## 6.2 Inverse Functions – Day 2

**Objectives: Restricting domains to insure inverses are functions**
**Determining if two functions are inverses of one another**

$\left(-\frac{3}{2}\right)(x+4) = \left(-\frac{2}{3}y\right)\left(-\frac{3}{2}\right)$

**Warm-Up: Write the inverse of each relation or function.**

**1.** $\{(8,6), (-8,-1), (7,-3), (4,1)\}$ **2.** $f(x) = -\frac{2}{3}x - 4$

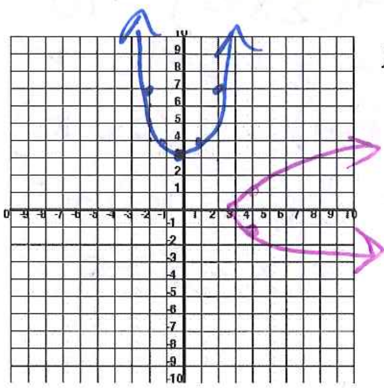
$\{(6,8)\ (-1,-8)\ (-3,7)\ (1,4)\}$ $x = -\frac{2}{3}y - 4$ $\boxed{-\frac{3}{2}x - 6 = y}$

**Graph the function using a table. Switch the x & y values and graph the inverse.**

**Ex.** $f(x) = x^2 + 3.$

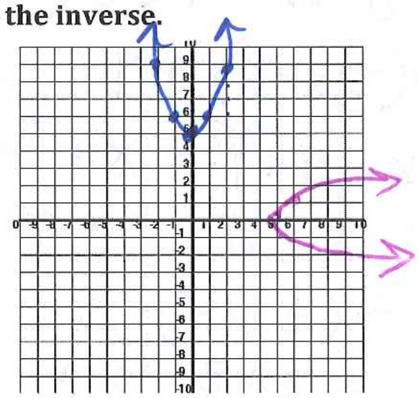
| x | y |
|---|---|
| -1 | 4 |
| 0 | 3 |
| 1 | 4 |

| x | y |
|---|---|
| 4 | -1 |
| 3 | 0 |
| 4 | 1 |



$f(x) = x^2 + 5$

| x | y |
|---|---|
| -1 | 6 |
| 0 | 5 |
| 1 | 6 |



**Function:**
**D:** ℝ or $(-\infty,\infty)$ **R:** $[3,\infty)$

**Inverse:**
**D:** $[3,\infty)$ **R:** ℝ or $(-\infty,\infty)$

**Function:**
**D:** $(-\infty,\infty)$ **R:** $[5,\infty)$

**Function:**
**D:** $[5,\infty)$ **R:** $(-\infty,\infty)$

**Is the inverse a function?** ___no___ **Why or why not ?** ___fails vertical line test.___

**Horizontal Line Test:** Just as we use the ___vertical line test___ to determine if a graphed equation is a function, we can use the ___horizontal line test___ to predict if its inverse will be a function.

**Sometimes it is necessary to restrict the** ___domain___ **of a relation in order for its inverse to be a function.**

**How might we restrict the Domain in each example so that their inverses will be functions?**

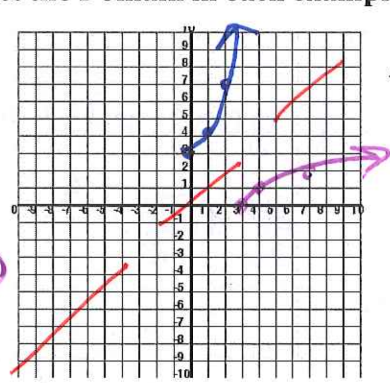
**ex.** $f(x) = x^2 + 3.$

Inverse $x = y^2 + 3$

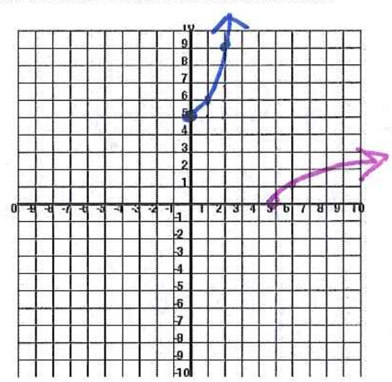
$x - 3 = y^2$

$y = \sqrt{x-3}$

don't put "±" in front.



$f(x) = x^2 + 5$



**Function:**
**D:** $[0,\infty)$ **R:** $[3,\infty)$

**Inverse:**
**D:** $[3,\infty)$ **R:** $[0,\infty)$

**Function:**
**D:** $[0,\infty)$ **R:** $[5,\infty)$

**Inverse:**
**D:** $[5,\infty)$ **R:** $[0,\infty)$

**Two functions are inverses of one another if and only if: $f[g(x)] = x$ and $g[f(x)] = x$.**

**Use composition of functions to determine if each pair of functions are inverses of one another.**

**Ex.** $f(x) = 3x + 9$ *and* $g(x) = \frac{1}{3}x - 3$

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

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

$= x - \cancel{9} + \cancel{9} = x$ ✓

$g(f(x)) = g(3x+9)$

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

$= x + \cancel{3} - \cancel{3}$ ✓

yes

**1.** $f(x) = 2x - 10$ *and* $g(x) = \frac{1}{2}x + 5$

$f(g(x)) = f(\frac{1}{2}x + 5)$

$= 2(\frac{1}{2}x + 5) - 10$

$= x + \cancel{10} - \cancel{10}$ ✓

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

$= \frac{1}{2}(2x - 10) + 5$

$= x - \cancel{5} + \cancel{5}$ ✓

yes

**2.** $f(x) = -6x$ *and* $g(x) = \frac{1}{6}x$

$f(g(x)) = f(\frac{1}{6}x)$

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

nope

$x \neq -x$

**3.** $f(x) = 8x - 10$ *and* $g(x) = \frac{x+10}{8}$

$f(g(x)) = f(\frac{x+10}{8})$

$= \cancel{8}(\frac{x+10}{\cancel{8}}) - 10$

$= x + \cancel{10} - 10$ ✓

yes

$g(f(x)) = g(8x - 10)$

$= \frac{(8x-10) + 10}{8} = \frac{8x - \cancel{10} + \cancel{10}}{8} = x$ ✓

**4.** $f(x) = (x + 6)^2$ *and* $g(x) = \sqrt{x} - 6$

$f(g(x)) = f(\sqrt{x} - 6)$

$= (\sqrt{x} - \cancel{6} + \cancel{6})^2 = (\sqrt{x})^2 = x$ ✓

$g(f(x)) = g(x+6)^2$

$= \sqrt{(x+6)^{\cancel{2}}} - 6$

$= x + \cancel{6} - \cancel{6}$

$= x$ ✓

yes

**5.** $f(x) = \frac{2}{3}x^3$ *and* $g(x) = \sqrt[3]{\frac{2}{3}x}$

$f(g(x)) = f(\sqrt[3]{\frac{2}{3}x})$

$= \frac{2}{3}(\sqrt[\cancel{3}]{\frac{2}{3}x})^{\cancel{3}} = \frac{2}{3}(\frac{2}{3}x)$

$= \frac{4}{9}x$

nope

Don't cancel one another!