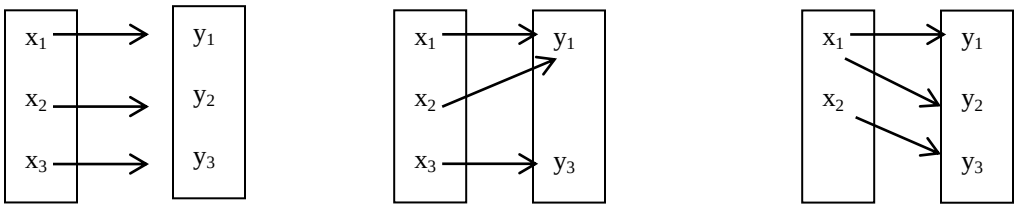
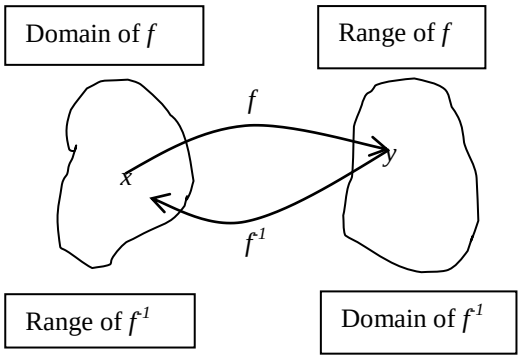
Pre-AP Algebra 2
Lesson 1-3 – Inverse Functions

Objectives: Students will be able to determine the inverse of a function given a table, graph, or equation. Students will determine the domain and range of the inverse function.

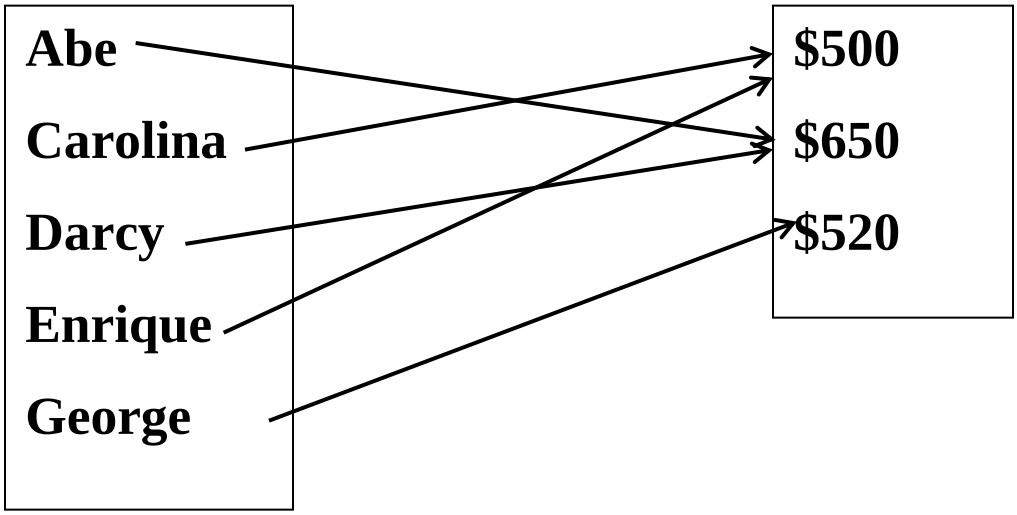
Materials: Do Now; special note-taking templates; overheads for direct instruction; pair work; homework

Time	Activity
10 min	**Homework Review** Put up the answers to hw #1-2 on the overhead. Give students time to discuss in groups any problems.
15 min	**Homework Presentation** Show students how to do selected problems from the tally sheet.
40 min	**Direct Instruction -** Hand out the special note-taking templates. Show the examples of arrow mappings on the overhead: the first example is one-to-one, and the second is not. Underneath, ask students to help develop the inverse mappings. *Which of the resulting relations is a function? Which isn't? Why?* **Concepts:** An inverse of a function is created by **reversing the domain and range of the function**. *On a third overhead, show two sets of ordered pairs. Ask students to find the inverses, and to determine if they are functions. They will see that the first function's inverse is a function and the second is not. This occurs because, in the 2nd function, there are some y-values that are repeated. Thus, when they are reversed, that assigns multiple y-values to a single x-value.* When the inverse of a function *f* is itself a function, then *f* is said to be a **one-to-one function**. This says that, if you pick any x_1 and x_2 in the domain, $f(x_1) \neq f(x_2)$. It can be illustrated as follows: **One-to-one function** **function (but not one-to-one)** **not a function**  *On the fourth overhead, show two examples of **graphs** of functions. The first one is **not** one-to-one, and the second one is. Ask students to visually determine if it is one-to-one or not (i.e. are there any repeated y-values?). Show how to use the horizontal line test.* **Vertical line test (review):** If every **vertical** line intersects the graph of a **relation** *f* in at most one point, then *f* is a **function**. **Horizontal line test:** If every **horizontal** line intersects the graph of a **function** *f* in at most one point, then *f* is **one-to-one**. If a function is one-to-one, its inverse is a function.

	 *Notice that, if you start with x, you end up back with x. Inverse functions undo each other. In other words:* $f^{-1}(f(x)) = x$ *and* $f(f^{-1}(x)) = x$ Note: $f^{-1}(x)$ is not the same as $[f(x)]^{-1}$ To check if functions are inverse, you must test this property. **Examples:** Are the following functions inverses? 1) *f(x) = 2x + 3 and g(x) = ½(x – 3)* 2) $f(x) = x^3$ *and* $g(x) = \sqrt[3]{x}$ Find the inverse (switch x and y, then solve for y): Given $f(x)$, find $f^{-1}(x)$. 1) $f(x) = 5x - 1$ 2) $f(x) = -3(x + 6) - 7$
20 min	**Pair Work** Hand out **Inverse Functions** practice sheet.

Homework #1-3:

Domain: The employees at a company
Range: The weekly salaries paid at the company

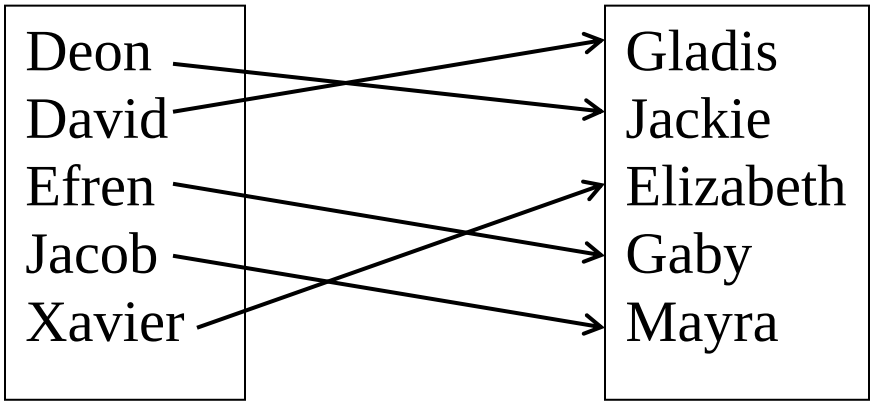


Is this a function?

Domain: The weekly salaries paid at the company
Range: The employees at a company

Is this a function?

Domain: Male Dancing Partners
Range: Female Dancing Partners



Is this a function?

Domain: Female Dancing Partners
Range: Male Dancing Partners

Gladis	Deon
Jackie	David
Elizabeth	Efren
Gaby	Jacob
Mayra	Xavier

Is this a function?

Relation 1	**Inverse of 1**
(-3, -27)	**(,)**
(-2, -8)	**(,)**
(-1, -1)	**(,)**
(0, 0)	**(,)**
(1, 1)	**(,)**
(2, 8)	**(,)**
(3, 27)	**(,)**

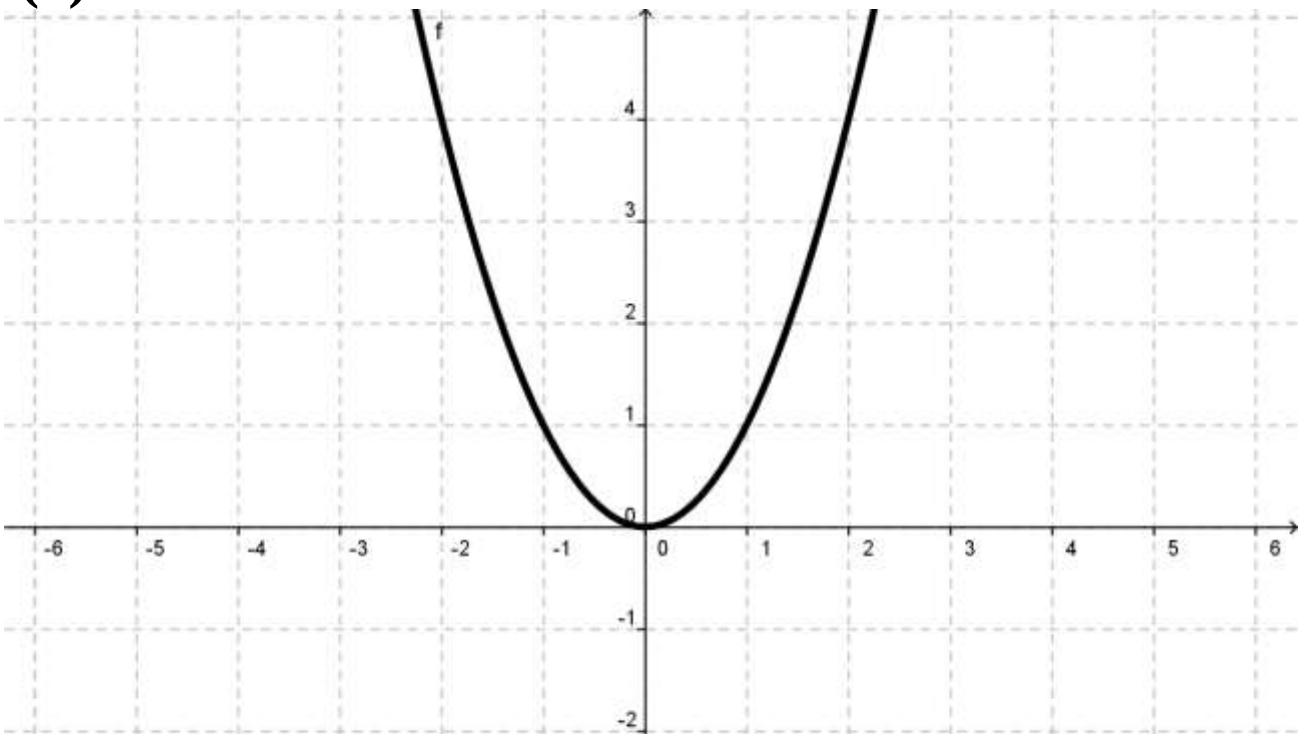
Is this a function? **Is the inverse a function?**

Relation 2	**Inverse of 2**
(-3, 9)	**(,)**
(-2, 4)	**(,)**
(-1, 1)	**(,)**
(0, 0)	**(,)**
(1, 1)	**(,)**
(2, 4)	**(,)**
(3, 9)	**(,)**

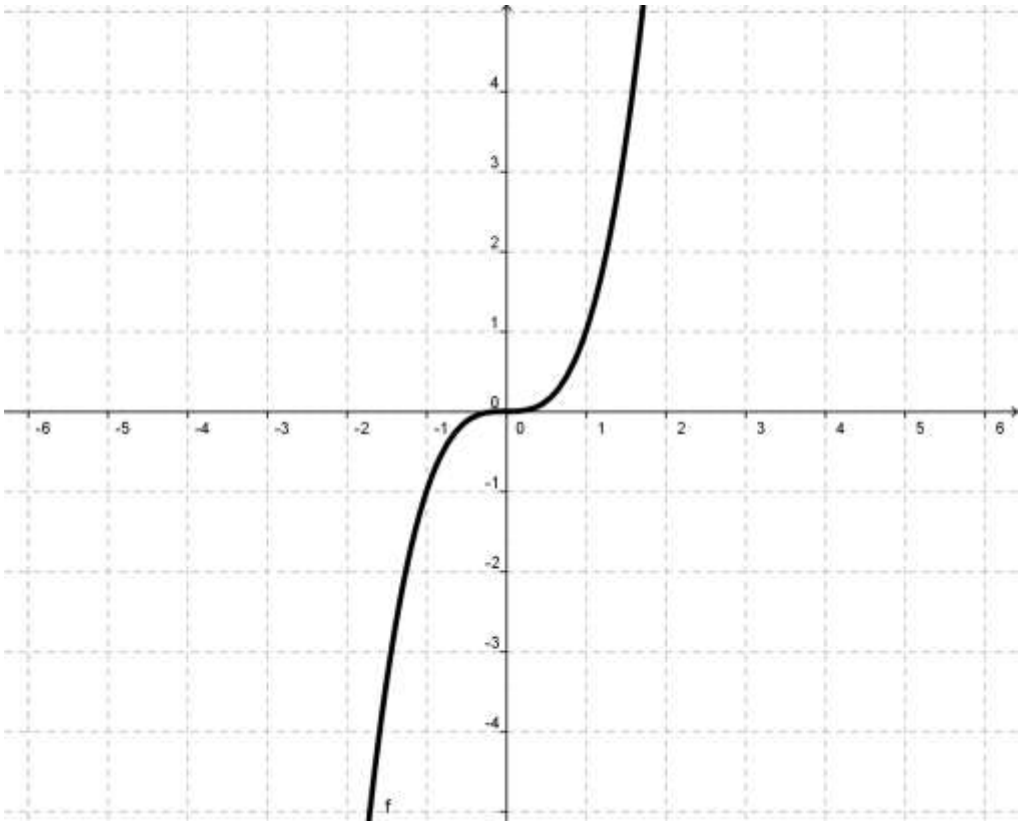
Is this a function? **Is the inverse a function?**

Why is the inverse of relation 1 a function, while the inverse of relation 2 is not?

f(x) **Is this a one-to-one function?**



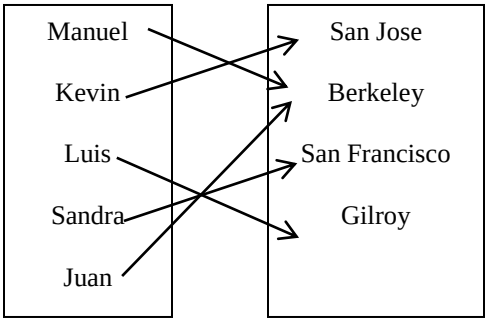
g(x) **Is this a one-to-one function?**

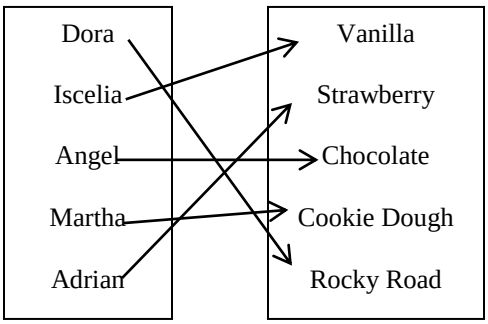


Pre-AP Algebra 2 **Name**_____
Lesson 1-3 – Pairwork

Inverse Functions Practice

1) Draw an arrow map that shows the *inverse* of the function given. Then, determine if the inverse is also a *function*.





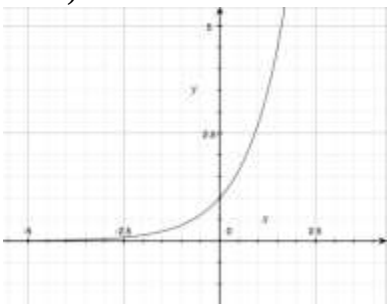
2) Label each relation properly: "Not a function"; "Function (***not*** one-to-one)"; "Function (one-to-one)".

a)
(3, 8)
(-4, 7)
(2, 9)
(-3, 3)
(5, 9)

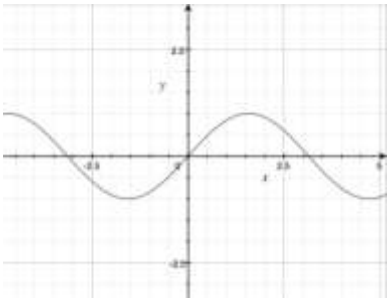
b)
(-2, 5)
(4, 9)
(-4, 7)
(-2, 6)
(5, 8)

c)
(0, 9)
(-4, 7)
(3, 5)
(5, 2)
(7, 1)

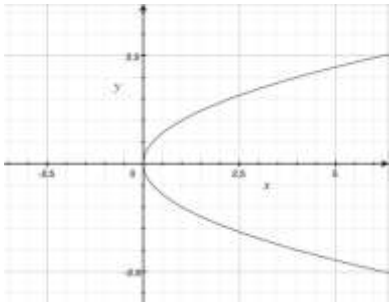
d)



e)



f)



3) Check to see if these functions are inverses. Remember, f(g(x)) and g(f(x)) both must equal *x*.

a) $f(x) = 2x + 3, \quad g(x) = -3x - 2$

b) $f(x) = 2x - 4, \ g(x) = \frac{x+4}{2}$

4) Find the inverse of each function. Remember, switch *x* and *y*, and then solve again for *y*.

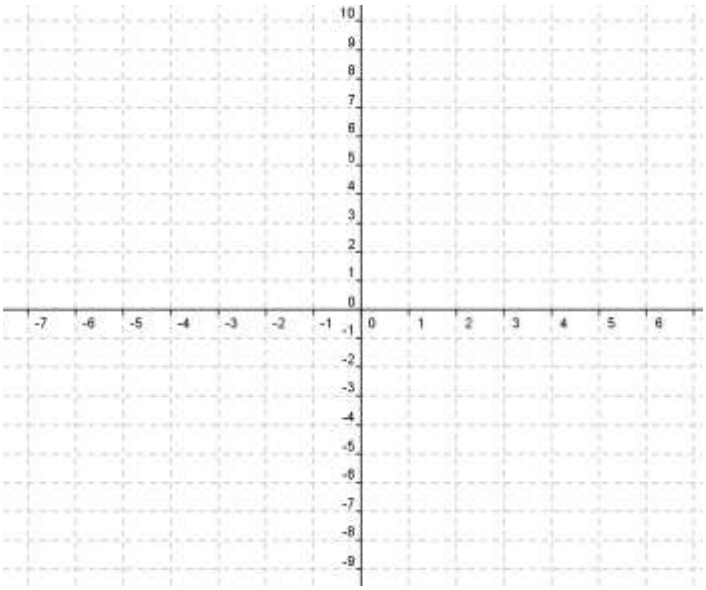
a) $f(x) = 4x - 5$

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

5) Graph $f(x) = 2x + 4$ and $g(x) = \frac{1}{2}x - 2$ on the same graph by hand.

6) Find *f(3)* and *g(10)*.

7) What point do they share?



8) Find the equation for *f(g(x))* and *g(f(x))*.

9) What do you notice about the graphs?

Pre-AP Algebra 2 **Name**_____
Lesson 1-3 – Homework

Check for Understanding

Can you complete these problems correctly by yourself

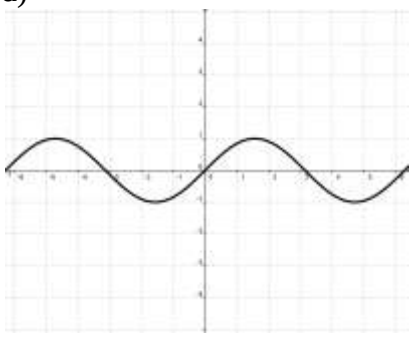
1) Label each relation properly: "Not a function"; "Function (***not*** one-to-one)"; "Function (one-to-one)".

a)
(3, 2)
(-2, 7)
(-2, 5)
(1, 3)
(5, 9)

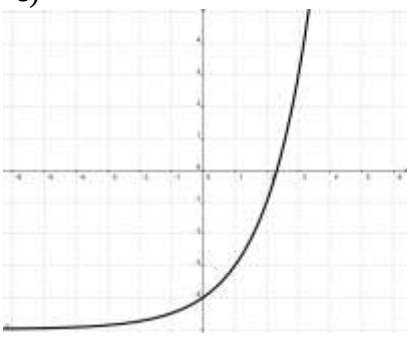
b)
(0, 3)
(-2, 5)
(1, 6)
(2, -6)
(3, 4)

c)
(-6, 2)
(-4, 6)
(1, 3)
(-1, 7)
(0, 2)

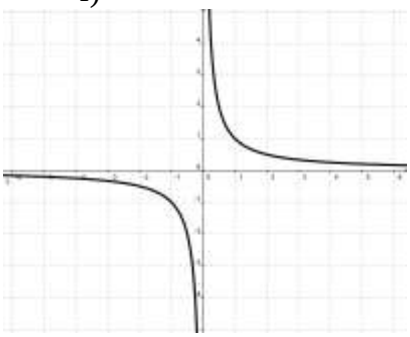
d)



e)



f)



2) Find the inverse of each function. Remember, switch *x* and *y*, and then solve again for *y*.

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

b) $g(x) = 6 - 3x$

3) Check to see if these functions in problem 2 are inverses. Remember, f(g(x)) and g(f(x)) both must equal *x*.

a)

b)

Spiral

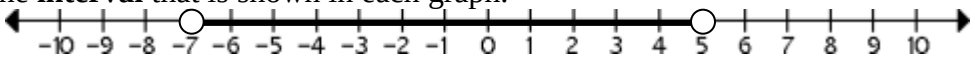
What do you remember from Algebra 1? (these are skills we will need in Algebra 2) You also need to remember what we have already learned in this unit.

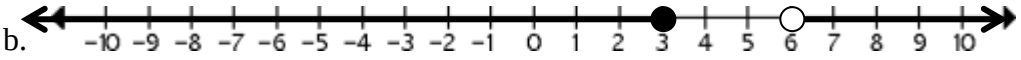
1) Angelica drew a line that passed through the points (-3, 6) and (-2, 11). Kiara drew a line that was perpendicular to Angelica's line, and it passed through the point (5, -3). What is the equation of the line (in slope-intercept form) that Kiara drew?

2) Solve the equation for x: $2-\frac{2}{3}x=\frac{5}{8}(2x+1)$

---

3) Write the **interval** that is shown in each graph.

a. 

b. 

4) Graph each interval on a number line. Pay attention to open/closed endpoints.

a. $(-3,+\infty)$ b. $(-\infty,-4]$ c. $[2,6.5)$ d. $(-\infty,0)\cup(0,+\infty)$

e. $(-\infty,3)\cup(5,9]$ f. $[-5,-1.5]\cup\left(0,\frac{10}{3}\right)$ g. $(-\infty,-3)\cup(-1,3)\cup[5,+\infty)$

5) Write each interval in inequality notation.

a. $(-1,5)$ b. $(-5,+\infty)$ c. $(-\infty,-6]\cup[2,+\infty)$

6) Write each inequality in interval notation.

a. $x<8$ b. $-2\le x\le 5$ c. $x<0$ or $x>5$

7) Solve each inequality. Write the solution in both inequality *and* interval notation. Then graph the solution on a number line.

a. $5-3x<-2$ *or* $5-3x>2$ b. $-9\le\frac{2}{3}x-5\le 9$

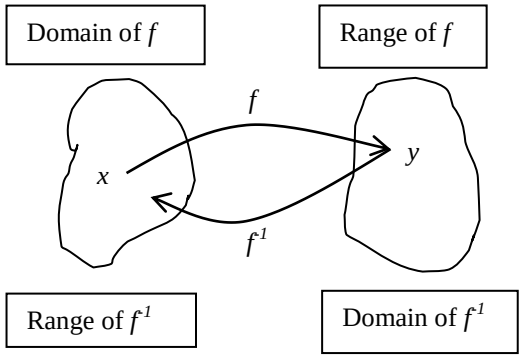
c. $|x|>4$ d. $|x|\le 5$

8) Given $f(x)=-2x^2+3x-4,\ g(x)=x+1,\ h(x)=3x^2$

a. $f(-2)$
b. $h(5)$
c. $f(g(2))$
d. $(f+g)(x)$
e. $(h-f)(x)$
f. $(g\cdot h)(x)$
g. $g(h(x))$
h. $h(g(x))$
i. $f(g(x))$

Lesson Name: Inverse Functions **Date: _____** **Student: _____**

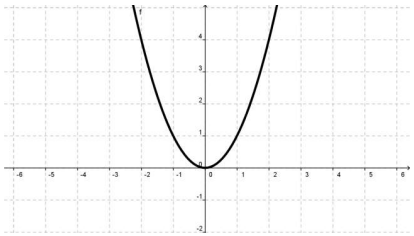
Concepts	Examples
Inverse Functions:	**Domain:** Employees at a company **Range:** Weekly salaries paid Abe, Carolina, Darcy, Enrique, Guillermo $500, $650, $520 **Domain:** Weekly salaries paid **Range:** Employees at a company
One-to-one functions:	**Domain:** Male Dancing Partners **Range:** Female Dancing Partners Deon, David, Efren, Jacob, Xavier Gladis, Jackie, Elizabeth, Gaby, Mayra **Domain:** Female Dancing Partners **Range:** Male Dancing Partners
Vertical line test:	**Relation 1** (-3, -27) (-2, -8) (-1, -1) (0, 0) (1, 1) (2, 8) (3, 27) **Function?** **Inverse of R1** (,) (,) (,) (,) (,) (,) (,) **Function?** **Relation 2** (-3, 9) (-2, 4) (-1, 1) (0, 0) (1, 1) (2, 4) (3, 9) **Function?** **Inverse of R2** (,) (,) (,) (,) (,) (,) (,) **Function?**
Horizontal line test:	



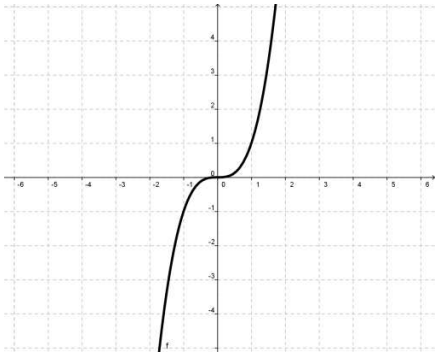
Inverse functions undo each other!

To test if functions are inverse…

f(x)



g(x)



Are the following functions inverses?

1) *f(x) = 2x + 3 and g(x) = ½(x – 3)*

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

Find the inverse (rewrite f(x) as *y*, switch *x* and *y*, then solve for *y*):

1) $f(x) = 5x - 1$

2) $f(x) = -3(x + 6) - 7$