

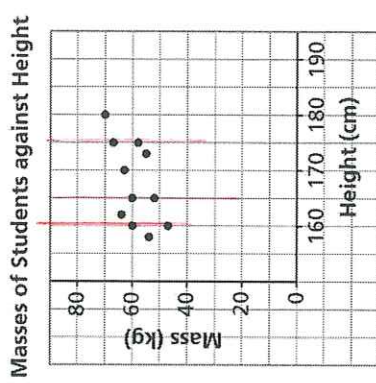
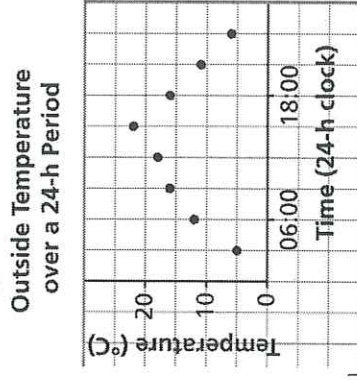
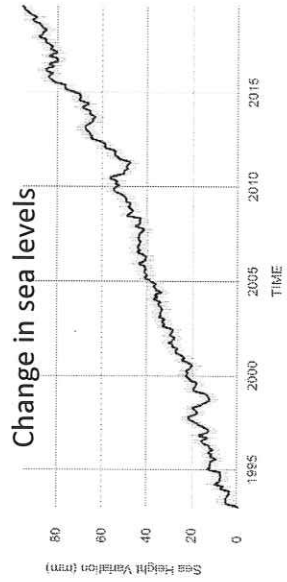
### 5.5 Graphs of Relations and Functions

**Function:** A relation where each element in the domain is associated with exactly one element of the range. To determine whether a relation is a function from its graph, we use the **vertical line test**: If you can draw a vertical line that crosses more than one point on the graph, then the graph does not represent a function.

**Domain:** The set of first elements of a relation. On a graph, the first elements are the **horizontal coordinates (usually the x-values)**.

**Range:** The set of second elements of a relation. On a graph, the second elements are the **vertical coordinates (usually the y-values)**.

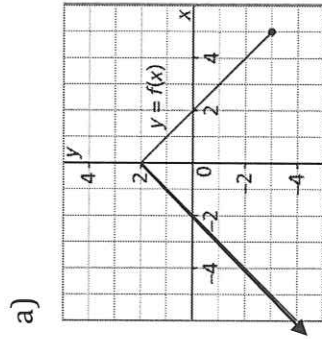
**Example:** Which of these graphs represents a function? Justify your answer.



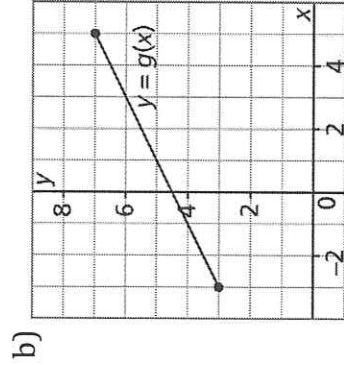
These 2 pass the vertical line test, they're both functions.

Not a function, fails the vertical line test.

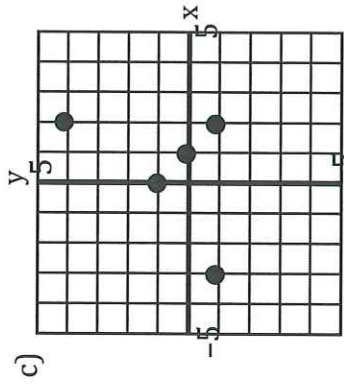
**Example:** Determine the domain and range of the graph of each relation.



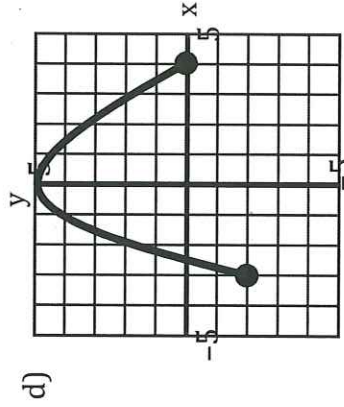
D:  $\{x | x \leq 5, x \in \mathbb{R}\}$   
 R:  $\{y | y \leq 2, y \in \mathbb{R}\}$



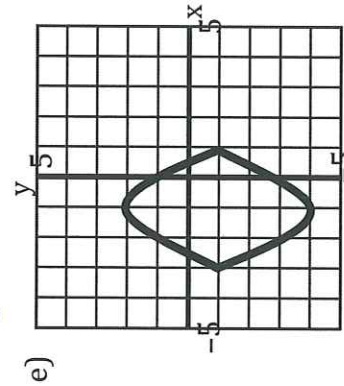
D:  $\{x | -3 \leq x \leq 5, x \in \mathbb{R}\}$   
 R:  $\{y | 3 \leq y \leq 7, y \in \mathbb{R}\}$



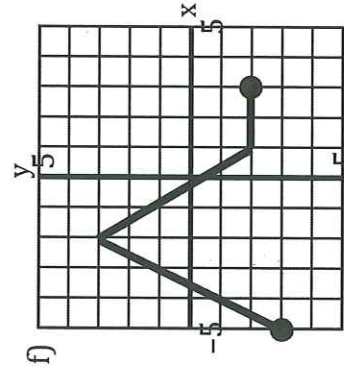
D:  $\{x | x = -3, 0, 1, 2\}$   
 R:  $\{y | y = -1, 0, 1, 4\}$



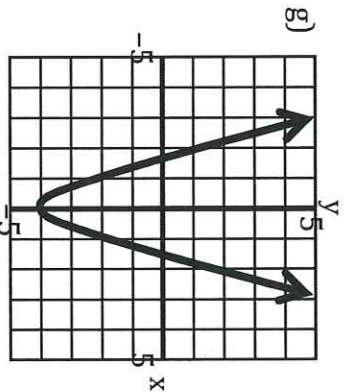
D:  $\{x | -3 \leq x \leq 4, x \in \mathbb{R}\}$   
 R:  $\{y | -2 \leq y \leq 5, y \in \mathbb{R}\}$



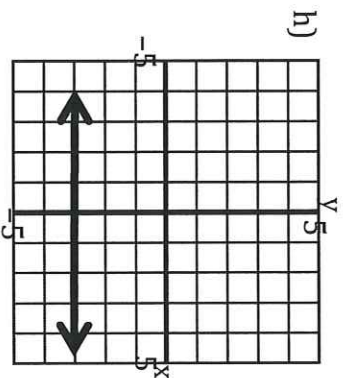
D:  $\{x | -3 \leq x \leq 1, x \in \mathbb{R}\}$   
 R:  $\{y | -4 \leq y \leq 2, y \in \mathbb{R}\}$



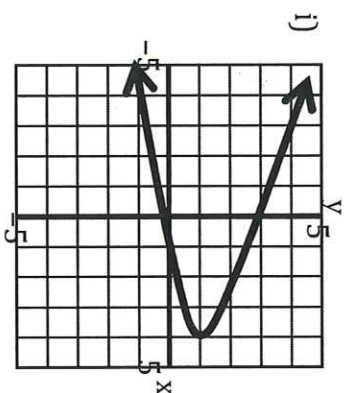
D:  $\{x | -5 \leq x \leq 3, x \in \mathbb{R}\}$   
 R:  $\{y | -3 \leq y \leq 3, y \in \mathbb{R}\}$



D:  $\{x | x \in \mathbb{R}\}$   
 R:  $\{y | y \geq -4, y \in \mathbb{R}\}$



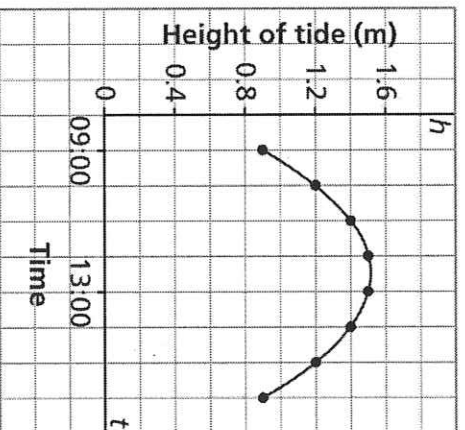
D:  $\{x | x \in \mathbb{R}\}$   
 R:  $\{y | y = -3\}$



D:  $\{x | x \leq 4, x \in \mathbb{R}\}$   
 R:  $\{y | y \in \mathbb{R}\}$

Example: 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



a) Identify the dependent variable and the independent variable. Justify your choices.

dependent: Height independent: Time  
 Height of tide changes with time.

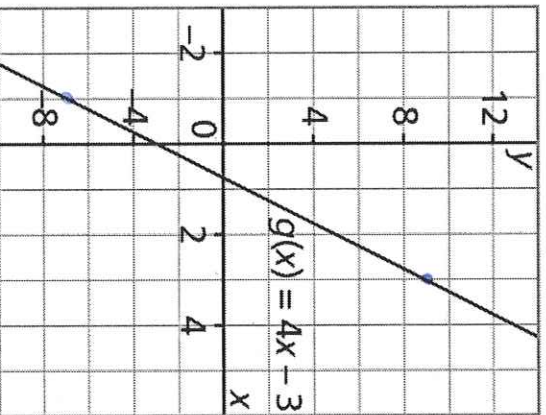
b) Why are the points on the graph connected? Explain.

Tide heights exist at all times, not just when they're measured.

c) Determine the domain and range of the graph.

D:  $\{t | 09:00 \leq t \leq 16:00, t \in \mathbb{R}\}$   
 R:  $\{h | 0.9 \leq h \leq 1.5, h \in \mathbb{R}\}$

Example: Here is a graph of the function  $g(x) = 4x - 3$ .



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

$g(3) = 9$  OR  $g(3) = 4(3) - 3 = 9$

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

$g(x) = -7$   
 $x = ?$  OR  $g(x) = -7$   
 $4x - 3 = -7$   
 $4x = -4$   
 $x = -1$