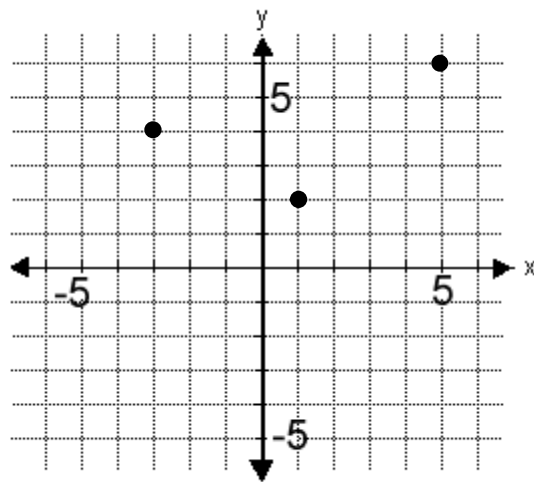


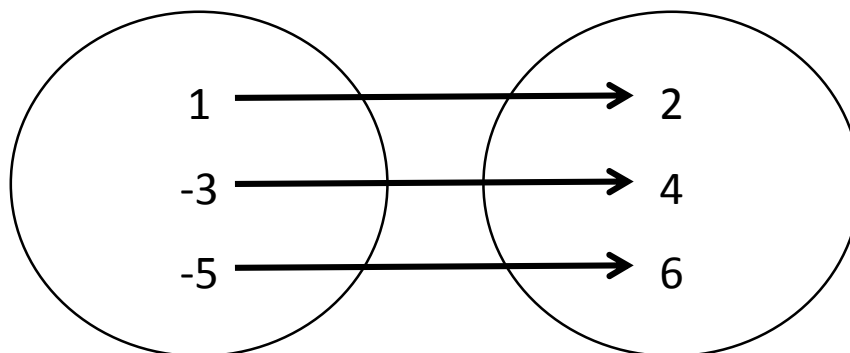
Definition: A relation is a set of ordered pairs.

Example: $\{(1, 2), (-3, 4), (5, 6)\}$

We can also show this as a graph:



It can also be shown by a circle map:



Look at the example again: $\{(1, 2), (-3, 4), (5, 6)\}$

Definition: The domain is the set of all x-coordinates.

Definition: The range is the set of all y-coordinates.

For our example:

$$\text{Domain} = \{-3, 1, 5\} \quad \text{and} \quad \text{Range} = \{2, 4, 6\}$$

Sample Problem: Find the domain and range.

$$A = \{(1, 10), (-3, 9), (2, 5), (4, -3)\}$$

Answer:

$$\text{Domain} = \{-3, 1, 2, 4\} \quad \text{and} \quad \text{Range} = \{-3, 5, 9, 10\}$$

Sample Problem: Find the domain and range.

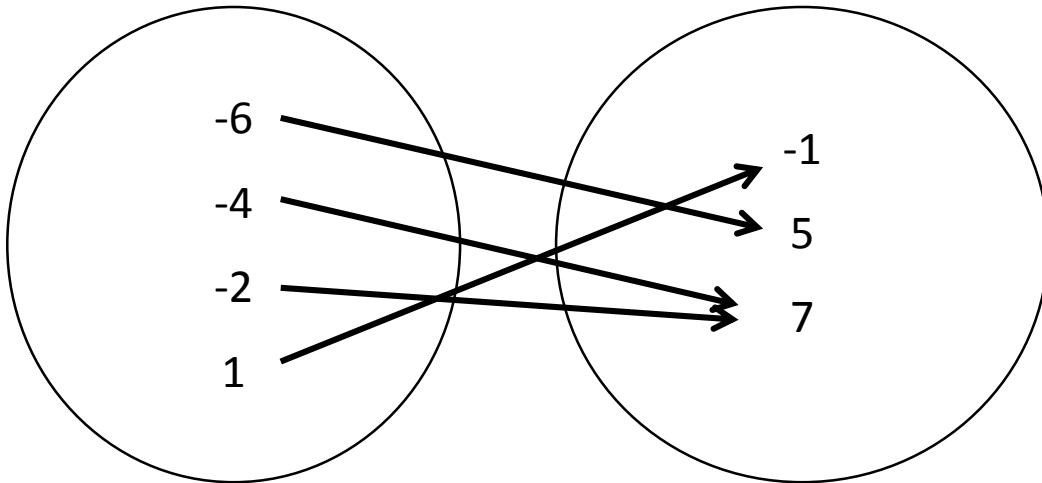
$$B = \{(-6, 8), (-7, 7), (3, -1), (-4, 8)\}$$

Answer:

$$\text{Domain} = \{-7, -6, -4, 3\} \quad \text{and} \quad \text{Range} = \{-1, 7, 8\}$$

Sample Problem: Draw a circle map for the following relation.

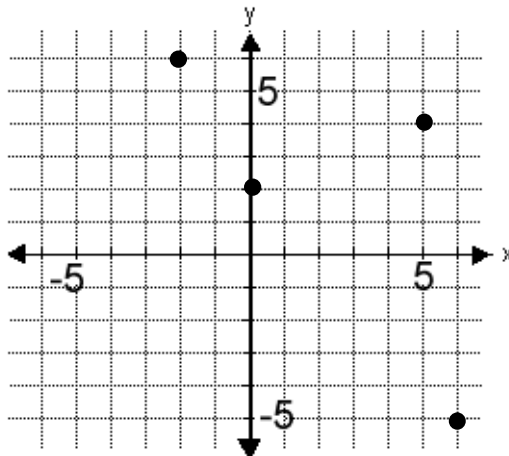
$$C = \{(-6, 5), (-2, 7), (1, -1), (-4, 7)\}$$



What is the domain and range?

Answer: Domain = $\{-6, -4, -2, 1\}$ and Range = $\{-1, 5, 7\}$

Sample Problem: Find the domain and range.



Answer: Domain = $\{-2, 0, 5, 6\}$ and Range = $\{-5, 2, 4, 6\}$

Relations defined by an Equation

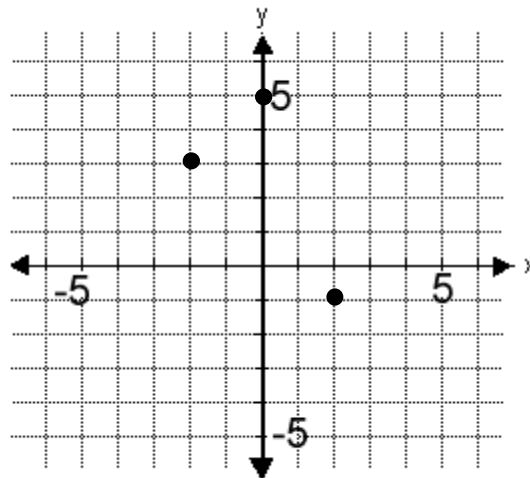
Sample Problem: Write the relation as a set of ordered pairs if the domain is $\{-2, 0, 1, 3\}$ for $y = 3x$.

Answer: $\{(-2, -6), (0, 0), (1, 3), 3, 9)\}$

Sample Problem: Write the relation as a set of ordered pairs if the domain is $\{-4, 0, 3\}$ for $y = x + 5$.

Answer: $\{(-4, 1), (0, 5), (3, 8)\}$

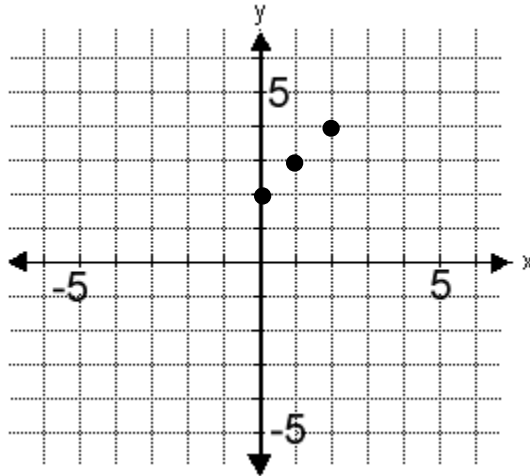
Sample Problem: Graph $H = \{-2, 3), (0, 5), (2, -1)\}$



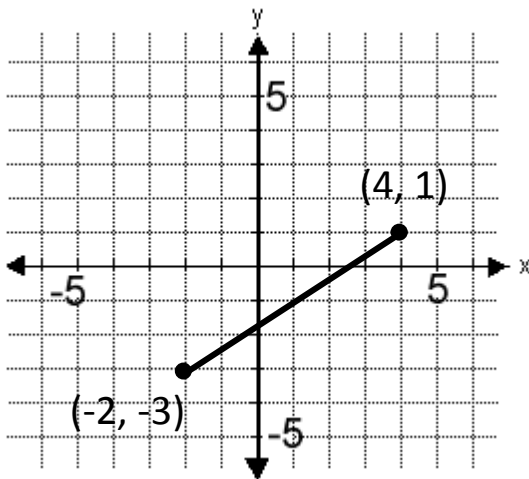
What is the domain and range?

Answer: Domain = $\{-2, 0, 2\}$ and Range = $\{-1, 3, 5\}$

Sample Problem: Graph the relation if $y = x + 2$ for the domain $\{0, 1, 2\}$

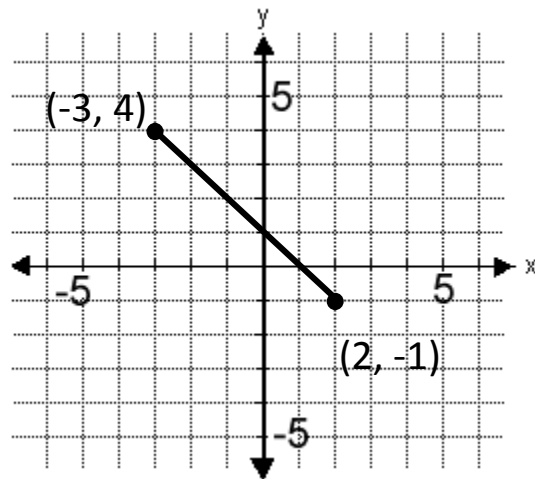


Sample Problem: Find the domain and range:



Domain: $\{-2 \leq x \leq 4\}$

Range: $\{-3 \leq y \leq 1\}$



Domain: $\{-3 \leq x \leq 2\}$

Range: $\{-1 \leq y \leq 4\}$

Definition: A function is a relation in which no two ordered pairs have the same first coordinate.

Ways to show a function:

1. A list of ordered pairs
2. A graph
3. A circle map
4. A rule

Note: These are the same ways that we show any relation.

Function Tests

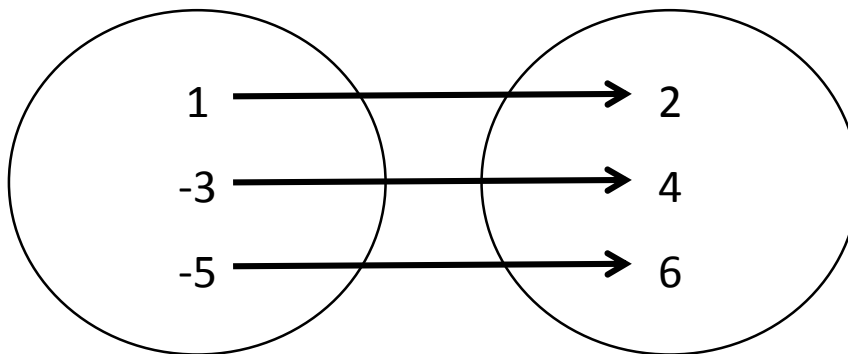
Tell if the following are functions:

$$R = \{(1, 2), (2, 4), (3, 5)\}$$

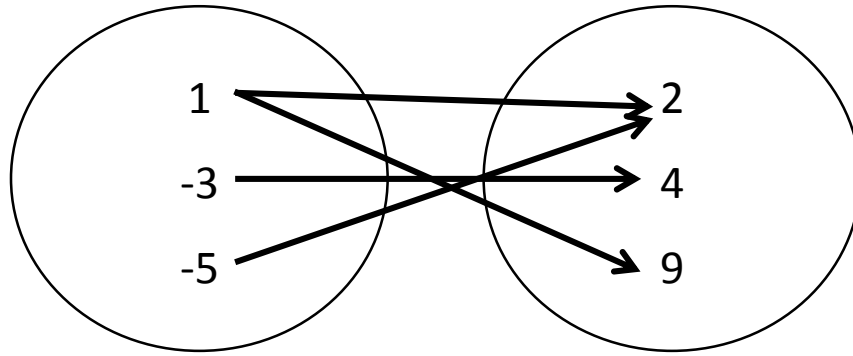
$$S = \{(1, 2), (-1, 10), (1, 4)\}$$

function

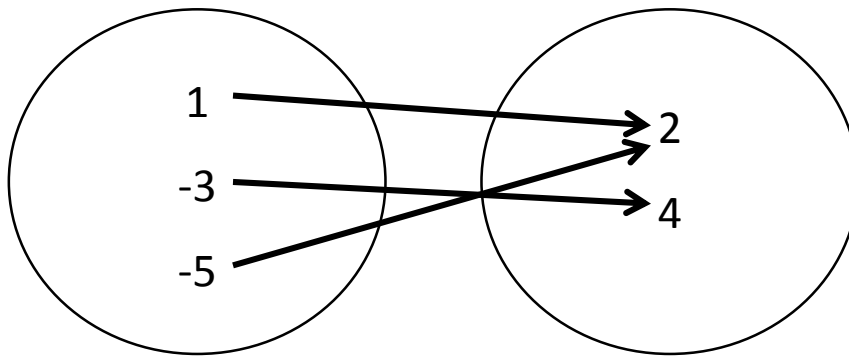
Not a function



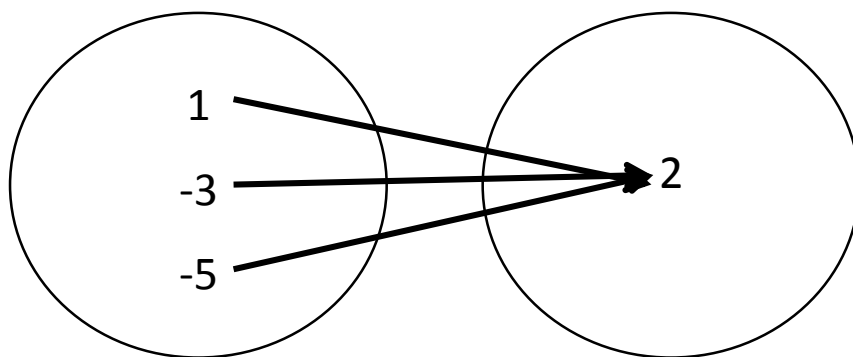
Function



Not a function



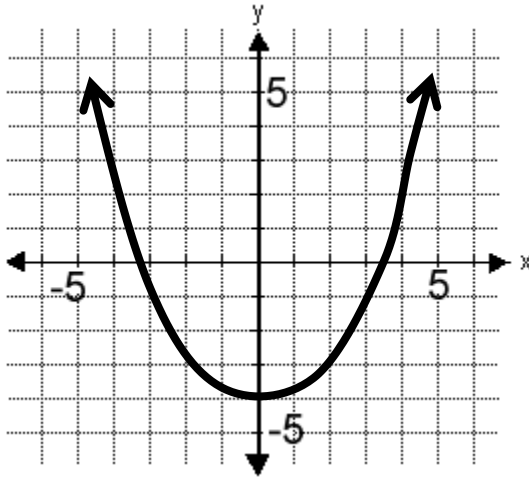
function



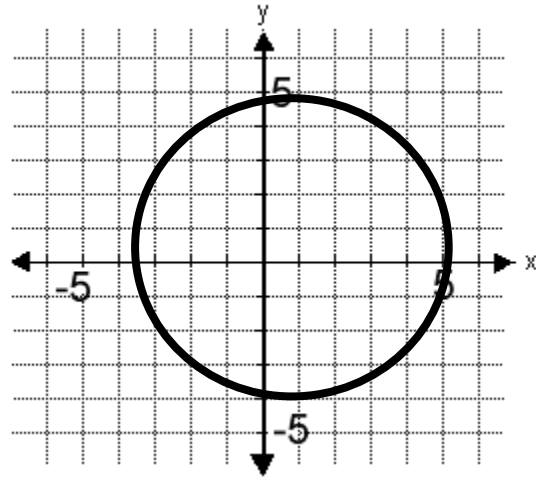
function

For graphs we use the Vertical Line Test.

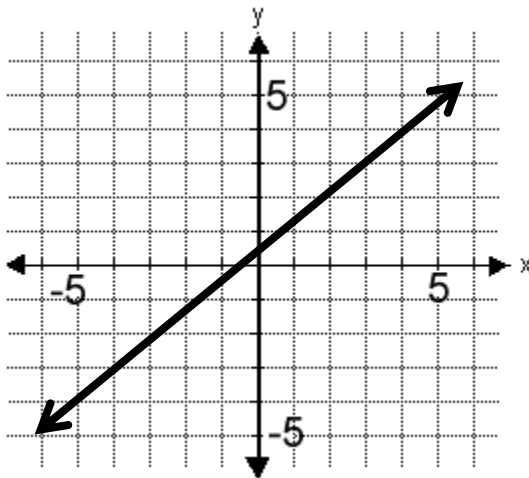
If one vertical line crosses more than one point, it is not a function.



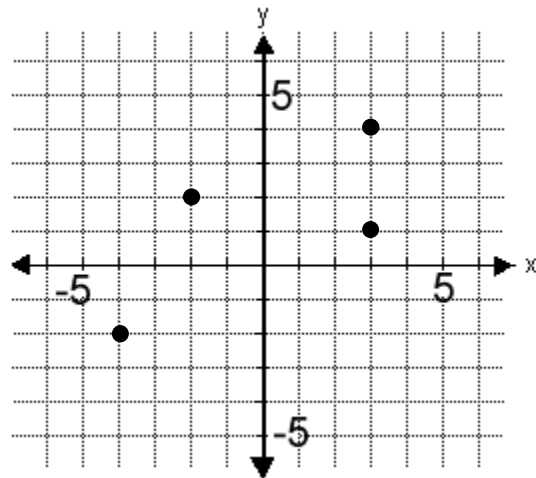
function



not a function



function



not a function