Any thing ☆ is challenge problem

Lesson 1.2: Function Notation

In algebra, symbols such as x and y are used to represent numbers. To represent functions, we often use symbols such as $f(x)$ and $g(x)$. For example, we may write:

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

The symbol, $f(x)$ is read "f of x", and means that the expression which follows contains x as a variable. This notation is useful because it simplifies recording the values of the function for several values of x. For example, $f(6)$ means to substitute 6 for x everywhere x occurs in the expression.

$$f(x) = x^2 - 3x - 4$$
$$f(6) = 6^2 - 3(6) - 4$$
$$= 36 - 18 - 4$$
$$= 14$$

Example 1

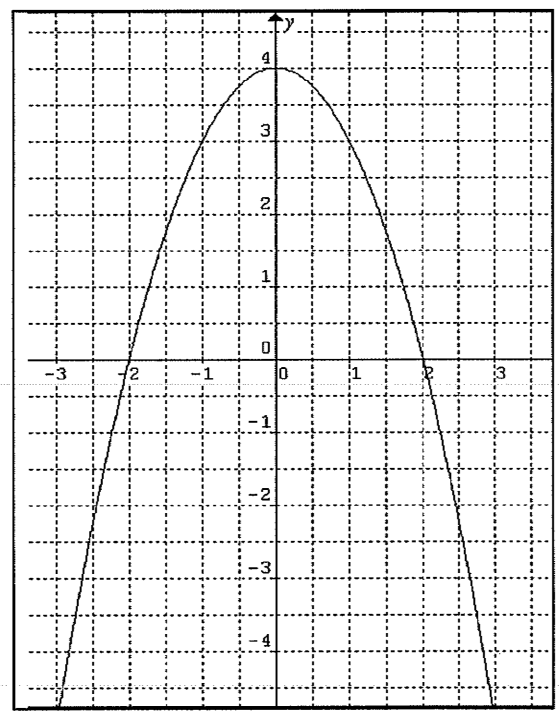
If $f(x) = 3x^2 - x - 6$, find $f(2)$.

$f(2) = 3(2)^2 - 2 - 6$
$= 12 - 2 - 6$
$= \boxed{4}$

Example 2

From the graph of $y = f(x)$ shown, find:

a) $f(2) = 0$ b) $f(0) = 4$ c) $f(-1) = 3$



Example 3

If $f(x) = -3x + 2$ write and simplify:

a) $f(p) = -3p + 2$

b) $f(3t)$
$-3(3t) + 2$
$\boxed{-9t + 2}$

c) $f(-a)$
$-3(-a) + 2$
$\boxed{3a + 2}$

d) $f(4 + 3w)$
$-3(4 + 3w) + 2$
$-12 - 9w + 2$
$\boxed{-9w - 10}$

Example 4

If $f(x) = 4x + 3$ find the value of x when $f(x) = 15$.

$15 = 4x + 3$

$12 = 4x$

$3 = x$

★ **Example 5**

CHALLENGE If $f(x) = x^2 + 5x$ find x when $f(x) = 14$.

$14 = x^2 + 5x$

$0 = x^2 + 5x - 14$

$0 = (x+7)(x-2)$

$x = -7, 2$

Example 6

If $f(x) = 5 - 3x$ and $g(x) = 4x + 1$, find a value of x such that:

a) $f(x) = g(x)$

$5 - 3x = 4x + 1$

$4 = 7x$

$\frac{4}{7} = x$

b) $f(x + 2) = g(x - 1)$

$5 - 3(x+2) = 4(x-1) + 1$

$5 - 3x - 6 = 4x - 4 + 1$

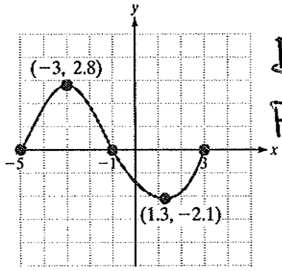
$-3x - 1 = 4x - 3$

$2 = 7x$

$\frac{2}{7} = x$

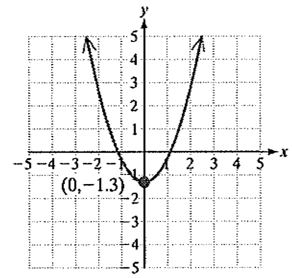
For Exercises 11–24, find the domain and range of the relations. ~~Use interval notation where appropriate.~~

11.



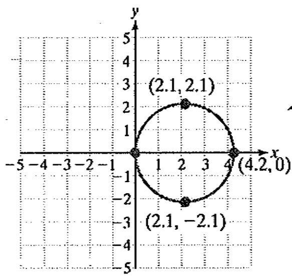
$D: \{x \in \mathbb{R} \mid -5 \le x \le 3\}$
$R: \{y \in \mathbb{R} \mid -2.1 \le y \le 2.8\}$

12.



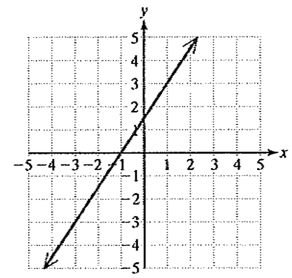
$D: \{x \in \mathbb{R}\}$
$R: \{y \in \mathbb{R} \mid y \ge -1.3\}$

13.



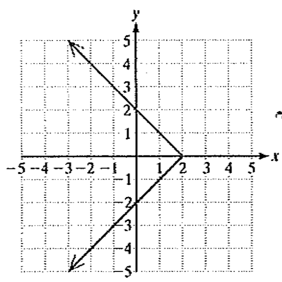
$D: \{x \in \mathbb{R} \mid 0 \le x \le 4.2\}$
$R: \{y \in \mathbb{R} \mid -2.1 \le y \le 2.1\}$

14.



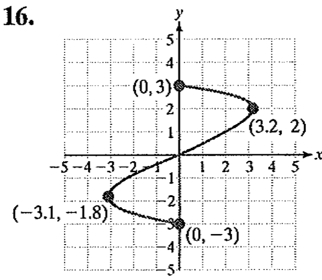
$D: \{x \in \mathbb{R}\}$
$R: \{y \in \mathbb{R}\}$

15.



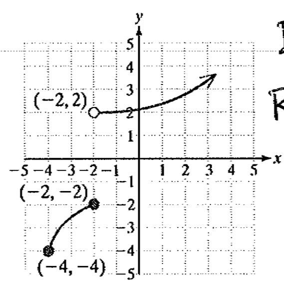
$D: \{x \in \mathbb{R} \mid x \le 2\}$
$R: \{y \in \mathbb{R}\}$

16.



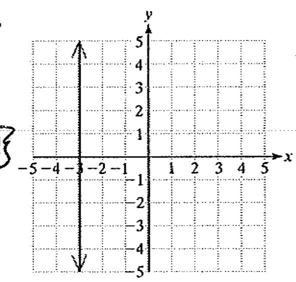
$D: \{x \in \mathbb{R} \mid -3.1 \le x \le 3.2\}$
$R: \{y \in \mathbb{R} \mid -3 \le y \le 3\}$

17. *Hint:* The open circle indicates that the point is not included in the relation.



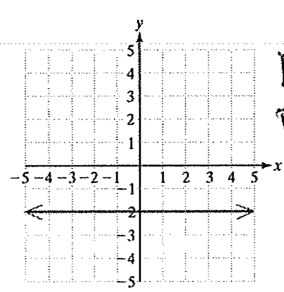
$D: \{x \in \mathbb{R} \mid x \ge -4\}$
$R: \{y \in \mathbb{R} \mid -4 \le y \le -2 \text{ or } y > 2\}$

18.



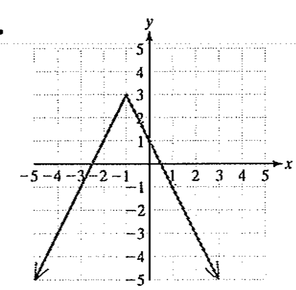
$D: \{x \in \mathbb{R} \mid x = -3\}$
$R: \{y \in \mathbb{R}\}$

19.



$D: \{x \in \mathbb{R}\}$
$R: \{y \in \mathbb{R} \mid y = 2\}$

20.

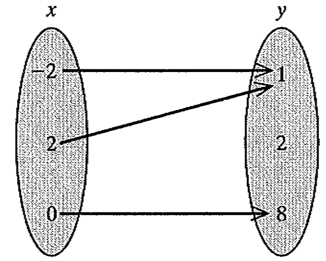


$D: \{x \in \mathbb{R}\}$
$R: \{y \in \mathbb{R} \mid y \le 3\}$

Concept 1: Definition of a Function

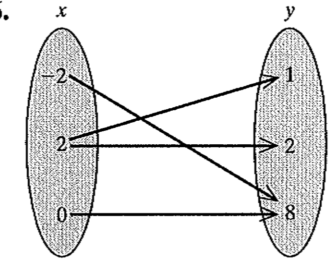
For Exercises 5–10, determine if the relation defines y as a function of x.

5.



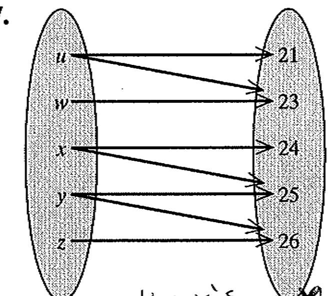
Yes, each x goes to only one y.

6.



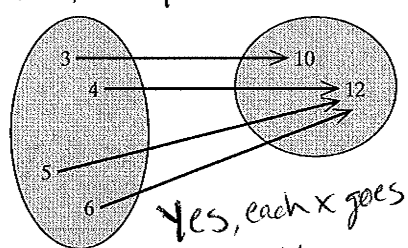
No, the x-value of −2 goes to two y-values 1 & 2

7.



No, the x's u, x, y map to more than one y-value

8.



Yes, each x goes to only one y

9. $\{(1, 2), (3, 4), (5, 4), (-9, 3)\}$

Yes, each x goes to only one y

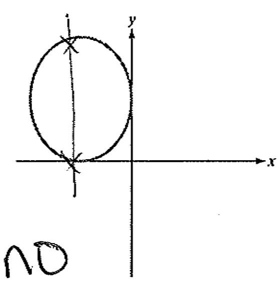
10. $\left\{(0, -1.1), \left(\frac{1}{2}, 8\right), (1.1, 8), \left(4, \frac{1}{2}\right)\right\}$

Yes, each x goes to only one y.

Concept 2: Vertical Line Test

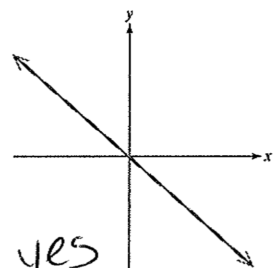
For Exercises 11–16, use the vertical line test to determine whether the relation defines y as a function of x.

11.



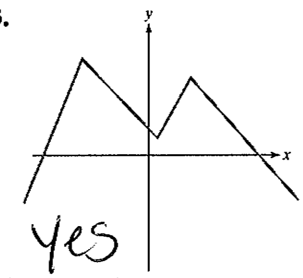
NO

12.



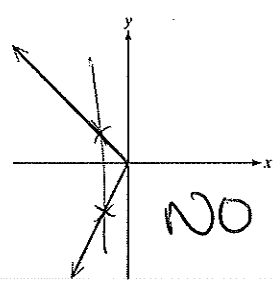
yes

13.



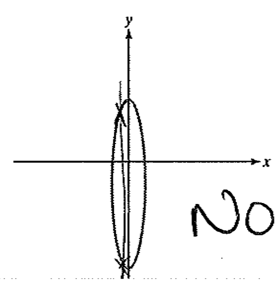
Yes

14.



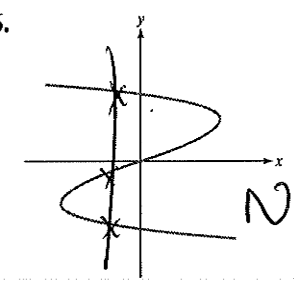
NO

15.



NO

16.



NO

Concept 3: Function Notation

Consider the functions defined by $f(x) = 6x - 2$, $g(x) = -x^2 - 4x + 1$, $h(x) = 7$, and $k(x) = |x - 2|$. For Exercises 17–48, find the following.

17. $g(2)$ −4−8+1 = −11 ★ **18.** $k(2)$ |0| = 0 **19.** $g(0)$ = 1 **20.** $h(0)$ = 7

★ **21.** $k(0)$ = |−2| = 2 **22.** $f(0)$ = −2 **23.** $f(t)$ = 6t−2 **24.** $g(a)$ = −a²−4a+1

Name: ______________________________ Per: _______ Date: ______________

WORKSHEET – DOMAINS AND RANGES OF RELATIONS AND FUNCTIONS

<u>Part 1 – Identify Domains, Ranges, and Functions.</u> Identify the domain and range of each relation given below. Then determine if the relation represents a function. Record your answers in the appropriate spaces provided for each problem.

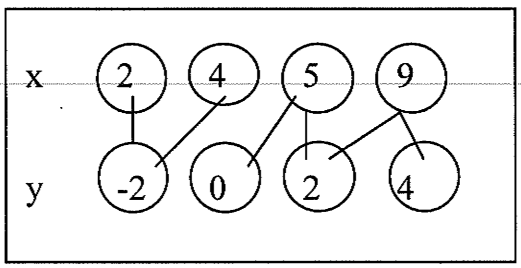
1. {(2, 3), (-1, 5), (0, -1), (3, 5), (5, 0)}

Domain: {-1, 0, 2, 3, 5}

Range: {-1, 0, 3, 5}

Function: **yes** no

2.

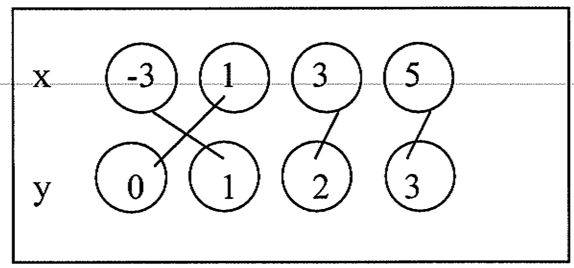


Domain: {2, 4, 5, 9}

Range: {-2, 0, 2, 4}

Function: yes **no**

3.

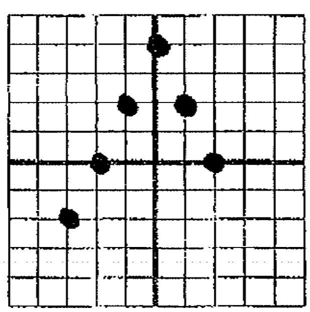


Domain: {-3, 1, 3, 5}

Range: {0, 1, 2, 3}

Function: **yes** no

4.

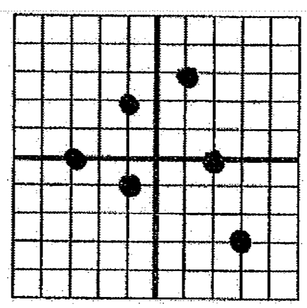


Domain: {-3, -2, -1, 0, 1, 2}

Range: {-2, 0, 2, 4}

Function: **yes** no

5.



Domain: {-3, -1, 1, 2, 3}

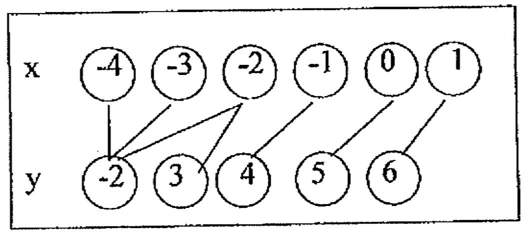
Range: {-3, -1, 0, 2, 3}

Function: yes **no**

Name: ______________________________ Per: _______Date: ________________

Part 2 – Different Representations. **Read each problem carefully and perform the indicated task. Also, for each problem, determine if the relation given represents a function and record your answers in the appropriate spaces provided for each problem.**

6. Rewrite the relation given to the right as a set of ordered pairs.



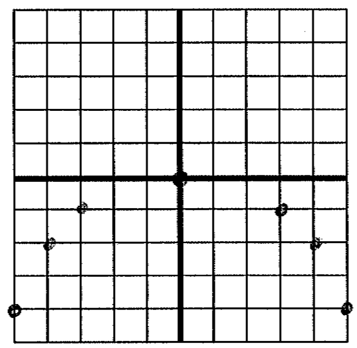
Answer:

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

Function: yes (no)

7. Graph the relation given below on the coordinate plane to the right.

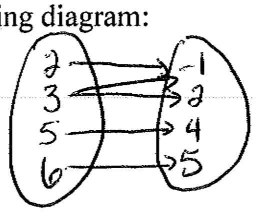
x	-5	-4	-3	0	3	4	5
y	-4	-2	-1	0	-1	-2	-4



Function: (yes) no

8. Construct a mapping diagram in the space below to represent the following set of ordered pairs.
(2, -1), (3, 2), (5, 4), (3, -1), (6, 5)

Mapping diagram:



Function: yes (no)

9. Create a table that is equivalent to the relation graphed on the coordinate plane to the right.

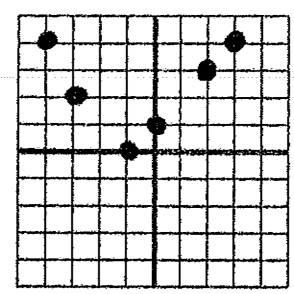


Table:

x	-4	-3	-1	0	2	3
y	4	2	0	1	3	4

Function: (yes) no

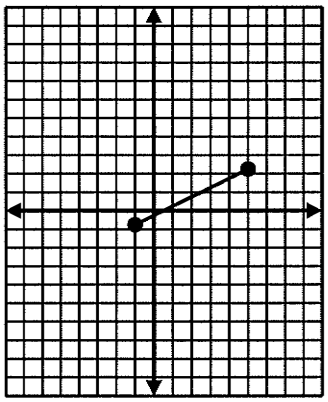
Domain and Range Homework

Name ______________________________

Date Due 10/15/09 Period __________

For each problem:
a) State the domain
b) State the range
c) Determine if the graph is a function

1.

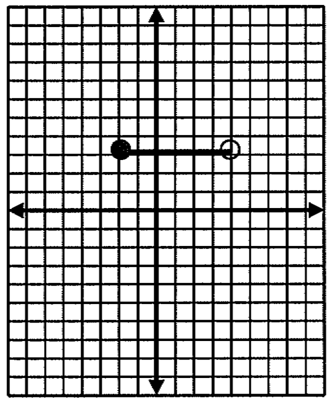


a) D: $\{x \in \mathbb{R} \mid -1 \le x \le 5\}$

b) R: $\{y \in \mathbb{R} \mid -1 \le y \le 2\}$

c) yes

2.

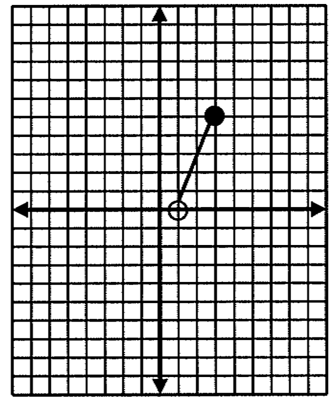


a) D: $\{x \in \mathbb{R} \mid -2 \le x < 4\}$

b) R: $\{y \in \mathbb{R} \mid y = 3\}$

c) yes

3.

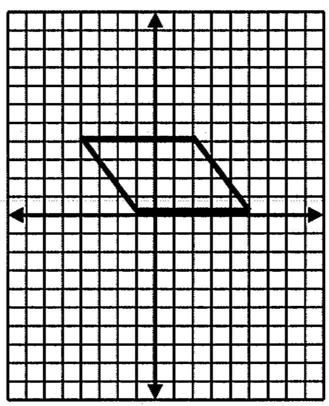


a) D: $\{x \in \mathbb{R} \mid 1 < x \le 2\}$

b) R: $\{y \in \mathbb{R} \mid 0 < y \le 5\}$

c) yes

4.

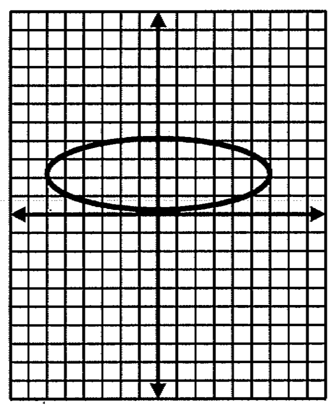


a) D: $\{x \in \mathbb{R} \mid 4 \le x \le 5\}$

b) R: $\{y \in \mathbb{R} \mid 0 \le y \le 4\}$

c) NO

5.

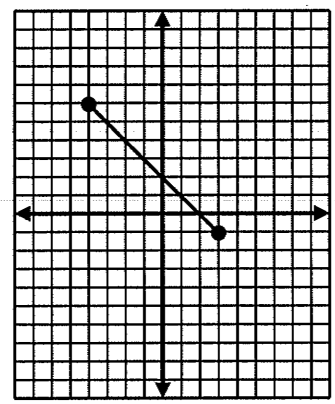


a) D: $\{x \in \mathbb{R} \mid -6 \le x \le 6\}$

b) R: $\{y \in \mathbb{R} \mid 0 \le y \le 4\}$

c) NO

6.

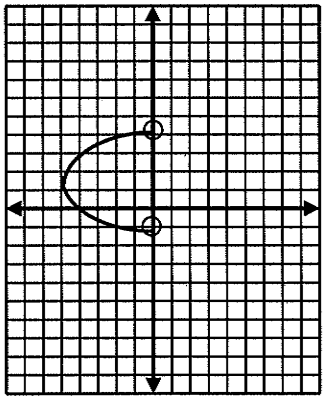


a) D: $\{x \in \mathbb{R} \mid -4 \le x \le 3\}$

b) R: $\{y \in \mathbb{R} \mid -1 \le y \le 6\}$

c) yes

7.

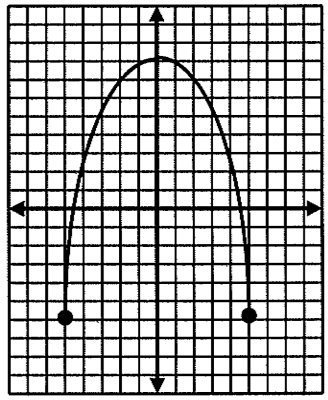


a) D: {x∈ℝ | −5 ≤ x < 0}

b) R: {y∈ℝ | −1 < y < 4}

c) NO

8.

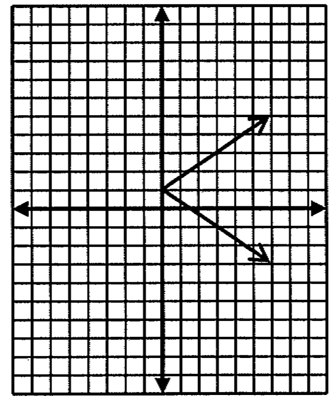


a) D: {x∈ℝ | −5 ≤ x ≤ 5}

b) R: {y∈ℝ | −6 ≤ y ≤ 8}

c) yes

9.

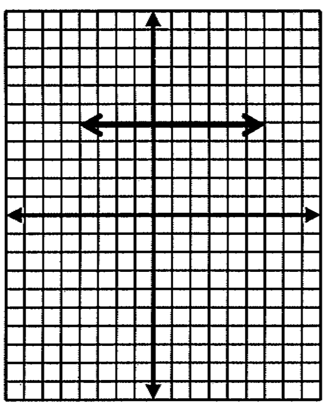


a) D: {x∈ℝ | x ≥ 0}

b) R: {y∈ℝ}

c) NO

10.

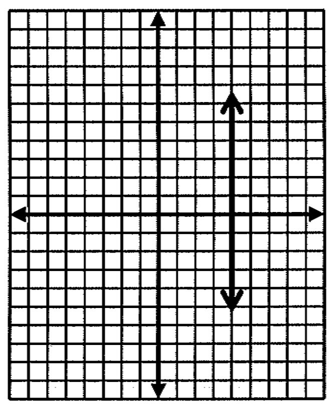


a) D: {x∈ℝ}

b) R: {y∈ℝ | y = 5}

c) yes

11.

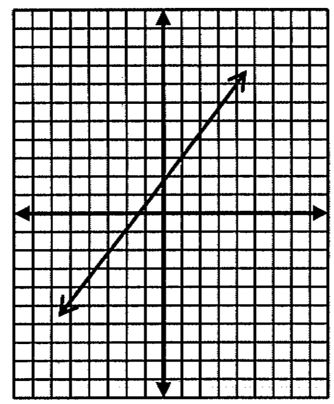


a) D: {x∈ℝ | x = 4}

b) R: {y∈ℝ}

c) NO

12.



a) D: {x∈ℝ}

b) R: {y∈ℝ}

c) yes

13. Tara's car travels about 25 miles on one gallon of gas. She has between 10 and 12 gallons of gas in the tank.

a) List the independent and dependent quantities. miles – independent
gallons in tank – dependent

b) ~~Find~~ Describe the reasonable domain and range values.
D: {x∈ℝ | 0 ≤ x ≤ 300}
R: {y∈ℝ | 0 ≤ y ≤ 12}
The possible miles can start at 0 and go up to 25(12) which is 300.
The gallons can only go up to 12 and down to 0.

c) Write the reasonable domain and range as inequalities.

14. Sal and three friends plan to bowl one or two games each. Each game costs $2.50.

a) List the independent and dependent quantities. # of games bowled – independent
total $ for bowling – dependent

b) ~~Find~~ Describe the reasonable domain and range values. The domain can only be integers, you will get charged for a whole game if you start it. They are planning on 1-2 games each so total 4-8 games. ~~Range~~ Range is the lowest cost $10 to the highest cost $20.

c) Write the reasonable domain and range as inequalities.
D: {x∈ℤ | 4 ≤ x ≤ 8}
R: {y∈ℝ | 10 ≤ y ≤ 20}