

## 5.5 Graphs of Relations and Functions

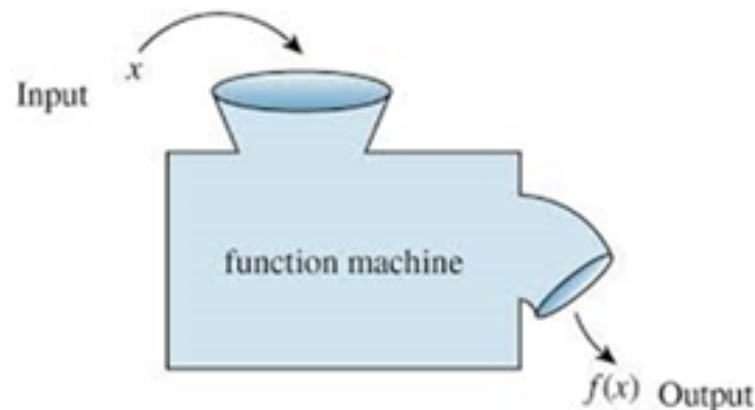
### **Lesson Focus**

Determine the properties of graphs of relations and functions

# Reminder

**Relation** - associates the elements of one set with the elements of another set.

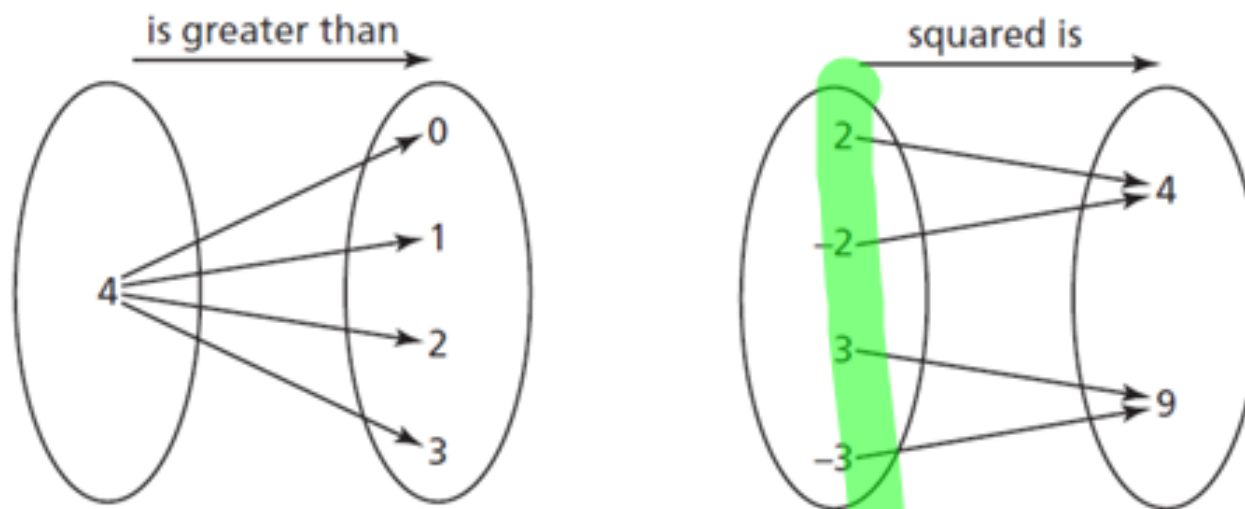
**Function** – is a special type of **relation** where each element in the domain is associated with exactly one element in the range



# Explore

**Domain** – set of values of the independent variable, the **x-values when graphed**

**Range** – set of values of the dependent variable, the **y-values when graphed**

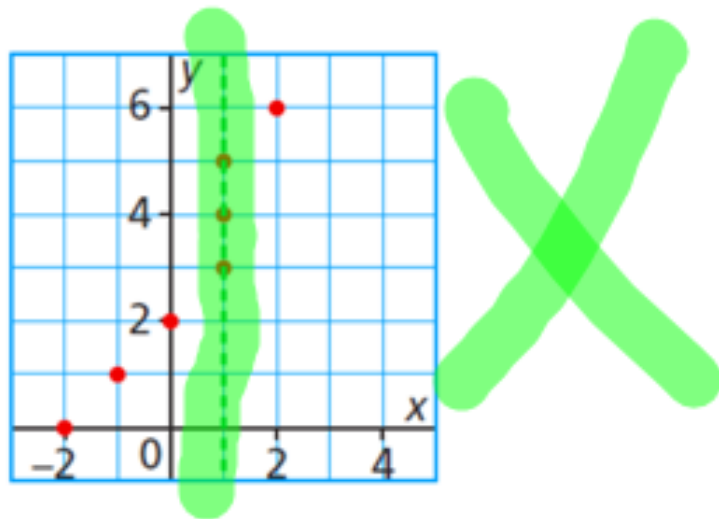


Which of these relations represents a **function**?

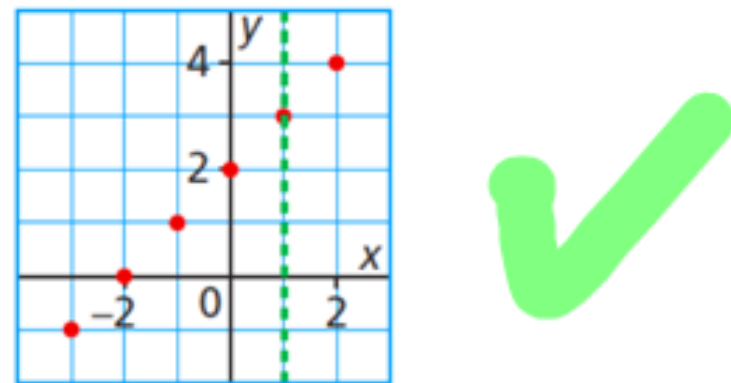
What would each of these graphs look like?

# Graphs of Functions

A relation that is not a function has two or more ordered pairs with the same first coordinate. So, when the ordered pairs of the relation are plotted on a grid, a vertical line can be drawn to pass through more than one point.



A function has ordered pairs with different first coordinates. So, when the ordered pairs of the function are plotted on a grid, any vertical line drawn will always pass through no more than one point.

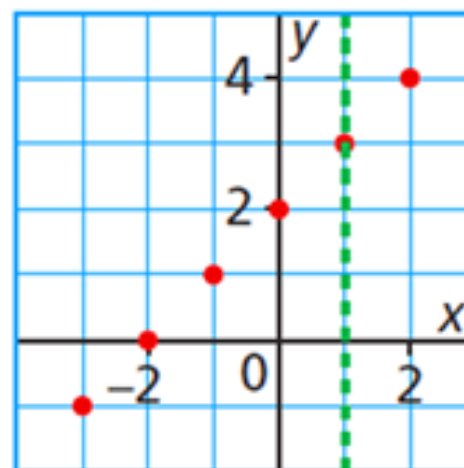
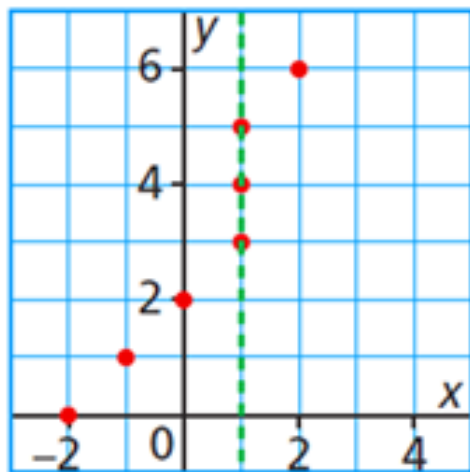


# Vertical Line Test

## Vertical Line Test for a Function

A graph represents a function when no two points on the graph lie on the same vertical line.

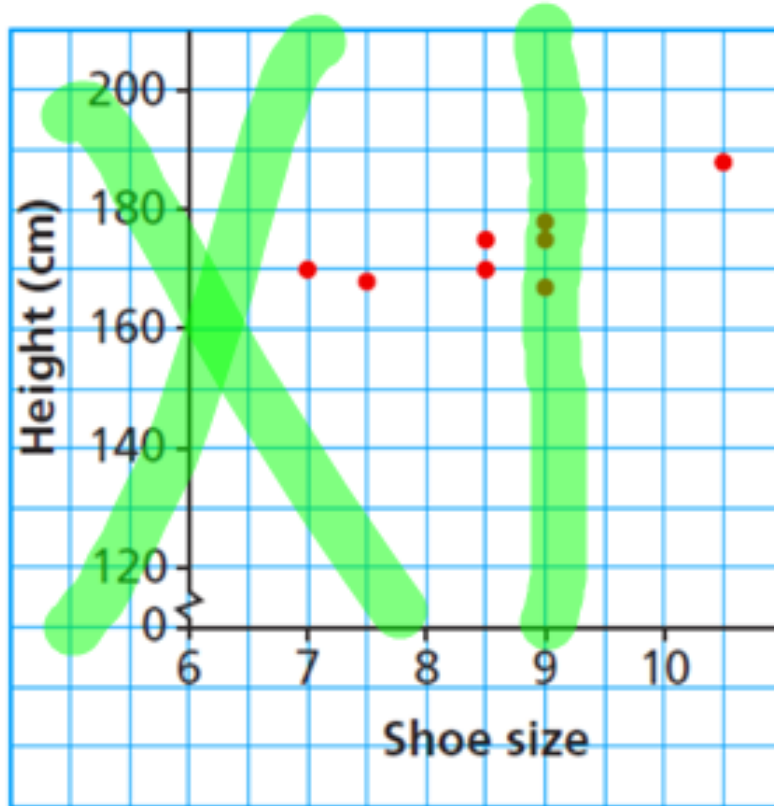
Place a ruler vertically on a graph, then slide the ruler across the graph. If one edge of the ruler always intersects the graph at no more than one point, the graph represents a function.



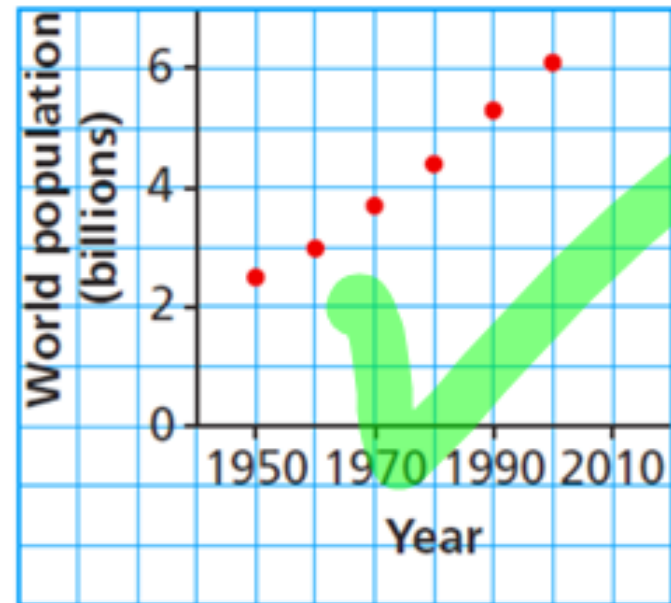
# Example

Which of these graphs represents a function? Justify the answer.

a) Height against Shoe Size



b) World Population

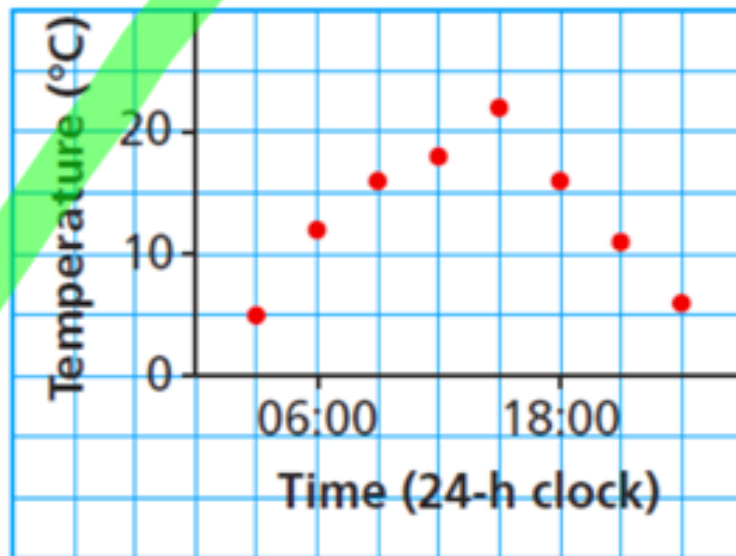


# Example – Your Turn

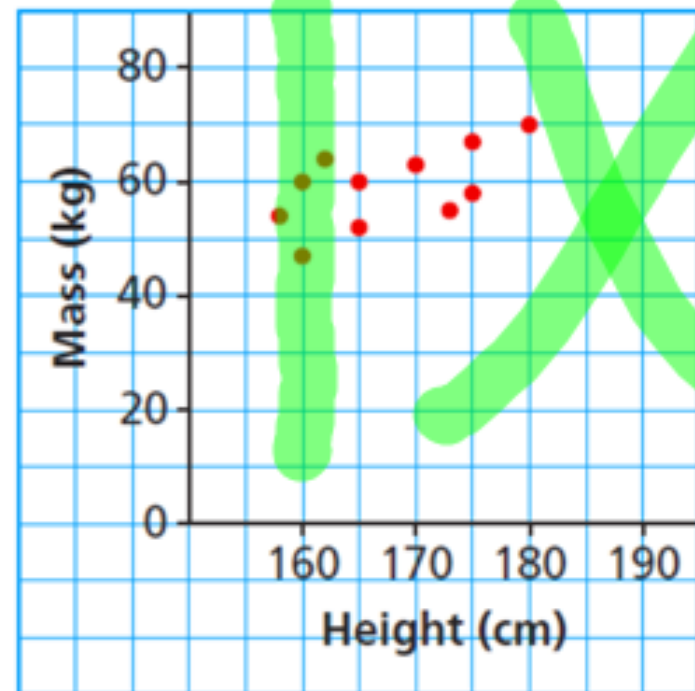
Which of these graphs represents a function? Justify your answer.

How does the vertical line test relate to the definition of a function?

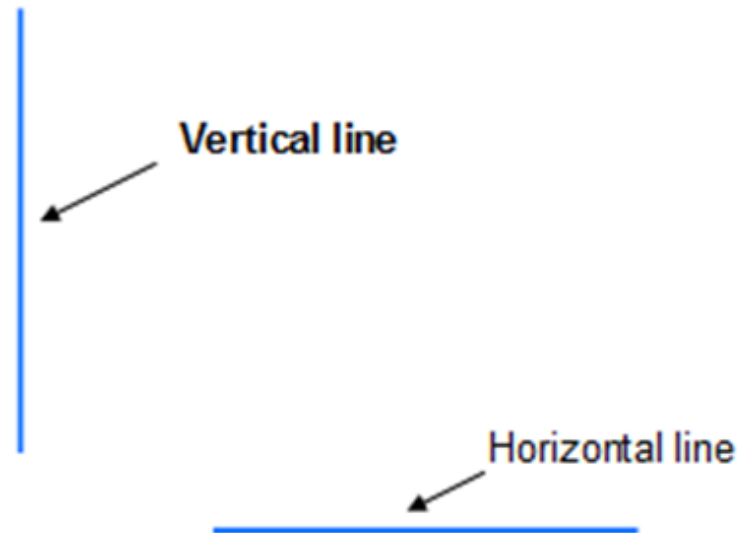
a) Outside Temperature over a 24-h Period



b) Masses of Students against Height

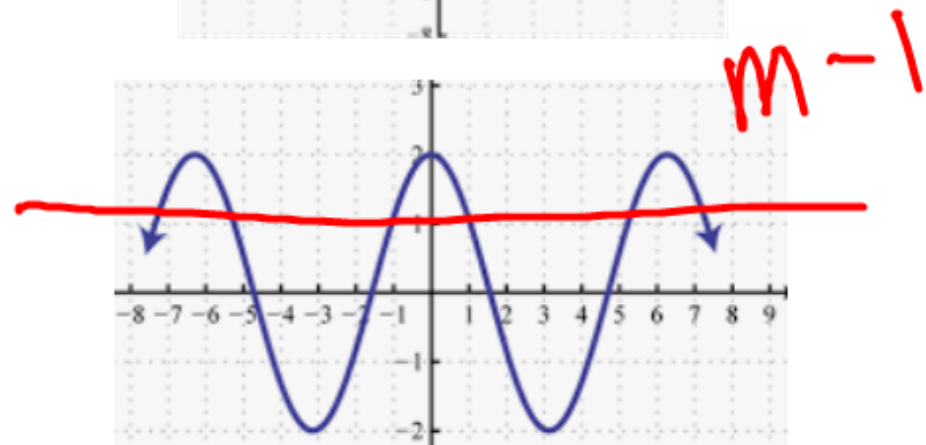
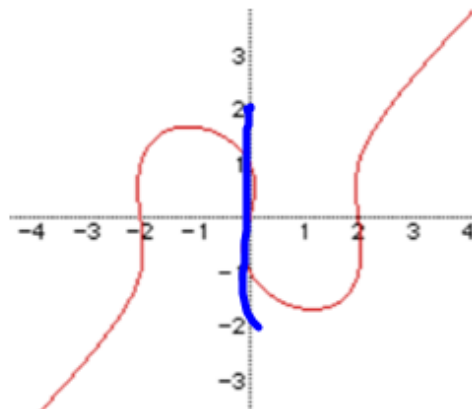
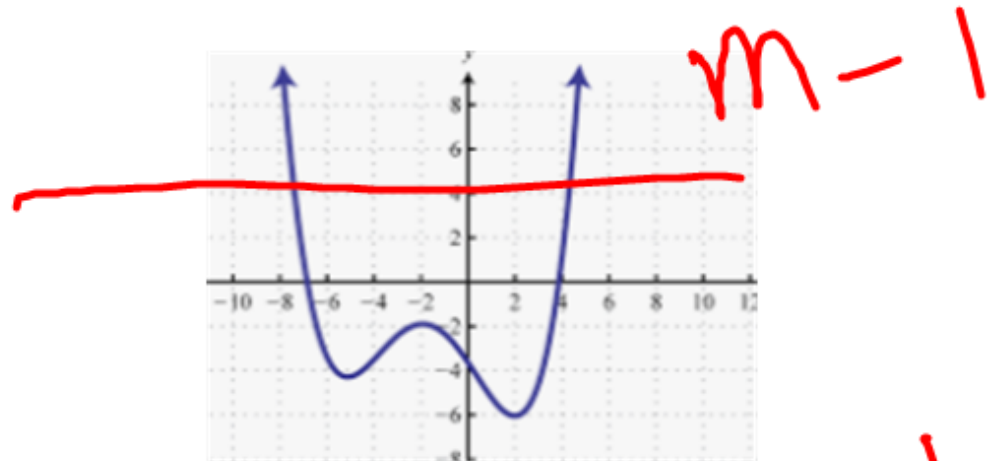
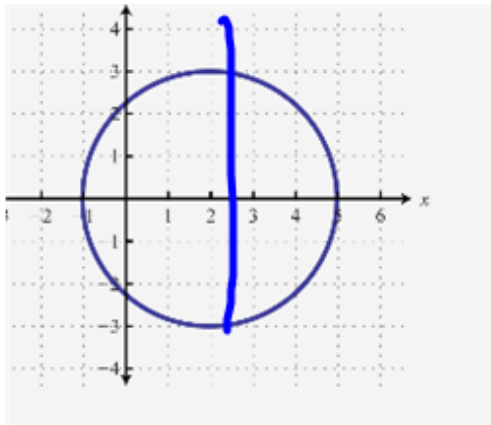
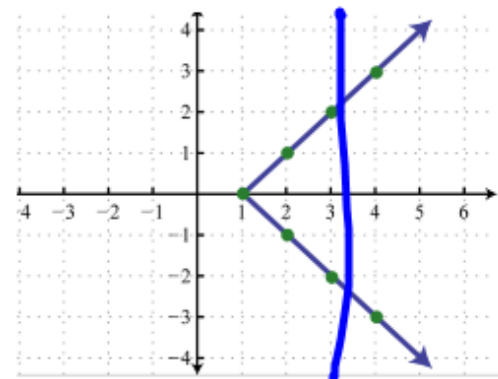
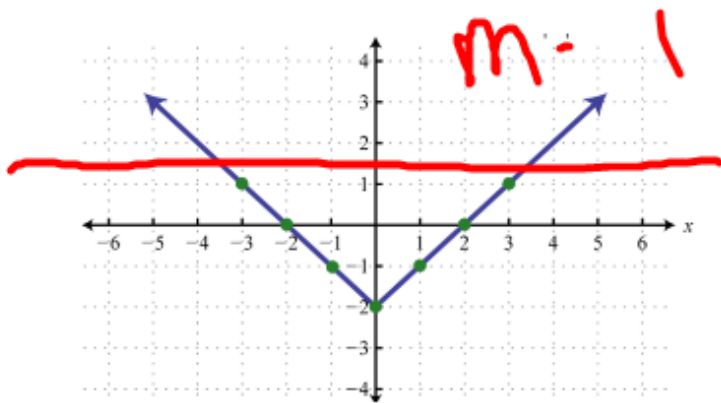


We can use the **Vertical Line Test** to determine if the graph of a relation is a function. If we determine that the relation is a function, we can use the **Horizontal Line Test** to determine if the function is **1-1** or **Many-1**.





Which of the following are functions? If they are a function are they 1-1 or Many-1?



# Graphs

*Domain* – set of  $x$ -values

*Range* – set of  $y$ -values

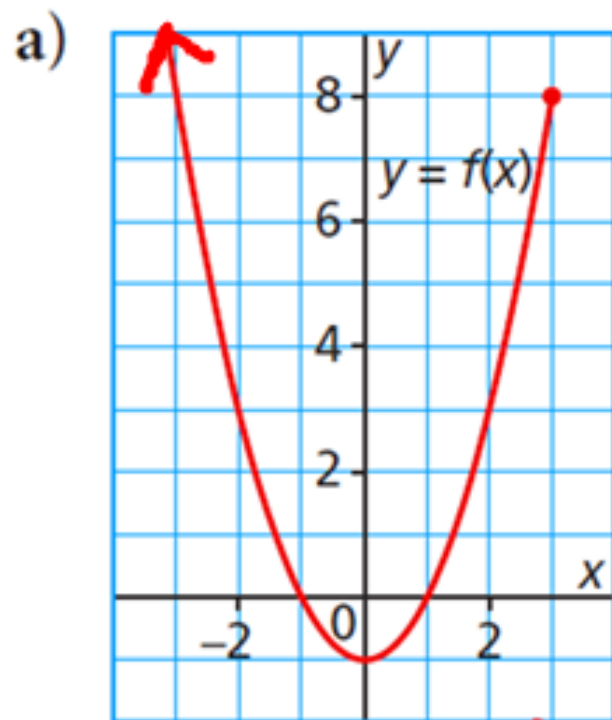
*Closed dot* – point included in the domain/range

*Open dot* – point not included in the domain/range

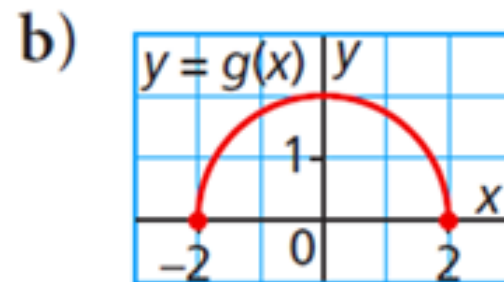
*No dot* – graph continues in that direction

# Example

Determine the domain and range of the graph of each function.



$$D: x \leq 3$$
$$R: y \geq -1$$



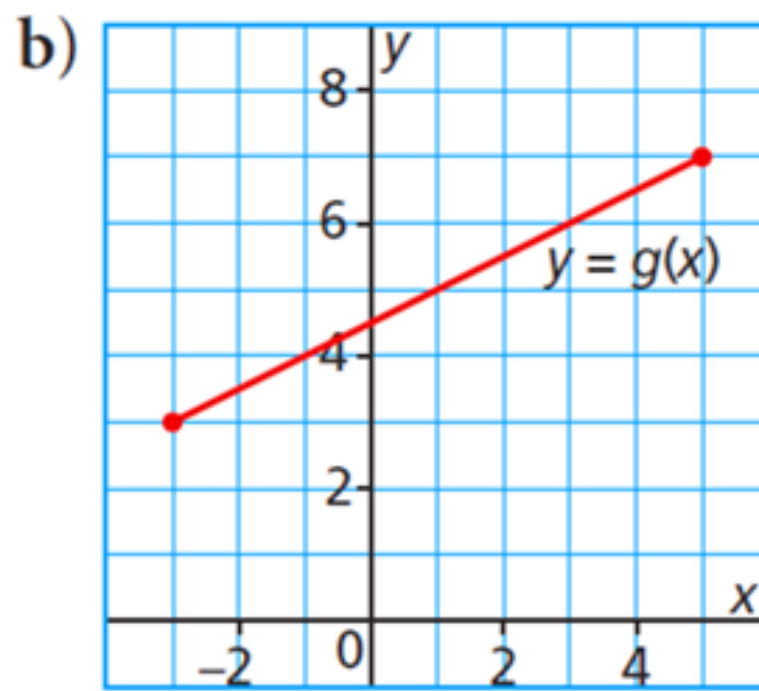
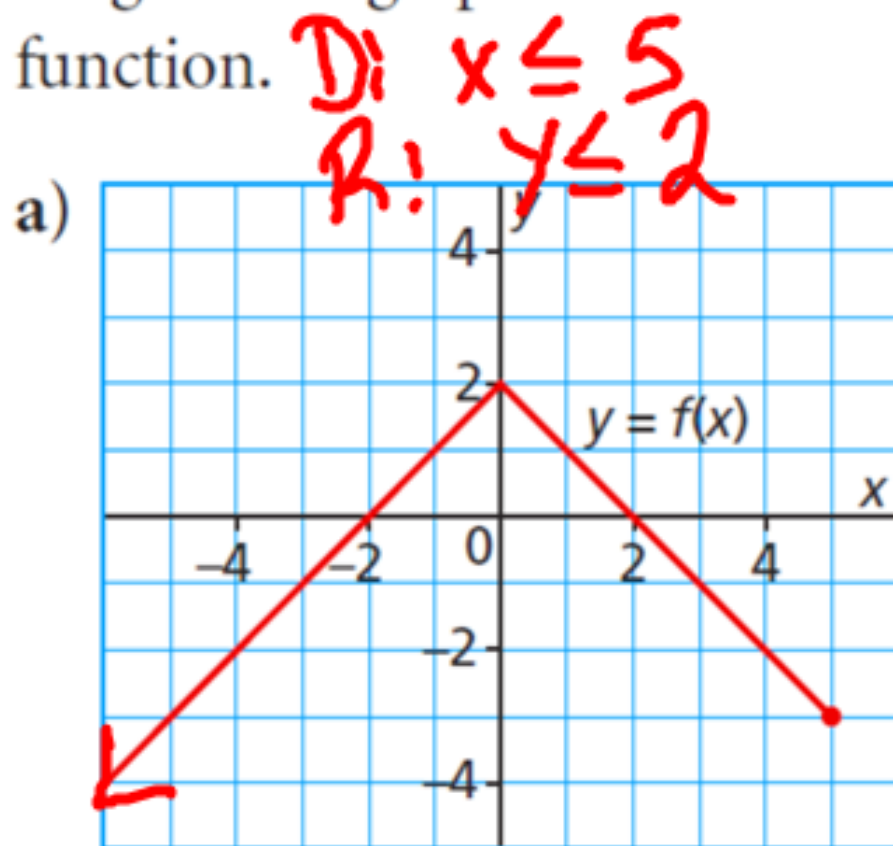
$$D: -2 \leq x \leq 2$$

$$R: 0 \leq y \leq 2$$

## Example – Your Turn

Determine the domain and range of the graph of each function.

$$D: -3 \leq x \leq 5$$
$$R: 3 \leq y \leq 7$$



# Homework

## Discuss the Ideas

1. How do you decide whether to connect the points you plot for a graph?
2. What can you tell about the domain and range of a function from its graph?
3. How can you identify whether a graph represents a function?

**P. 293-297**

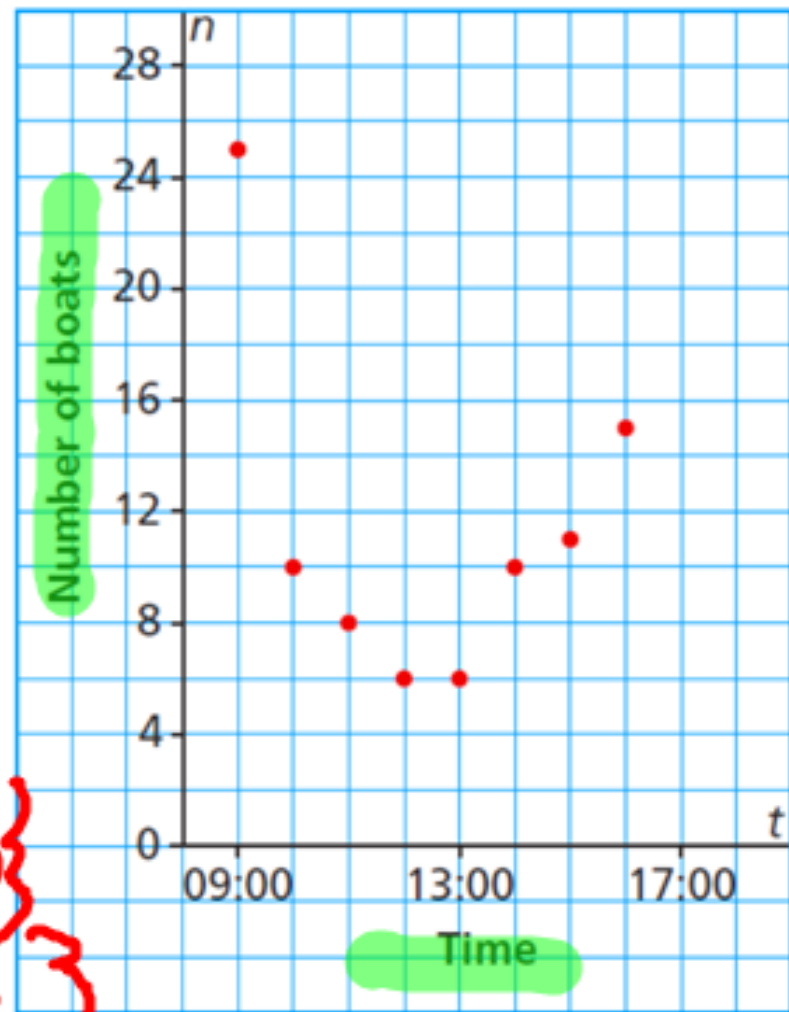
**# 4, 5, 7, 8, 9, Handout**

# Example

This graph shows the number of fishing boats,  $n$ , anchored in an inlet in the Queen Charlotte Islands as a function of time,  $t$ .

- Identify the dependent variable and the independent variable. Justify the choices.
- Why are the points on the graph not connected? Explain.
- Determine the domain and range of the graph.

Number of Fishing Boats Anchored in an Inlet

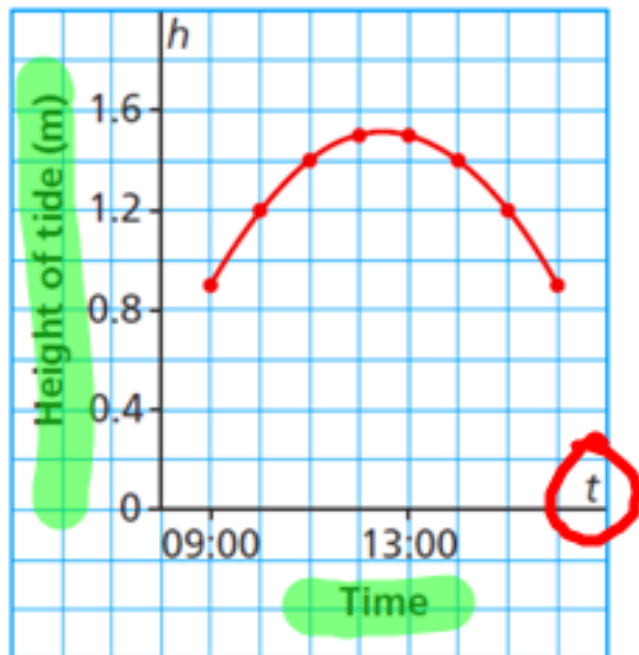


$D: \{9, 10, 11, 12, 13, 14, 15, 16\}$   
 $R: \{6, 8, 10, 11, 15, 25\}$

# Example – Your Turn

This graph shows the approximate height of the tide,  $h$  metres, as a function of time,  $t$ , at Port Clements, Haida Gwaii on June 17, 2009.

Height of Tide at Port Clements,  
June 17, 2009



- Identify the dependent variable and the independent variable. Justify your choices.
- Why are the points on the graph connected? Explain.
- Determine the domain and range of the graph.

$$D: 9 \leq t \leq 16$$

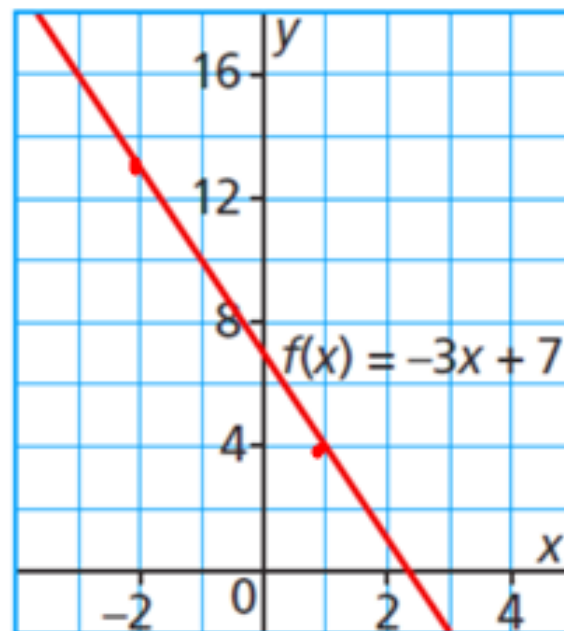
$$R: 0.9 \leq h \leq 1.5$$

# Example

Here is a graph of the function  $f(x) = -3x + 7$ .

a) Determine the range value when the domain value is  $-2$ . **13**

b) Determine the domain value when the range value is  $4$ . **1**

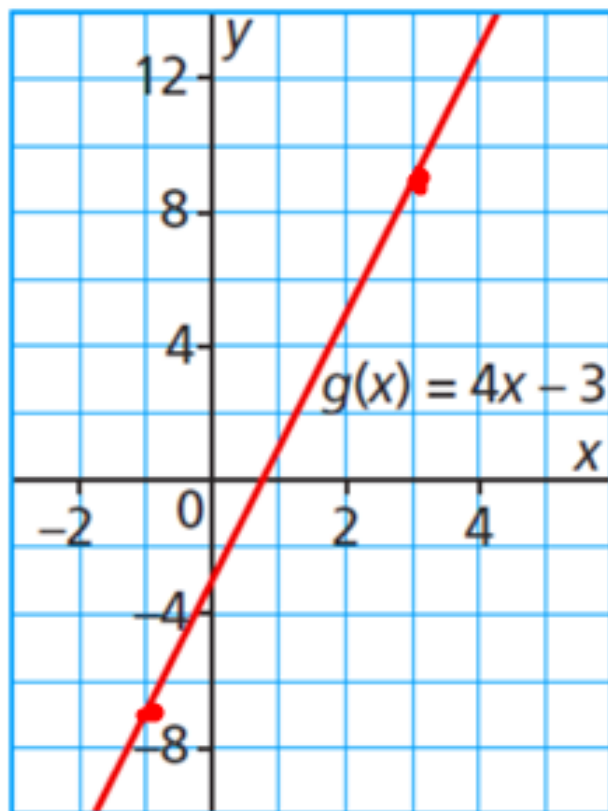




## Example – Your Turn

Here is a graph of the function

$$g(x) = 4x - 3.$$



a) Determine the range value when the domain value is 3.

9

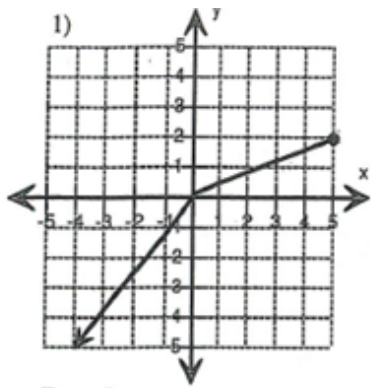
b) Determine the domain value when the range value is  $-7$ .

-1

# Homework

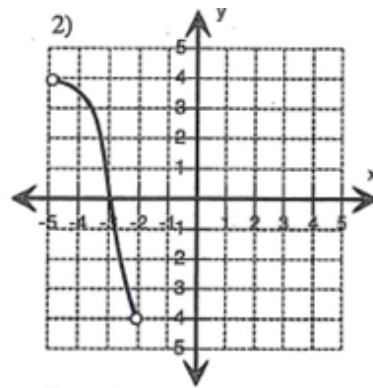
**P. 293-297**

**# 10, 11, 13, 15, 16, 17, 19, 22, 23**



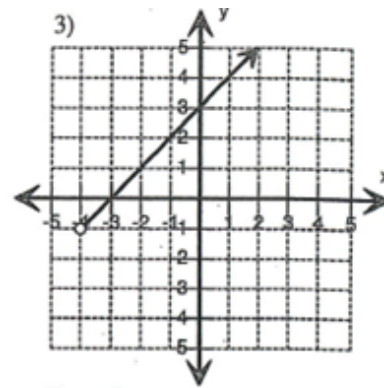
Domain : \_\_\_\_\_

Range : \_\_\_\_\_



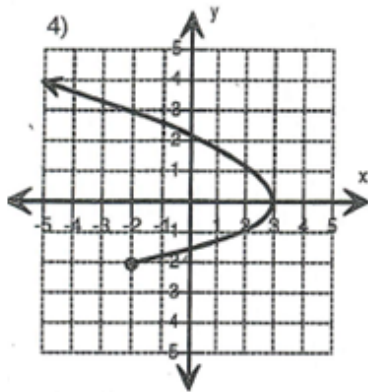
Domain : \_\_\_\_\_

Range : \_\_\_\_\_



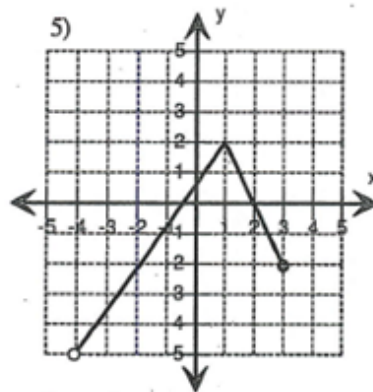
Domain : \_\_\_\_\_

Range : \_\_\_\_\_



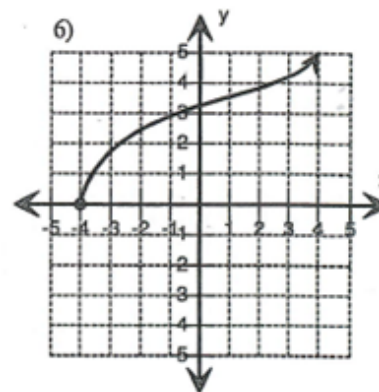
Domain : \_\_\_\_\_

Range : \_\_\_\_\_



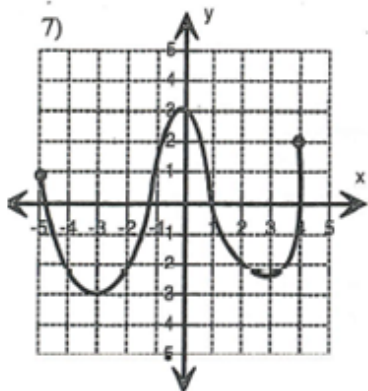
Domain : \_\_\_\_\_

Range : \_\_\_\_\_

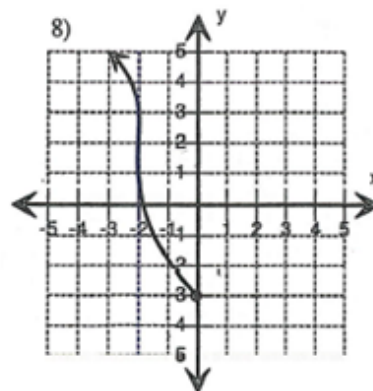


Domain : \_\_\_\_\_

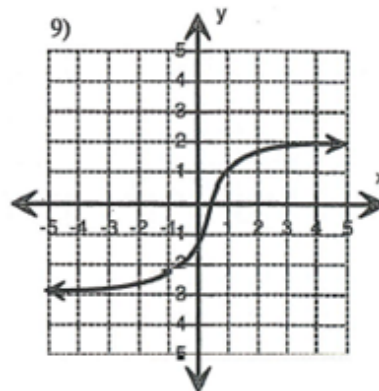
Range : \_\_\_\_\_



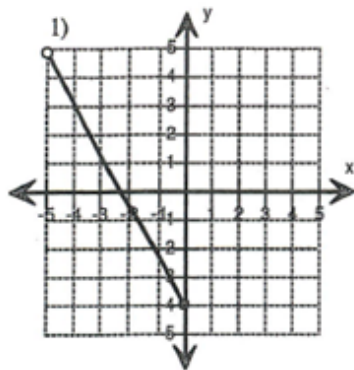
Domain : \_\_\_\_\_



Domain : \_\_\_\_\_

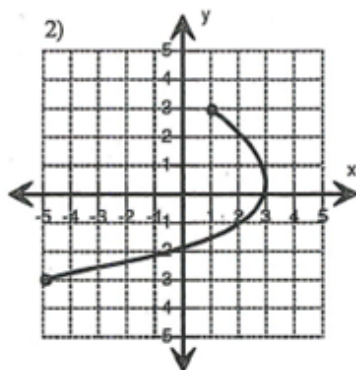


Domain : \_\_\_\_\_



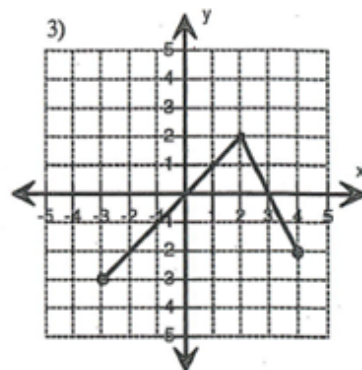
Domain : \_\_\_\_\_

Range : \_\_\_\_\_



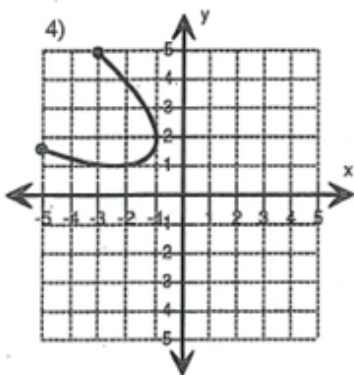
Domain : \_\_\_\_\_

Range : \_\_\_\_\_



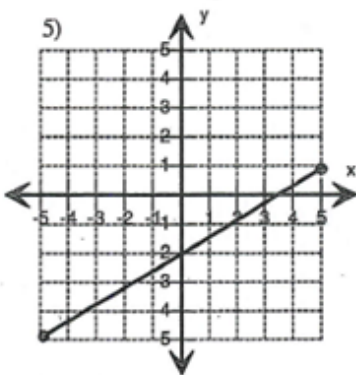
Domain : \_\_\_\_\_

Range : \_\_\_\_\_



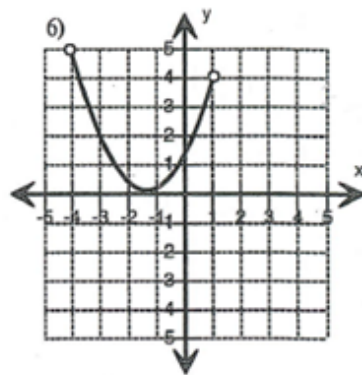
Domain : \_\_\_\_\_

Range : \_\_\_\_\_



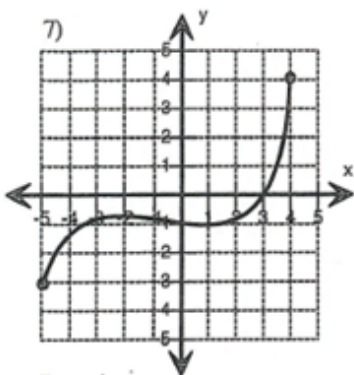
Domain : \_\_\_\_\_

Range : \_\_\_\_\_

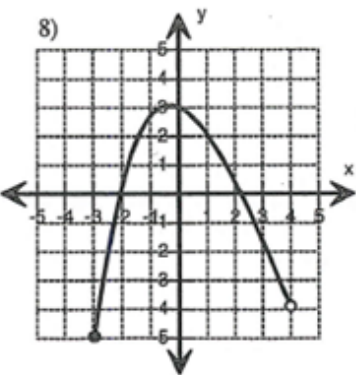


Domain : \_\_\_\_\_

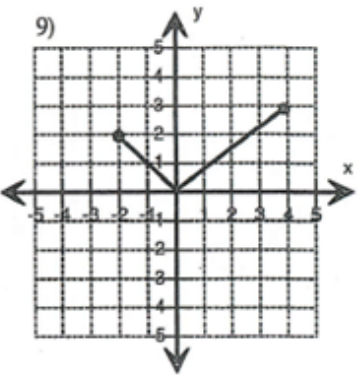
Range : \_\_\_\_\_



Domain : \_\_\_\_\_



Domain : \_\_\_\_\_



Domain : \_\_\_\_\_