

1. Good news! The vending machine in the cafeteria has broken so that you can get a drink without putting in any money. Levi runs down to the vending machine, presses Button 1 and gets a Vitamin Water. He presses Button 1 again and gets another Vitamin Water. He presses Button 2 and gets a Gatorade; when he presses Button 2 again, he gets a Vitamin Water.
 - a. We say that an operation is a relation when a distinct input leads to an output. What are the inputs and outputs for the vending machine?
 - b. When an relation (machine or otherwise) is operating consistently, it is called a function. Is the vending machine operating as a function for Levi? Explain why or why not.
 - c. More formally, functions are relations in which a given input always results in the only one output. Explain what this formal definition means for the vending machine. Under what conditions would the vending machine be a function? (This would be a good time to define **function** in your notes).
 - d. When operating normally, the vending machine should follow the table below:

Button	1	2	3	4	5
Drink	Vitamin Water	Gatorade	Vitamin Water	Gatorade	Orange Juice

Is the vending machine normally a function? Explain why or why not. What is the domain and range for the vending machine?

- e. Recall that the inverse of a relation reverses the input and outputs. What would the table look like for the inverse of the normally operating vending machine?

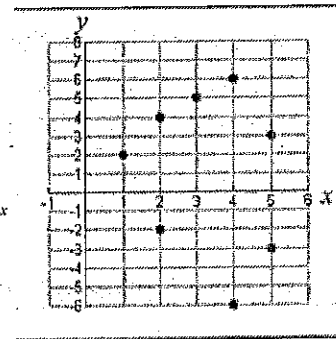
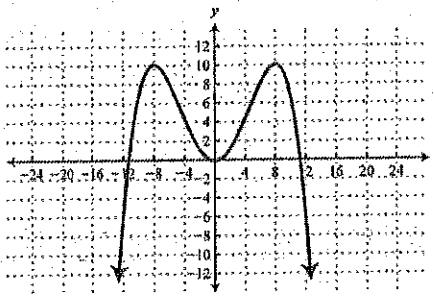
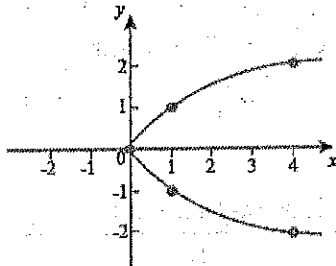
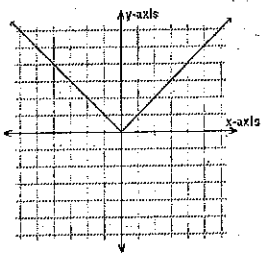
- f. What is the domain and range of the inverse of the vending machine? How does it compare to the domain and range of the first table? (This would be a good time to put information about the domain and range of inverse functions in your notes).
- g. Is the inverse of the vending machine a function? Explain why or why not.

Mathematical Functions:

2. a. Complete the table below for the function $g(x) = (x - 1)^3 + 2$

x	-1	0	1	2	3
y					

- b. Based on the table, is $g(x)$ a function?
- c. Go to [desmos.com](https://www.desmos.com) and graph $g(x)$. Can you locate any values of x (inputs) that have more than one output (y)?
- d. Read [Vertical Line Test \(all 3 slides\)](#). Which of the relations below are functions? Justify your answer. (This would be a good time to put information about how to identify a function using a graph in your notes).



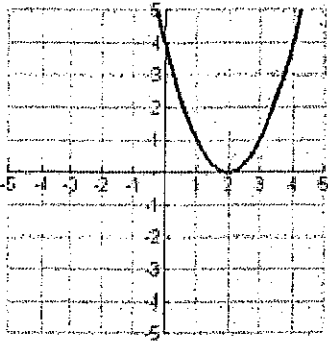
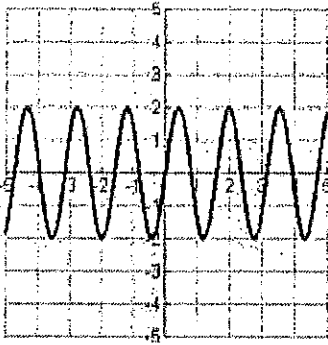
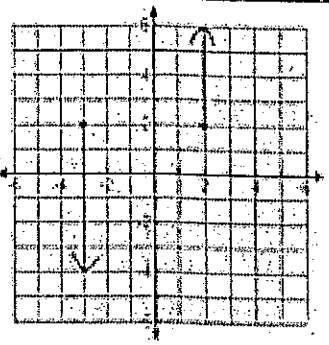
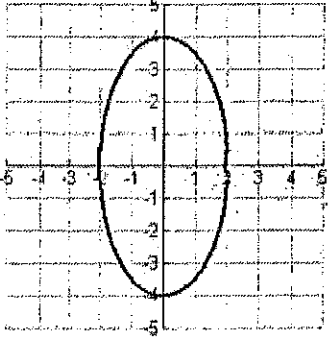
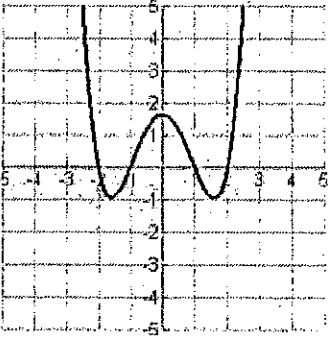
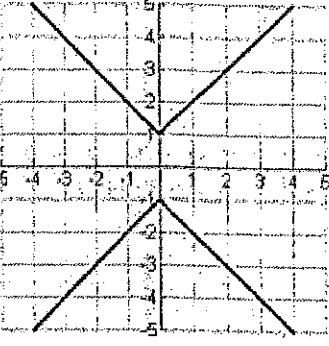
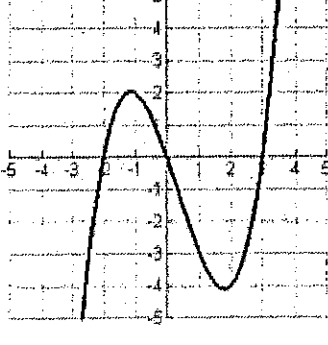
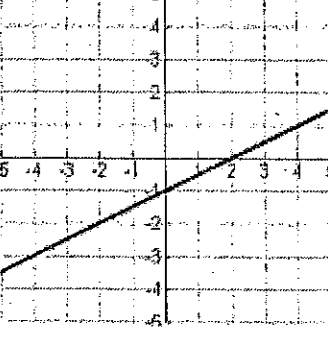
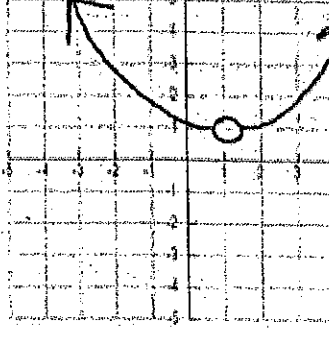
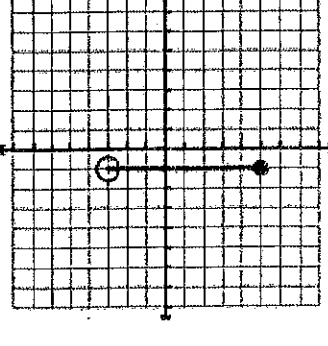
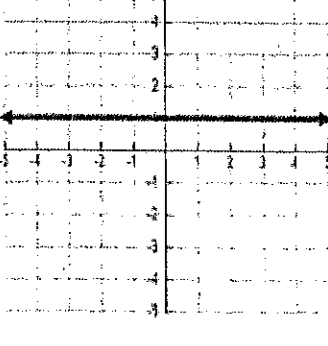
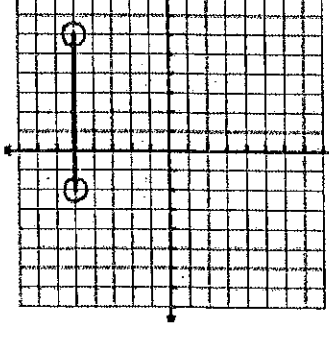
- f. Using [desmos.com](https://www.desmos.com), graph the relation $x^2 + y = 4$.
- i. Is this relation a function? Explain why or why not.
- ii. By switching the input (x) and output (y), graph the inverse of this relation. Is it a function? Explain why or why not.

iii. Repeat parts i and ii for each relation below:

- $x + y = 7$
- $y = (x - 1)^3 + 2$
- $y = 2|x + 4|$
- $0.25x^3 - y = 1$
- $4x^2 + y^2 = 25$

- f. Under what conditions will both a relation and its inverse be functions? When will one be a function and one not be a function? Are there situations in which both will not be functions? Be specific.

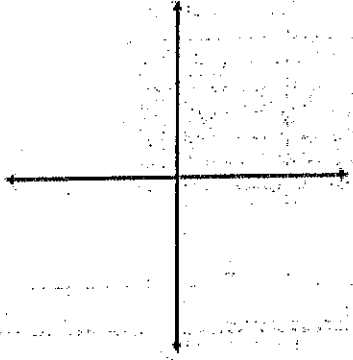
1. Find the domain and range for each graph. Then determine if the graph is a function.

 <p>D: _____ R: _____ Function: _____</p>	 <p>D: _____ R: _____ Function: _____</p>	 <p>D: _____ R: _____ Function: _____</p>
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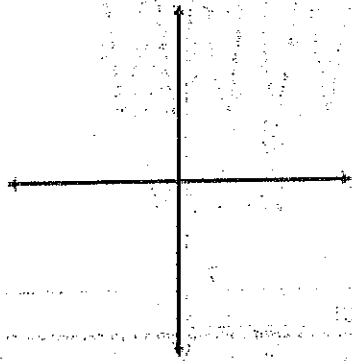
D: _____ R: _____ Function: _____	D: _____ R: _____ Function: _____	D: _____ R: _____ Function: _____
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2. Sketch a graph with the given domain and range:

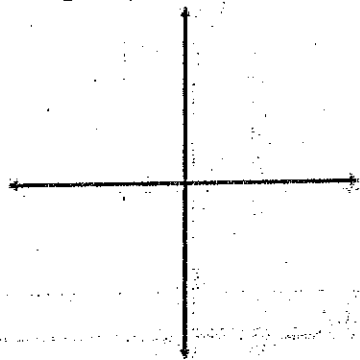
Domain: $3 \leq x \leq 7$
Range: $1 \leq y \leq 10$



Domain: $(-5, 2]$
Range: $[-3, 4)$



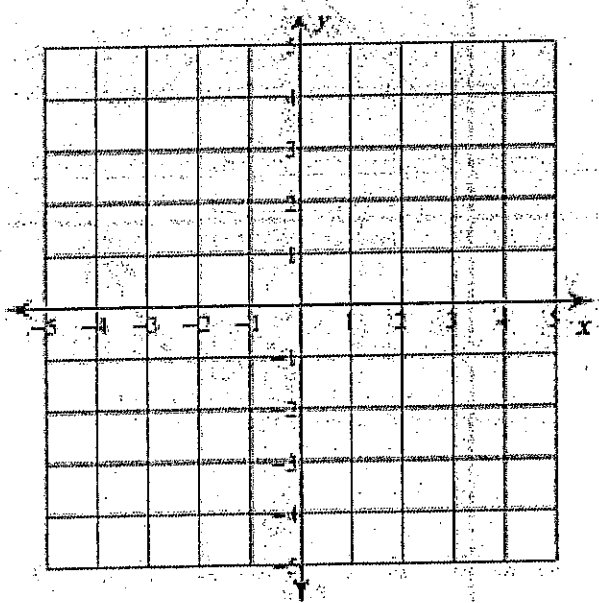
Domain: $[3, \infty)$
Range: $(-\infty, \infty)$



3. Solve the system graphically:

$$\begin{cases} y = 3x - 4 \\ x + 2y = 6 \end{cases}$$

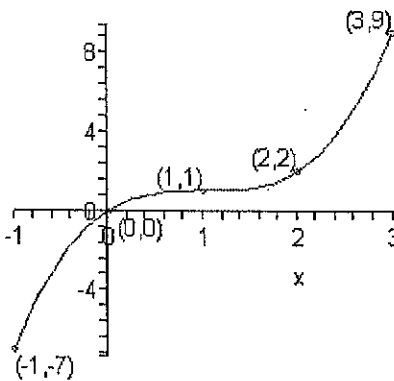
How could you solve this without a graph?



4. Solve the system WITHOUT graphing.

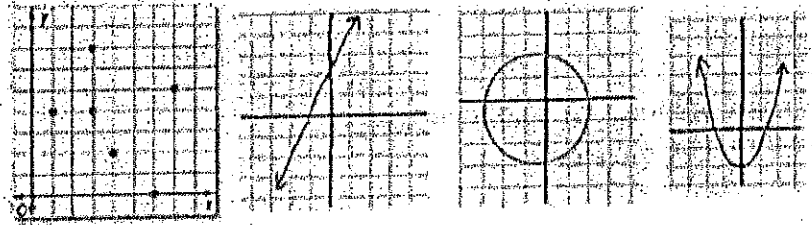
$$\begin{cases} -4x + y = 6 \\ -5x - y = 21 \end{cases}$$

AA3: Inverses Notes

Questions	Notes												
<p>1. I can find the inverse of a function:</p> <p>A. From an equation:</p> $f(x) = \frac{3}{2}x - 1$ $g(x) = .5(x + 3)^2 - 8$ $h(x) = \sqrt{2x + 1} + 5$ $j(x) = \frac{3}{x-1} + 2$ <p>B. From a table.</p> <table border="1"> <thead> <tr> <th>x</th> <th>$f(x)$</th> </tr> </thead> <tbody> <tr> <td>-8</td> <td>-2</td> </tr> <tr> <td>-1</td> <td>-1</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>8</td> <td>2</td> </tr> </tbody> </table> <p>C. From a graph</p>	x	$f(x)$	-8	-2	-1	-1	0	0	1	1	8	2	
x	$f(x)$												
-8	-2												
-1	-1												
0	0												
1	1												
8	2												

2. I can determine whether or not a relation is a function.

- Using a graph



- Using a table

3	3
4	5
5	7
5	9
6	11

5	31
6	28
7	25
8	22
9	19

2	3
3	3
4	3
5	3
6	3

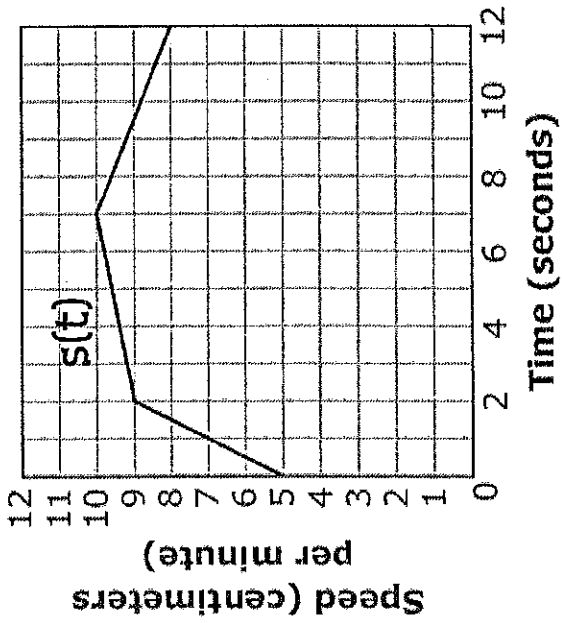
7	10
8	20
9	30
9	40
10	50

4. I can use composite functions to test inverses (A/B level only)

Use composite function to show that $f(x) = 2\sqrt{x-1} + 2$ and $g(x) = \left(\frac{x-2}{2}\right)^2 + 1$ are inverses

Evaluating a Function From a Graph

Snail Speed as a Function of Time



Evaluate	Meaning
$s(7) =$ _____	
$s(6) =$ _____	
	After 12 seconds, the snail was traveling at a speed of 8 cm/minute.
$s(11) =$ _____	
	After _____ second(s), the snail was traveling at a speed of 7 cm/minute.

Evaluating a Function From a Table

Charge for Delivery

Miles Traveled x	Charge $c(x)$
1	\$14.00
2	\$21.00
3	\$28.00
4	\$35.00
5	\$42.00
6	\$49.00

Evaluate	Meaning
$c(3) =$ _____	
$c(1) =$ _____	
	The delivery charge for 5 miles is \$42.00.
$c(4) =$ _____	
	The delivery charge for _____ miles is \$21.00.

1. Explain the difference between $f(2)$ and $f(x) = 2$.

2. Let $f(x) = 4 - 2x$

a) Evaluate $f(-6)$

b) Evaluate $f(3a)$

c) Evaluate $f(t+2)$

d) Solve $f(x) = 5$

3. Let $g(x) = x^2 - 7$

a) Evaluate $g(-3)$

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

4. Let $h(x) = (x - 2)(x + 7)$

a) Evaluate $h(2)$

b) Evaluate $h(a)$

5. Let $f(x) = \frac{8}{x+2}$

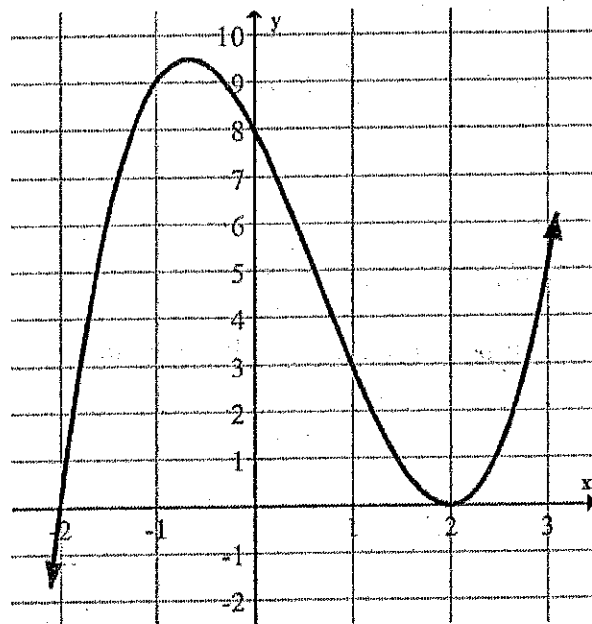
a) Evaluate $f(14)$

b) Evaluate $f(t)$

c) Solve $f(x) = 1$

6. Use the graph of $f(x)$ below to answer the following questions.

- Evaluate $f(3)$
- Evaluate $f(-1)$
- Solve $f(x) = 0$
- Solve $f(x) = -1$
- Identify the domain of this function.
- On what interval is the function decreasing?
- On what interval is the function increasing?
- Does the function have an absolute maximum?



8. Sketch the graph of a function whose domain is $(-\infty, \infty)$ and whose range is $(-\infty, \infty)$.

9. Sketch the graph of a function whose domain is $(-\infty, \infty)$ and whose range is $(-\infty, 0]$.

10. Sketch the graph of a function whose domain and range are both $[0, \infty)$.

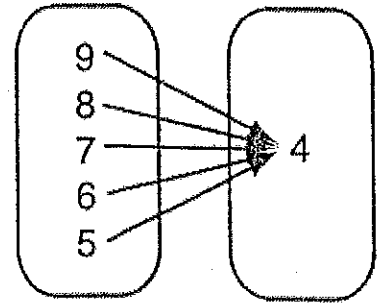
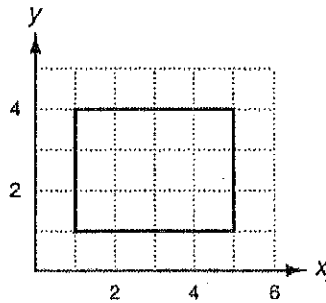
11. Use the table of values to answer the questions below.

x	-7	-2	0	1	3	4	6
$f(x)$	6	3	0	-2	1	0	0

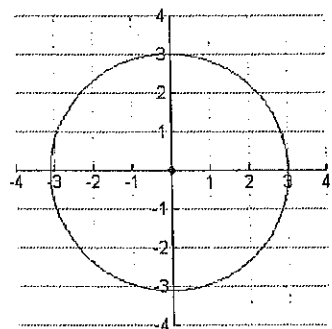
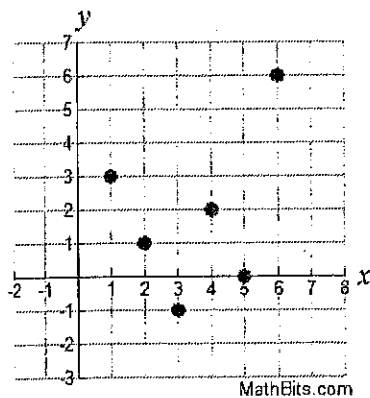
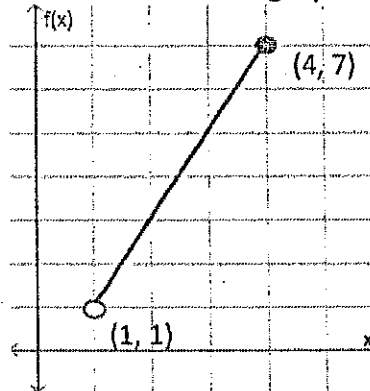
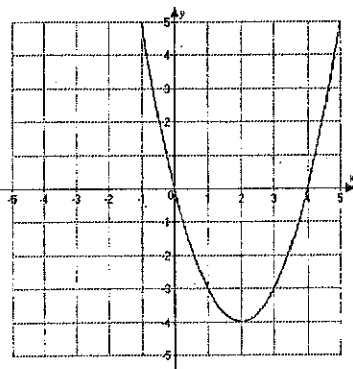
- Evaluate $f(3)$
- Evaluate $f(6)$
- Solve $f(x) = 6$
- Solve $f(x) = 0$

1. Tell whether the following are functions. Explain.

$\{(-2, 5), (-1, 1), (3, 1), (-1, -2)\}$



2. Find domain and range of the given graphs below. State if each graph is a function:



3. Use the functions $f(x) = x^2 - 4$, $g(x) = x - 3$, $h(x) = x + 2$ to answer the questions below.

a. Evaluate $f(-7)$

b. Solve $h(x) = -7$

c. Evaluate $g(-4)$

d. Solve $g(x) = 1$

e. Solve $f(x) = -5$

f. Evaluate $h(-1)$

g. Find the domain of $f(x)$.

h. Find the range of $h(x)$

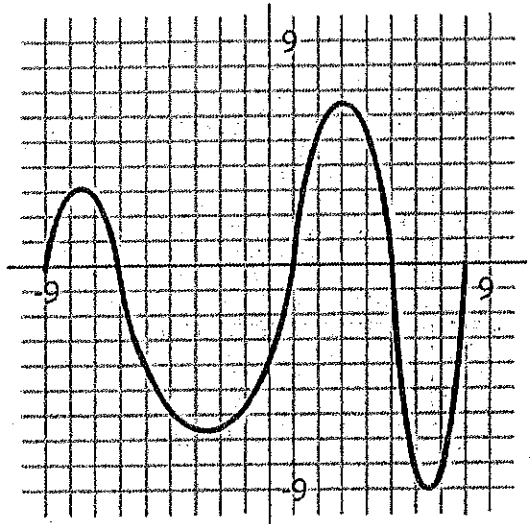
i. Find the range of $g(x)$

4. The following graph completely defines $f(x)$.

a. Evaluate $f(2)$

b. Evaluate $f(-2)$

c. Solve $f(x) = 0$



5. Find the inverse of the following functions:

a. $y = \frac{1}{2}x - 3$

c. $h(x) = \frac{7x+18}{2}$

b. $g(x) = \sqrt[3]{x} + 3$

d. $f(x) = 2x^4 + 5$

6. Given two function machines $f(x) = x^2 - 1$ and $g(x) = 3(x + 2)$.

a. If the two machines are connected so that $f(x)$ comes first, and 5 is dropped in, what comes out? (This is finding $g(f(5))$)

a. If the two machines are connected so that $g(x)$ comes first, and 5 is dropped in, what comes out? (This is finding $f(g(5))$)

7. Given two function machines $f(x) = \frac{2}{x-7}$ and $g(x) = 2x + 5$ calculate:

b. $g(3) =$

d. $f(g(2)) =$

c. $f(10) =$

e. $g(f(11)) =$

8. Find and verify the inverse of the following functions:

a. $f(x) = 3(4x + 5) - 1$

b. $g(x) = \frac{\sqrt[3]{x+4}}{2}$

1. Use the method from the previous class to find the inverse of each function below. Show your work.

a. $L(x) = 5x - 1$

b. $s(x) = \sqrt{x+4} - 3$

2. a. Complete the table below for the relation $g(x) = (x - 4)^2 + 1$

x	-2	0	2	4	6
y					

b. Based on the table, is $g(x)$ a function? Explain why or why not.

c. Complete the table below for the **inverse** of $g(x)$.

x					
y					

d. Is the inverse of $g(x)$ a function? Explain why or why not.

1. Use the method from the previous class to find the inverse of each function below. Show your work.

a. $L(x) = 3x - 7$

b. $s(x) = \sqrt{x+7} - 2$

2. a. Complete the table below for the relation $g(x) = (x - 3)^2 + 4$

x	-1	1	3	5	7
y					

b. Based on the table, is $g(x)$ a function? Explain why or why not.

c. Complete the table below for the **inverse** of $g(x)$.

x					
y					

d. Is the inverse of $g(x)$ a function? Explain why or why not.

Function Inverses

State if the given functions are inverses.

$$1) g(x) = 4 - \frac{3}{2}x$$

$$f(x) = \frac{1}{2}x + \frac{3}{2}$$

$$2) g(n) = \frac{-12 - 2n}{3}$$

$$f(n) = \frac{-5 + 6n}{5}$$

$$3) f(n) = \frac{-16 + n}{4}$$

$$g(n) = 4n + 16$$

$$4) f(x) = -\frac{4}{7}x - \frac{16}{7}$$

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

$$5) f(n) = -(n + 1)^3$$

$$g(n) = 3 + n^3$$

$$6) f(n) = 2(n - 2)^3$$

$$g(n) = \frac{4 + \sqrt[3]{4n}}{2}$$

$$7) f(x) = \frac{4}{-x - 2} + 2$$

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

$$8) g(x) = -\frac{2}{x} - 1$$

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

Find the inverse of each function.

$$9) h(x) = \sqrt[3]{x} - 3$$

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

$$11) h(x) = 2x^3 + 3$$

$$12) g(x) = -4x + 1$$

$$13) g(x) = \frac{7x+18}{2}$$

$$14) f(x) = x+3$$

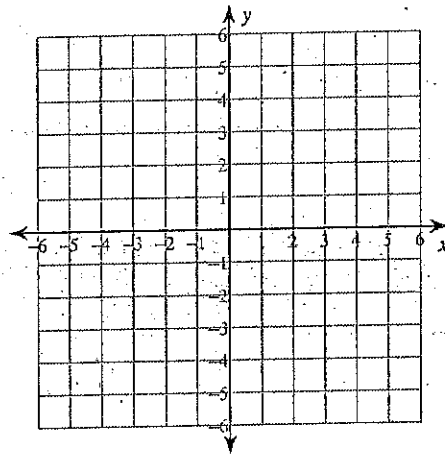
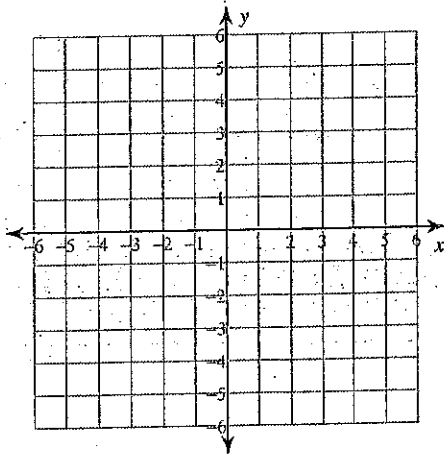
$$15) f(x) = -x+3$$

$$16) f(x) = 4x$$

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

$$17) f(x) = -1 - \frac{1}{5}x$$

$$18) g(x) = \frac{1}{x-1}$$



$$19) f(x) = -2x^3 + 1$$

$$20) g(x) = \frac{-x-5}{3}$$

