1.6 Inverse Functions

Review of Inverses you already know:

1) Additive Inverse:
   - What is the additive inverse of 2?
   - What do you get when you combine additive inverses?
   - What is the identity element for addition?

   (Identity element gives back what you put in)

2) Multiplicative Inverse:
   - What is the multiplicative inverse of 2?
   - What do you get when you combine multiplicative inverses?
   - What is the identity element for multiplication?

   (Identity element gives back what you put in)

INVERSES "UNDO" ONE ANOTHER

3) Composition is an "operation" unique to functions.

Ex: $f(x) = x+3$, what function, $g(x)$ would "undo" $f(x)$?

$g(x) =$ _____

What is $f(g(x))$? _____ $g(f(x))$ _____

What is the identity function? _____

If f(g(x))=x and g(f(x))=x then f and g are inverses of one another.

$g(x) = f^{-1}(x)$ read as the inverse of f

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

x	1	2	3	0	-1
f(x)	4	5	6	3	2

x	4	5	6	3	2
$f^{-1}(x)$	1	2	3	0	-1

What do you notice?

Property of Inverses:the domain of f =_____of f^{-1}

The range of f = _____ of f^{-1}

To verify inverses algebraically – show that _____= x and g(f(x)) = ___

Example: Show that $f(x) = \frac{x-9}{4}$ and g(x) = 4x + 9 are inverses of one another.

Additional practice p.69 #9-14

Put the equations of two inverses into your graphing calculator as y_1 and y_2. Zoom 5 (Zoom Square)
Is there a line of symmetry between these two graphs?

What is its equation?
Additional practice p69 #15-24
Verifying functions – Graphically and Numerically

If y = x is a line of symmetry then f(x) and g(x) are inverses. Be sure to look at them in zoom square mode.

To verify inverses numerically – use the table feature of the graphing calculator.
Input f(x) in y_1 and g(x) in y_2
$y_3 = y_1(y_2)$ and $y_4 = y_2(y_1)$

If the values of x, y_3 and y_4 are all the same then f and g are inverses.

Practice p 70 #25-28

For a function to have an inverse function, it must be a one-to-one function. Every x and every y is unique. Passes both vertical line test and Horizontal line test.

Practice p 70 #28-40

Finding an Inverse ALGEBRAICALLY:

1) **Replace f(x) with y.**
2) **Change x to y and y to x.**
3) **Get all the y's on one side and everything else on the other side of the equation**
4) **Solve for y (may have to factor out y)**

Ex1 f(x) = $3x+5$ **find its inverse function, if it exists**

1) **Graph f(x) to see if it is a One-to-One function. What is the test used?**
2) **Go through the steps above if it passes the test in #1.**
3) **Verify inverses algebraically or graphically.**

Ex 2 $f(x)=\dfrac{2x+3}{3x-5}$

Ex 3 $f(x)=x^3-5$

Additional practice: p70 # 41-62

Given graph of function – to find its inverse Swap the domain and range values.

P70 #67-68

Additional practice on inverses and composition: p71 #73-82