CCSS Algebra 3 Function Characteristics:

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 <u>relation</u> when a distinct input leads to an output. What are the inputs and outputs for the vending machine? Input = Button
Output = Drink

b. When an relation (machine or otherwise) is operating consistently, it is called a **<u>function</u>**. Is the vending machine operating as a function for Levi? Explain why or why not.

No. Button 2 is inconsistent.

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).

Function: Each button gives one drink consistently.

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? Yes. Each button gives a single type of drink. D = Button
R = Drink

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

Drink	VW	G	VW	G	OJ
Button	1	2	3	4	5

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).

D: Drink
R: Button

Domain & Range are switched.

g. Is the inverse of the vending machine a function? Explain why or why not.

No. VW & G are inconsistent because they come from 2 different buttons.

Mathematical Functions:

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

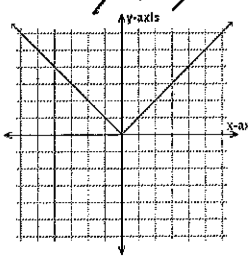
x	-1	0	1	2	3
y	−6	1	2	3	10

b. Based on the table, is $g(x)$ a function? Yes

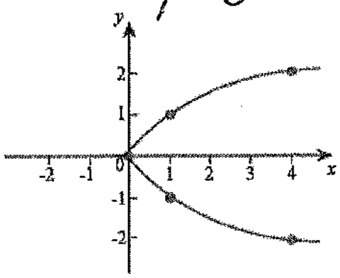
c. Go to desmos.com and graph $g(x)$. Can you locate any values of x (inputs) that have more than one output (y)? No

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).

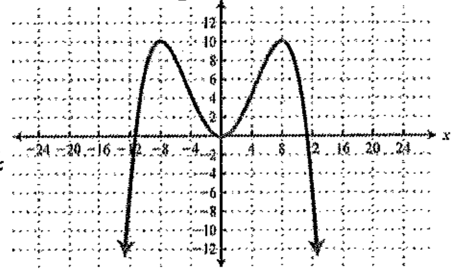
Yes



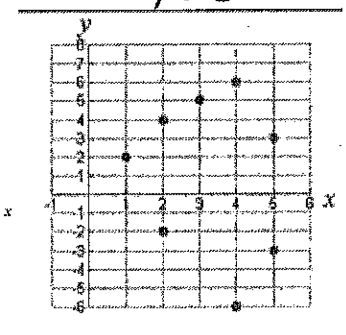
No



Yes



No



f. Using desmos.com, graph the relation $x^2 + y = 4$.

i. Is this relation a function? Explain why or why not. Yes, vertical line test

ii. By switching the input (x) and output (y), graph the inverse of this relation. Is it a function? Explain why or why not. No. Vertical line test

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

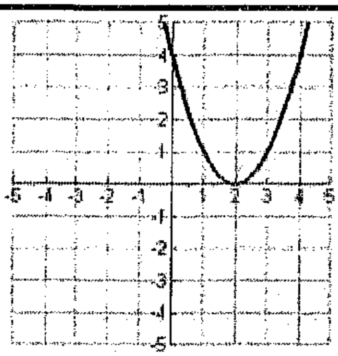
- $x + y = 7$ Yes
- $y = (x-1)^3 + 2$ Yes
- $y = 2|x+4|$ Yes
- $0.25x^3 - y = 1$ Yes
- $4x^2 + y^2 = 25$ No

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. Both are functions if every horizontal & vertical line intersects only once. Both are not functions if any horizontal or vertical line intersects more than once.

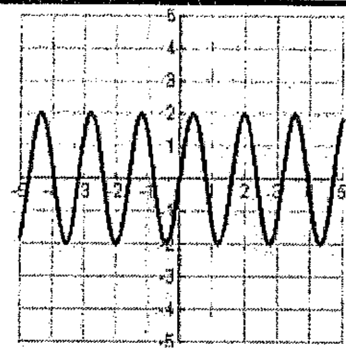
Algebra 3-4
Ch 1 Day 2 Domain and Range

Name: ______________________ Per:_____
August 31/September 1, 2016

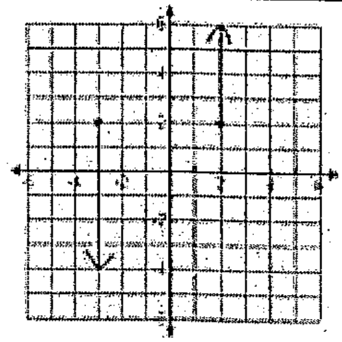
1. Find the domain and range for each graph. Then determine if the graph is a function.



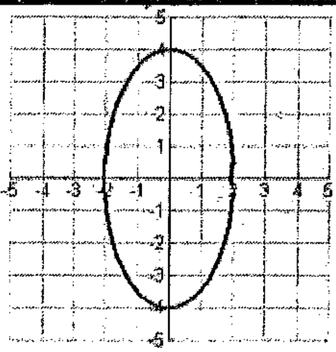
D: $(-\infty,\infty)$ R: $[0,\infty)$
Function: Yes



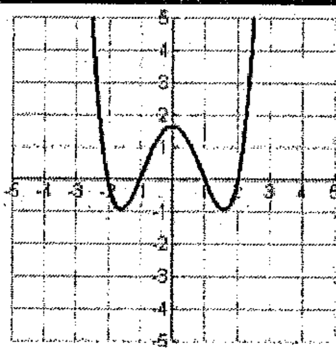
D: $(-\infty,\infty)$ R: $[-2,2]$
Function: Yes



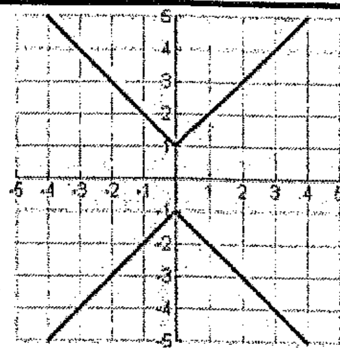
D: $[-3]\ [2]$ R: $(-\infty,\infty)$
Function: No



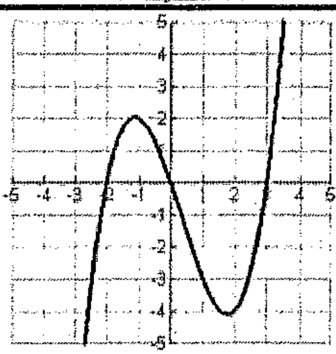
D: $[-2,2]$ R: $[-4,4]$
Function: No



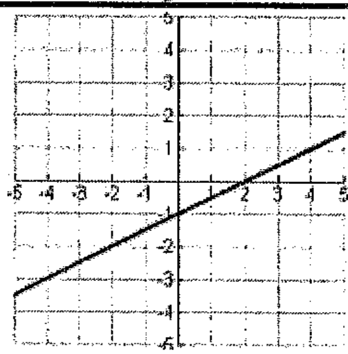
D: $(-\infty,\infty)$ R: $[-1,\infty)$
Function: Yes



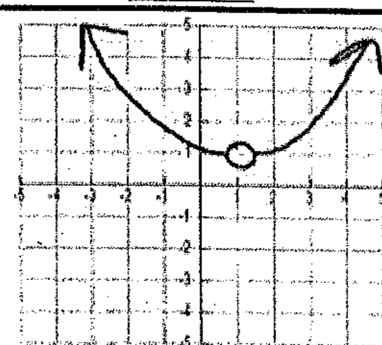
D: $(-\infty,\infty)$ R: $(-\infty,-1]\ [1,\infty)$
Function: No



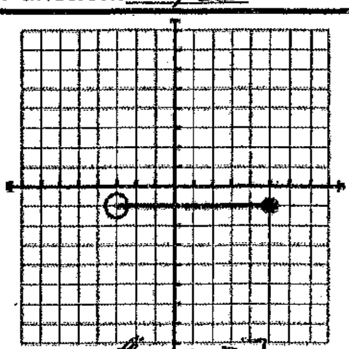
D: $(-\infty,\infty)$ R: $(-\infty,\infty)$
Function: Yes



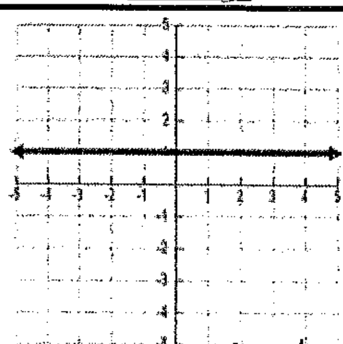
D: $(-\infty,\infty)$ R: $(-\infty,\infty)$
Function: Yes



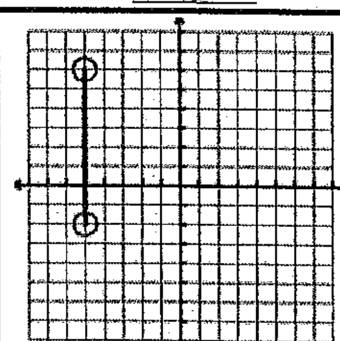
D: $(-\infty,1)(1,\infty)$ R: $(1,\infty)$
Function: Yes



D: $(-3,5]$, R: $[-1]$
F: Yes



D: $(-\infty,\infty)$ R $=[1]$
F: Yes

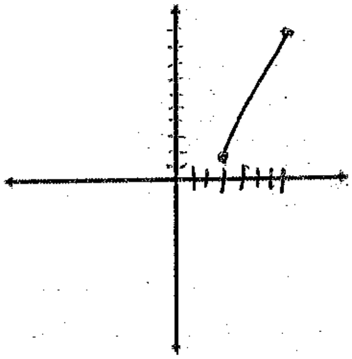


D: $[-2]$, R: $(-2,6)$
F: No

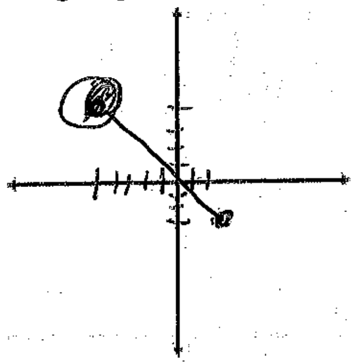
D:__________ R:__________ Function:________	D:__________ R:__________ Function:________	D:__________ R:__________ Function:________

2. Sketch a graph with the given domain and range:

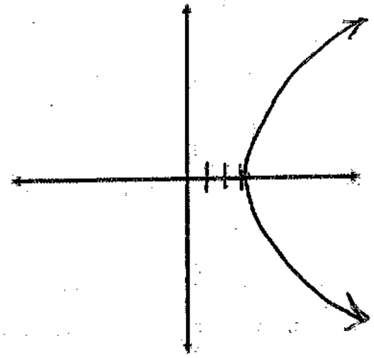
Domain: $3 \le x \le 7$
Range: $1 \le y \le 10$



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

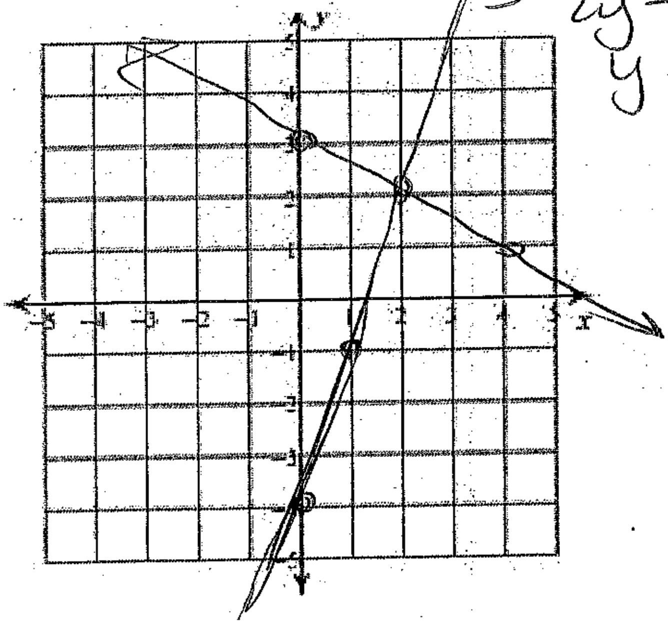


Domain: $[3, \infty)$
Range: $(-\infty, \infty)$



3. Solve the system graphically:

$\{y = 3x - 4 \qquad x + 2y = 6$



How could you solve this without a graph?

$2y = -x + 6$

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

Substitution

4. Solve the system WITHOUT graphing.

$\{-4x + y = 6 \qquad -5x - y = 21$

$+(-5x - y = 21)$

$-9x = 27$

$-9 \quad -9$

$x = -3$

$-4(-3) + y = 6$

$12 + y = 6$

$y = -6$

AA3: Inverses Notes

Questions	Notes
1. I can find the inverse of a function:	

A. From an equation:

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

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

$+1 \quad +1$

$\frac{2}{3}\left(y + 1 = \frac{3}{2}x\right)\frac{2}{3}$

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

$\frac{2}{3}(x+1) = y^{-1}$

$g(x) = .5(x+3)^2 - 8$

$.5(x+3)^2 - 8 = y$

$+8 \quad +8$

$\frac{.5(x+3)^2}{.5} = \frac{y+8}{.5}$

$\sqrt{(x+3)^2} = \sqrt{2y+16}$

$x + 3 = \sqrt{2y+16}$

$x = \sqrt{2y+16} - 3$

$y^{-1} = \sqrt{2x+16} - 3$

Make $y =$. Solve for x. Switch x & y

$h(x) = \sqrt{2x+1} + 5$

$y = \sqrt{2x+1} + 5$

$-5 \quad -5$

$(y-5)^2 = (\sqrt{2x+1})^2$

$(y-5)^2 = 2x + 1$

$-1 \quad -1$

$\frac{(y-5)^2 - 1}{2} = \frac{2x}{2}$

$\frac{(y-5)^2 - 1}{2} = x$

$\frac{(x-5)^2 - 1}{2} = y^{-1}$

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

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

$-2 \quad -2$

$x-1\left(\frac{3}{x-1} = y - 2\right)x-1$

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

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

$+1 \quad +1$

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

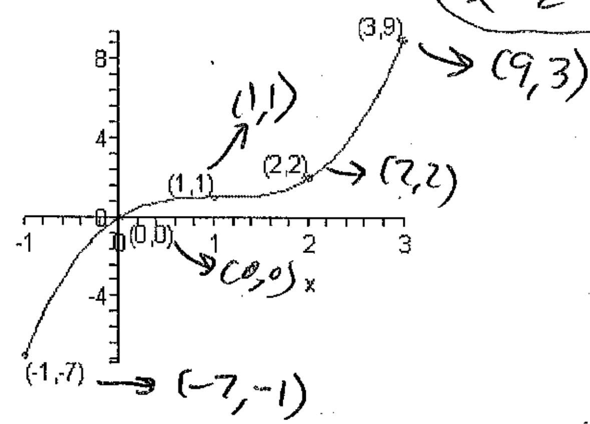
$\frac{3}{x-2} + 1 = y^{-1}$

B. From a table. Switch x & y

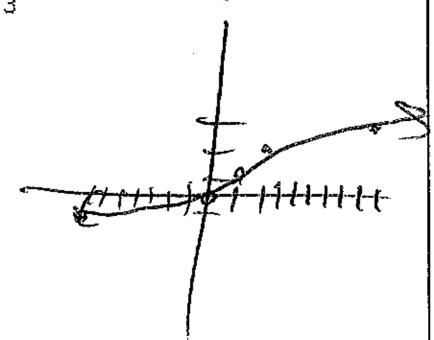
x	f(x)	x	$f^{-1}(x)$
-8	-2	-2	-8
-1	-1	-1	-1
0	0	0	0
1	1	1	1
8	2	2	8

C. From a graph

Switch x & y



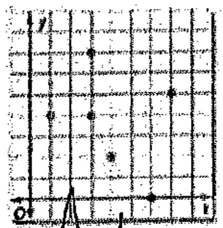
f^{-1}



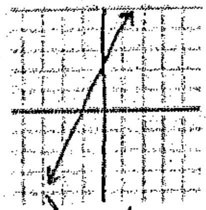
2. I can determine whether or not a relation is a function.

- Using a graph

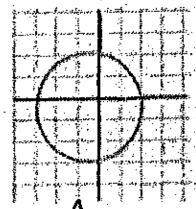
Vertical line Test.



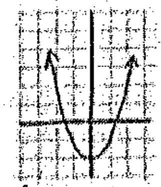
No



Yes



No



Yes

- Using a table

Does each x have only 1 y?

(No repeat x's with different y's)

No

3	3
4	5
5	7
5	9
6	11

Yes

5	31
6	28
7	25
8	22
9	19

Yes

2	3
3	3
4	3
5	3
6	3

No

7	10
8	20
9	30
9	40
10	50

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

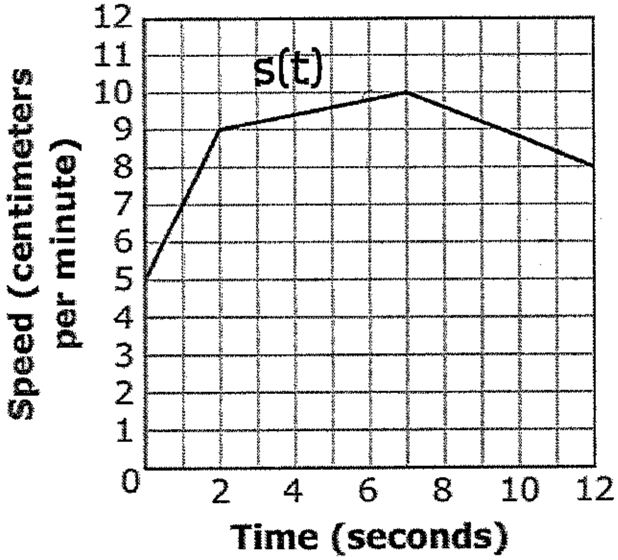
Use composite function to show that $f(x) = 2\sqrt{x-1} + 2$ and $g(x) = (\frac{x-2}{2})^2 + 1$ are inverses

Plug in f to g, get x as result

$$f(g(x)) = 2\sqrt{g(x) - 1} + 2$$
$$= 2\sqrt{(\tfrac{x-2}{2})^2 \cancel{+1} \cancel{-1}} + 2$$
$$= 2\sqrt{(\tfrac{x-2}{2})^2} + 2$$
$$= \cancel{2}(\tfrac{x-2}{\cancel{2}}) + 2$$
$$= x - 2 + 2$$
$$= x$$

f & g are inverses

Evaluating a Function From a Graph



Evaluate	Meaning
s(7) = 10	7 seconds in, speed is 10 cm/min
s(6) = 9.8	6 seconds 9.8 cm/min
S(12) = 8	After 12 seconds, the snail was traveling at a speed of 8 cm/minute.
s(11) = 8.5	11 seconds 8.5 cm/min
S(1) = 7	After 1 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) = 28	3 miles cost \$28
c(1) = 14	1 mile costs \$14
c(5) = 42	The delivery charge for 5 miles is \$42.00.
c(4) = 35	4 miles, \$35
c(2) = 21	The delivery charge for 2 miles is \$21.00.

Algebra 3-4
Function Notation

Name: ________________________ Per:____

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

x=2, plug in.

y=2, solve for x.

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

a) Evaluate $f(-6)$

$4-2(-6)$

$4+12$

16

b) Evaluate $f(3a)$

$4-2(3a)$

$4-6a$

c) Evaluate $f(t+2)$

$4-2(t+2)$

$4-2t-2$

$2-2t$

d) Solve $f(x)=5$

$4-2x=5$

$-4 \quad -4$

$-2x=1$

$\overline{-2} \quad \overline{-2}$

$x=-1/2$

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

a) Evaluate $g(-3)$ $=(-3)^2-7$

$9-7=2$

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

b) $x^2-7=-6$

$+7 \quad +7$

$x^2=1$

$x=\pm 1$

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

a) Evaluate $h(2)$ $h(2)=(2-2)(2+7)$

$=(0)(9)$

$=0$

b) Evaluate $h(a)$

b) $h(a)=(a-2)(a+7)$

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

a) Evaluate $f(14)$ $=\frac{8}{14+2}=\frac{1}{2}$

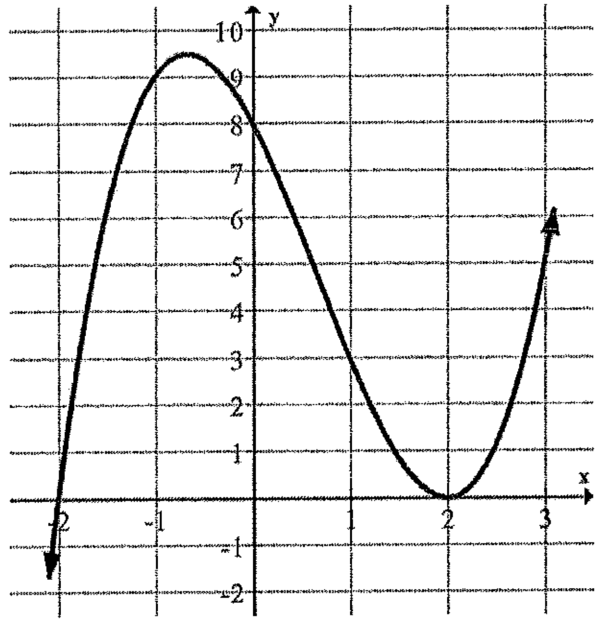
b) Evaluate $f(t)$ $=\frac{8}{t+2}$

c) Solve $f(x)=1$ $x+2\left(\frac{8}{x+2}=1\right)x+2$

$8=x+2$

$6=x$

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



a) Evaluate $f(3)$ 5

b) Evaluate $f(-1)$ 9

c) Solve $f(x)=0$ $x=-2, 2$

d) Solve $f(x)=-1$ $x=-2.1$

e) Identify the domain of this function.

$(-\infty, \infty)$

f) On what interval is the function decreasing?

$(-.5, 2)$

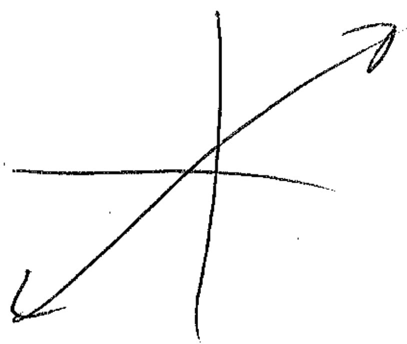
g) On what interval is the function increasing?

$(-\infty, -.5)$ $(2, \infty)$

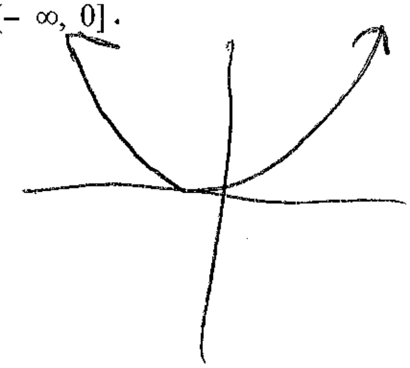
h) Does the function have an absolute maximum?

No.

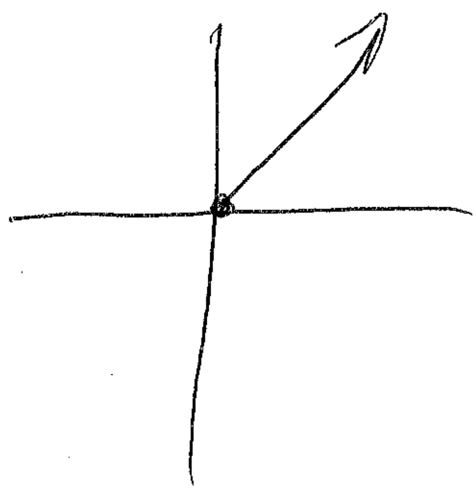
8. Sketch the graph of a function whose domain is $(-\infty,\infty)$ and whose range is $(-\infty,\infty)$.



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

a. Evaluate $f(3)$ $=1$

b. Evaluate $f(6)$ $=0$

c. Solve $f(x)=6$ $x=-7$

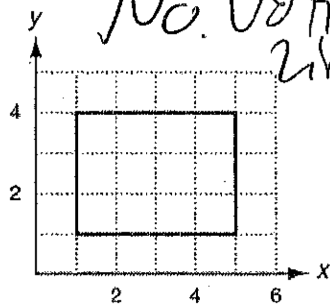
d. Solve $f(x)=0$ $x=0, 4, 6$

Algebra 3-4 Name: ______________ Per: _____
Unit 2 Review: Functions & Inverses Date: ______________

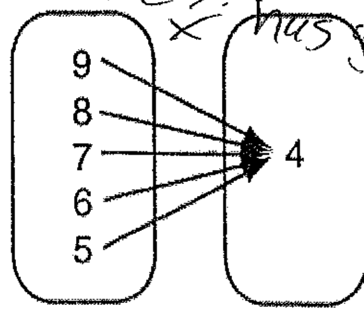
1. Tell whether the following are functions. Explain.

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

No. $x=-1$ has 2 y's

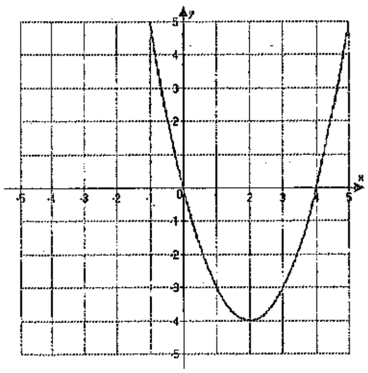


No. Vertical line test.

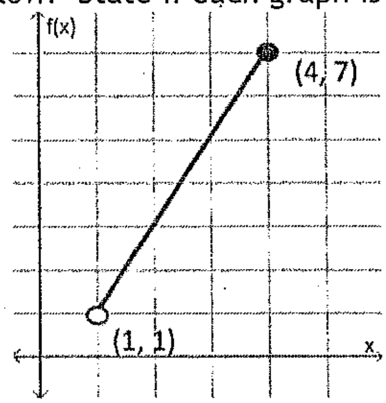


Yes. Each x has y=4.

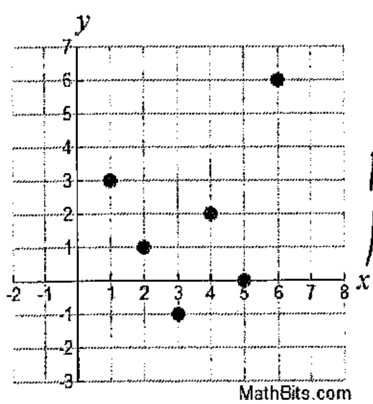
2. Find domain and range of the given graphs below. State if each graph is a function:



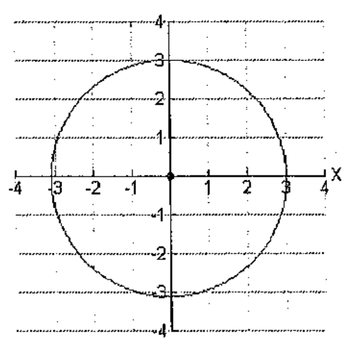
D: $(-\infty,\infty)$
R: $[-4,\infty)$
F: Yes



D: $(1,4]$
R: $(1,7]$
F: Yes



D: [1,2,3,4,5,6]
R: [-1,0,1,2,3,6]
F: Yes



D: $[-3,3]$
R: $[-3,3]$
F: No

3. Use the functions = – , = – , = + 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

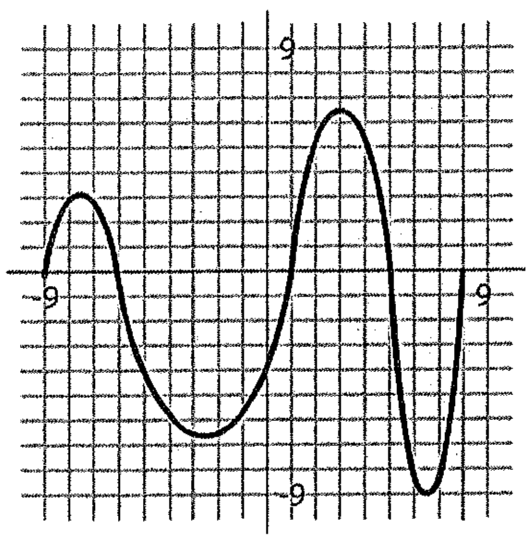
f. Evaluate *h(-1)*

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

b. Evaluate –

c. Solve =

5. Find the inverse of the following functions:

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

$+3 \quad +3$

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

$2y+6 = x$

$2y+6 = y^{-1}$

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

$y = \frac{7x+18}{2}$

$2y = 7x+18$

$-18 \quad -18$

$\frac{2y-18}{7} = \frac{7x}{7}$

$\frac{2y-18}{7} = x$

$\frac{2x-18}{7} = y^{-1}$

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

$y = \sqrt[3]{x} + 3$

$-3 \quad -3$

$(y-3)^3 = (\sqrt[3]{x})^3$

$(y-3)^3 = x$

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

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

$y = 2x^4 + 5$

$-5 \quad -5$

$\frac{y-5}{2} = \frac{2x^4}{2}$

$\sqrt[4]{\frac{y-5}{2}} = \sqrt[4]{x^4}$

$\sqrt[4]{\frac{y-5}{2}} = x$

$\sqrt[4]{\frac{x-5}{2}} = y^{-1}$

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 $g(f(5))$)

$f(5) = 5^2 - 1 = 24$

$g(24) = 3(24+2)$

$= 3(26)$

$= 78$

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

$g(5) = 3(5+2)$

$= 3(7) = 21$

$f(21) = 21^2 - 1$

$= 441 - 1 = 440$

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

b. $g(3) =$ $2(3)+5$

$6+5=11$

c. $f(10) =$ $\frac{2}{10-7} = \frac{2}{3}$

d. $f(g(2)) =$ $f(2(2)+5)$

$f(4+5)$

$f(9)$

$\frac{2}{9-7} = \frac{2}{2} = 1.$

e. $g(f(11)) =$ $g\left(\frac{2}{11-7}\right)$

$g\left(\frac{2}{4}\right)$

$2\left(\frac{2}{4}\right)+5$

$6.$

8. Find and <u>verify</u> the inverse of the following functions:

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

$y+1=3(4x+5)$

$\frac{y+1}{3} = 4x+5$

$\frac{y+1}{3} - 5 = 4x$

$\frac{\frac{y+1}{3} - 5}{4} = x$

$\frac{\frac{x+1}{3} - 5}{4} = y^{-1}$

Verify: $f(0) = 3(4(0)+5)-1$

$= 3(5)-1$

$= 14.$

$f^{-1}(14) = \frac{\frac{14+1}{3} - 5}{4}$

$= \frac{\frac{15}{3} - 5}{4}$

$= \frac{5-5}{4} = 0.$ ✓

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

$2y = \sqrt[3]{x+4}$

$(2y)^3 = x+4$

$(2y)^3 - 4 = x$

$(2x)^3 - 4 = y^{-1}$

$g(0) = \frac{\sqrt[3]{0+4}}{2} = \frac{\sqrt[3]{4}}{2}.$

$g^{-1}\left(\frac{\sqrt[3]{4}}{2}\right) = \left(2\frac{\sqrt[3]{4}}{2}\right)^3 - 4$

$= (\sqrt[3]{4})^3 - 4$

$= 4-4$

$= 0$ ✓

CCSS Advanced Algebra 3 AA3: Inverses Check-In C Name______________________

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

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

$y+1=5x$

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

$\frac{x+1}{5}=y^{-1}$

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

$y=\sqrt{x+4}-3$

$y+3=\sqrt{x+4}$

$(y+3)^2=x+4$
$\quad -4 \quad -4$

$(y+3)^2-4=x$

$(x+3)^2-4=y^{-1}$

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

x	-2	0	2	4	6
y	37	17	5	1	5

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

Yes

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

x	37	17	5	1	5
y	-2	0	2	4	6

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

No. $x=5$ has $y=2$ & $y=6$

CCSS Advanced Algebra 3 AA3: Inverses Check-In D Name________________________

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

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

$y = 3x - 7$

$y + 7 = 3x$

$\frac{y+7}{3} = x$

$L^{-1}(x) = \frac{x+7}{3}$

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

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

$(y-2)^2 = x+7$

$(y-2)^2 - 7 = x$

$(x-2)^2 - 7 = y^{-1}$

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

x	-1	1	3	5	7
y	20	8	4	8	20

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

Yes Each x has 1 y.

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

x	20	8	4	8	20
y	-1	1	3	5	7

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

No. x = 8 has y = 1 & y = 5

Name____________________

Function Inverses

Date________________ Period____

State if the given functions are inverses.

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

No $g(0) = 4$
$f(4) \neq 0$

2) $g(n) = \frac{-12 - 2n}{3}$
$f(n) = \frac{-5 + 6n}{5}$

No
$g(0) = -4$
$f(-4) \neq 0$

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

$f(0) = -4$
$g(-4) = 0$
Yes

4) $f(x) = -\frac{4}{7}x - \frac{16}{7}$
$g(x) = \frac{3}{2}x - \frac{3}{2}$

$f(0) = -\frac{16}{7}$
$g(-\frac{16}{7}) \neq 0$
No

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

$f(0) = -(0+1)^3 = -1$
$g(-1) = 3 + (-1)^3 \neq 0$
No

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

$f(0) = 2(0-2)^3 = -16$
$g(-16) = \frac{4 + \sqrt[3]{-64}}{2}$
$= 0$
Yes

7) $f(x) = \frac{4}{-x - 2} + 2$
$h(x) = -\frac{1}{x + 3}$

$f(0) = 0$
$h(0) \neq 0$
No

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

$g(1) = -3$
$f(-3) \neq 1$
No

Find the inverse of each function.

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

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

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

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

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

$h^{-1}(x) = \sqrt[3]{\frac{x-3}{2}}$

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

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

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

$g^{-1}(x) = \dfrac{2x - 18}{7}$

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

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

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

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

16) $f(x) = 4x$

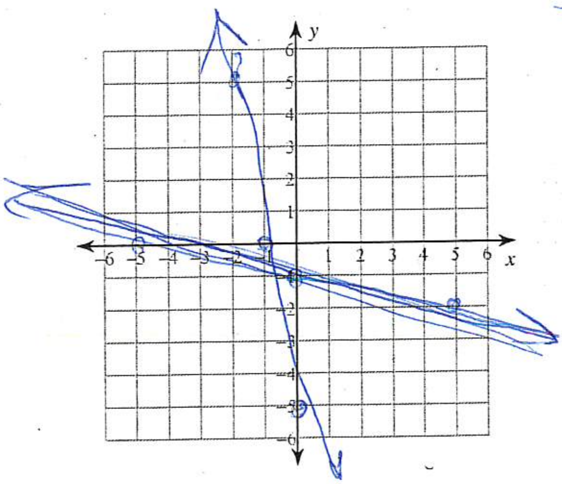
$f^{-1}(x) = \frac{1}{4}x$

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

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

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

$-5x - 5$



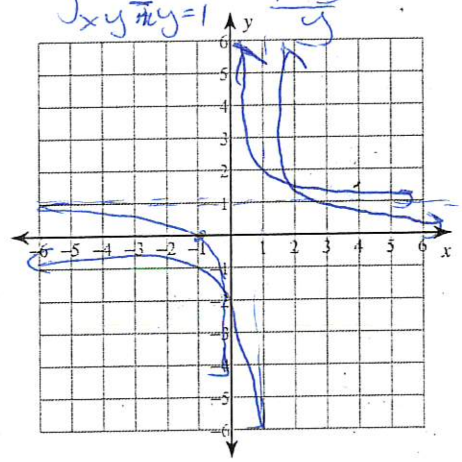
18) $g(x) = \dfrac{1}{x - 1}$

$g^{-1}(x) = \dfrac{1 + x}{x}$

$y(x-1) = 1$

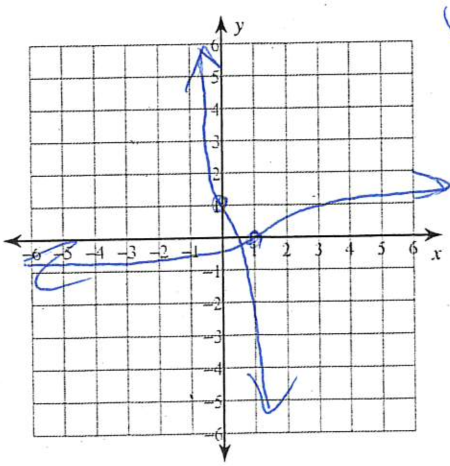
$xy - \cancel{x}y = 1$

$\dfrac{1 + y}{y}$



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

$f^{-1}(x) = \sqrt[3]{\dfrac{x - 1}{-2}}$



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

$g^{-1}(x) = -(3x + 5)$

$-3x - 5$