac{-4}{5}x - \frac{12}{5}$

*multiply/divide do the whole side

7) $g(n) = -2 + \frac{5}{2}x$

y

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

$+2 \quad +2$

$\frac{2}{5}(x + 2) = \frac{5}{2}y \cdot \frac{2}{5}$

$\frac{2}{5}x + \frac{4}{5} = g^{-1}(n)$

8) $h(n) = \frac{-n - 2}{2}$

9) $h(n) = \frac{-4 + n}{4}$

10) $g(x) = -x - 2$

11) $g(x) = 4x + 1$

12) $g(x) = \dfrac{-8-3x}{4}$

13) $g(x) = \dfrac{1}{2}x + \dfrac{3}{2}$

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

$-3/2 \quad -3/2$

$2(x - 3/2) = 2 \cdot \frac{1}{2}y$

$2x - 3 = g^{-1}(n)$

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

15) $f(x) = -4 + \dfrac{1}{4}x$

Find the inverse of each function. Then graph the function and its inverse.

16) $g(x) = \frac{-6 - x}{3}$

$y = \frac{-6}{3} - \frac{x}{3}$

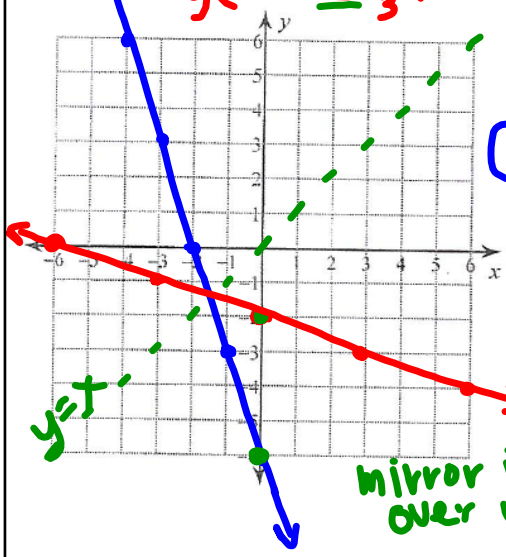
$g(n) = -2 - \frac{1}{3}x$

inverse

$3x = -6 - y$

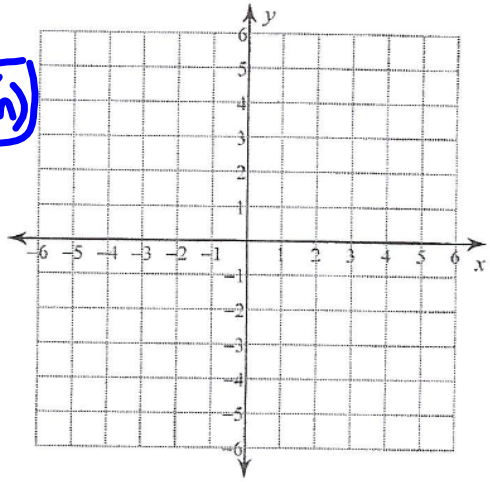
$3x + 6 = -y$

$-3x - 6 = y = g^{-1}(n)$

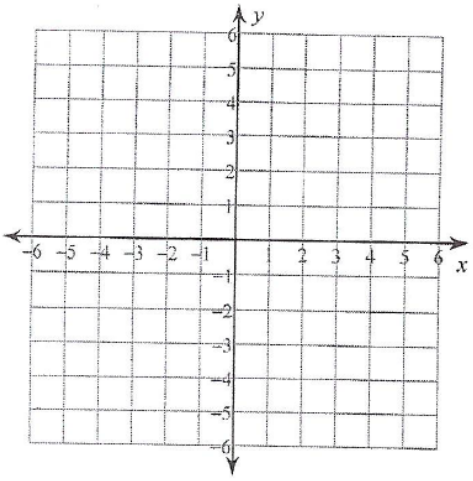


mirror images over $y=x$!

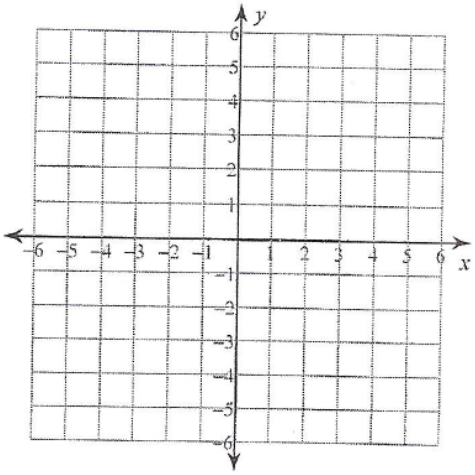
17) $g(x) = \frac{-3x - 6}{4}$



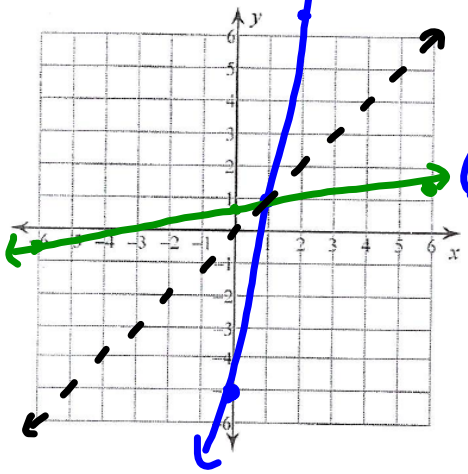
18) $f(x) = 3x + 3$



19) $g(x) = -\frac{3}{2}x - 6$



20) $f(x) = \frac{1}{6}x + \frac{5}{6}$



inverse

$x = \frac{1}{6}y + \frac{5}{6}$

$-5/6$ $-5/6$

$6(x - \frac{5}{6}) = \frac{1}{6}y$

$6x - 5 = f^{-1}(x)$