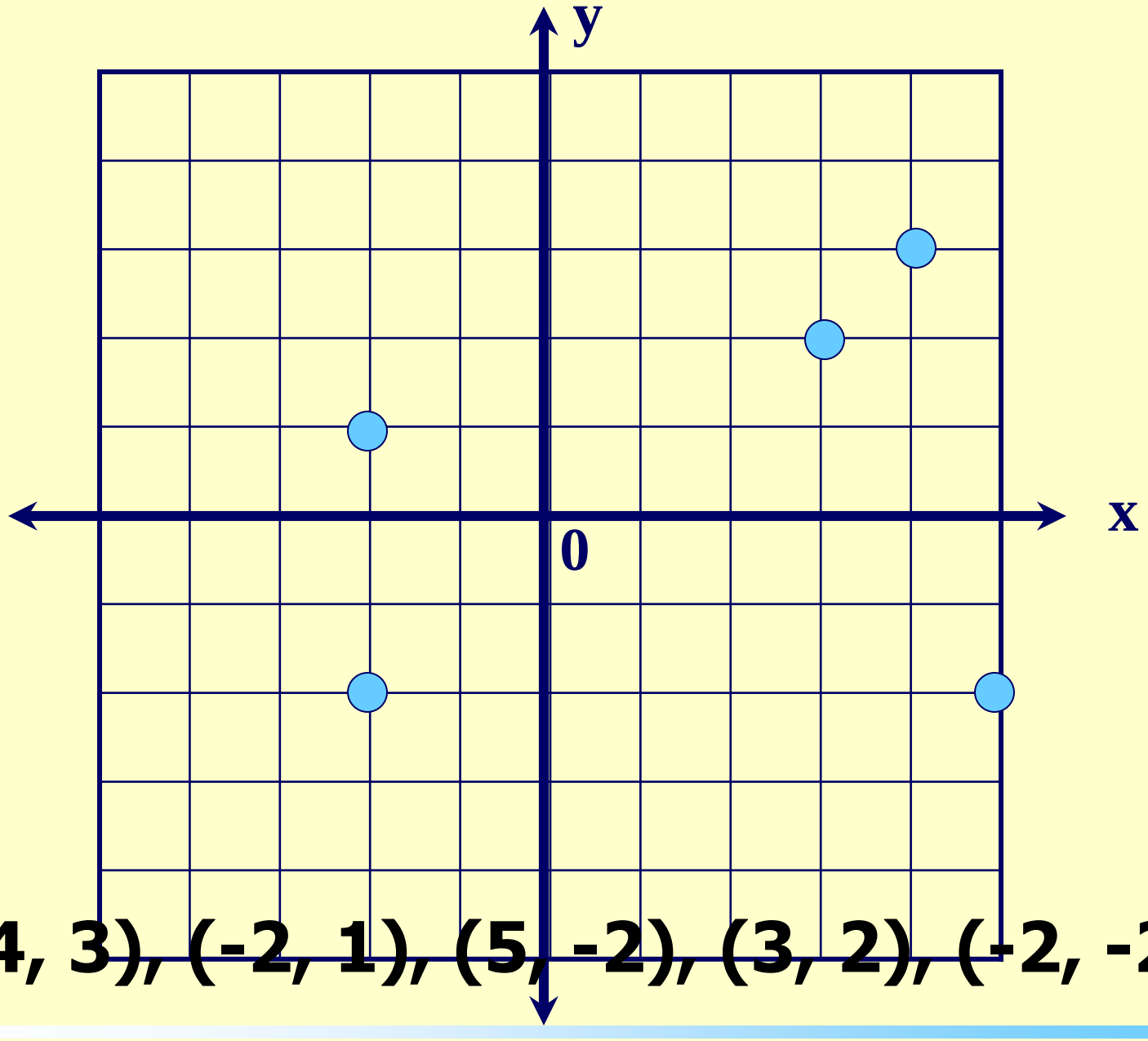

Relations

Relation – a set of ordered pairs

A relation can be represented by a set of ordered pairs, a table, a graph or a mapping.

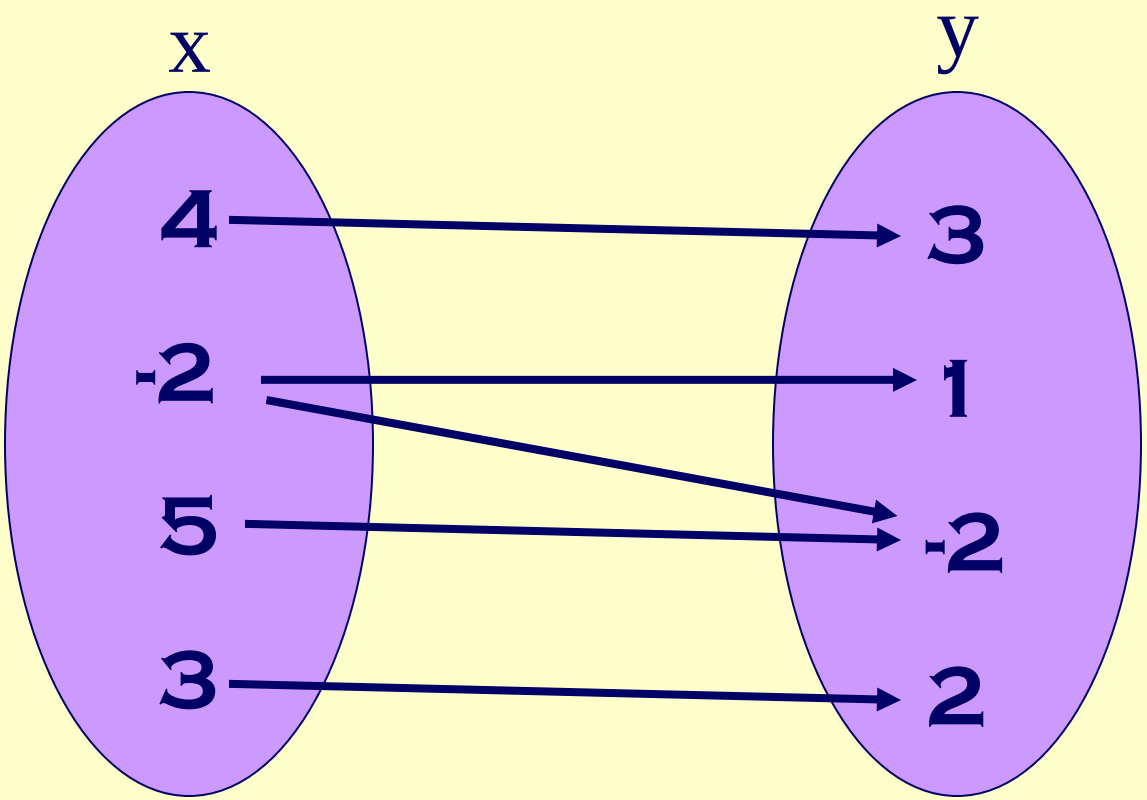
{(4, 3), (-2, 1), (5, -2), (3, 2), (-2, -2)}

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



{(4, 3), (-2, 1), (5, -2), (3, 2), (-2, -2)}

Mapping……



{(4, 3), (-2, 1), (5, -2), (3, 2), (-2, -2)}

{(4, 3), (-2, 1), (5, -2), (3, 2), (-2, -2)}

- **The DOMAIN of a relation is the x-coordinates of the ordered pairs.**

Domain – {-2, 3, 4, 5}

- **The RANGE of a relation is the y-coordinates of the ordered pairs.**

Range – {-2, 1, 2, 3}

- **The INVERSE of a relation is found by switching the coordinates of each ordered pair.**

{(3, 4), (1, -2), (-2, 5), (2, 3), (-2, -2)}

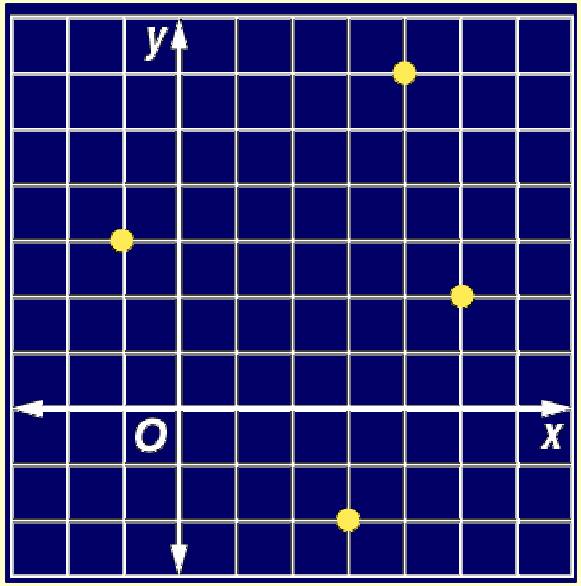
EXAMPLE

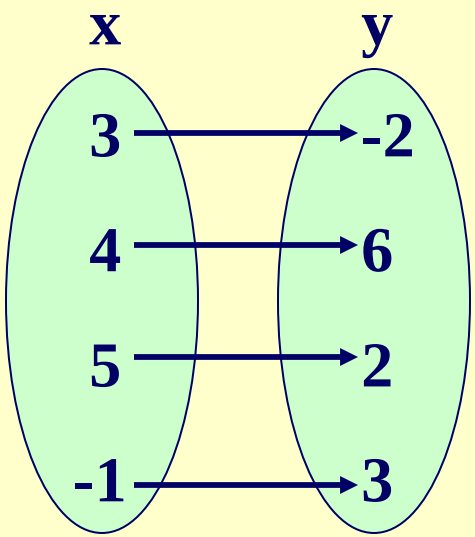
a) Express the relation $\{(3, -2), (4, 6), (5, 2), (-1, 3)\}$ as a table, a graph, and a mapping.

b) Determine the domain and range. Find the inverse.

Answer:

x	y
3	–2
4	6
5	2
–1	3



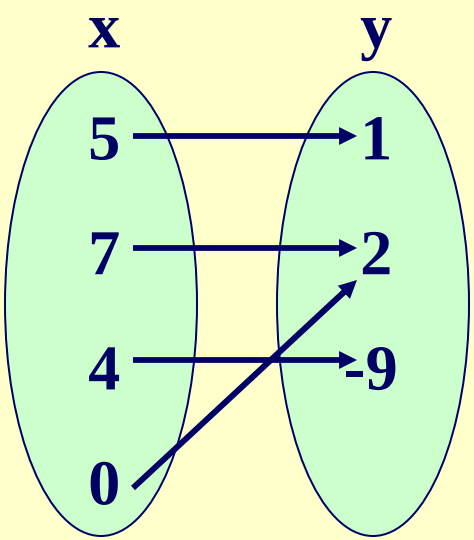


D = {–1, 3, 4, 5}; R = {–2, 2, 3, 6}

Inverse: {(-2, 3), (6, 4), (2, 5), (3, -1)

EXAMPLE Express the relation shown in the mapping as a set of ordered pairs. Then write the inverse of the relation.

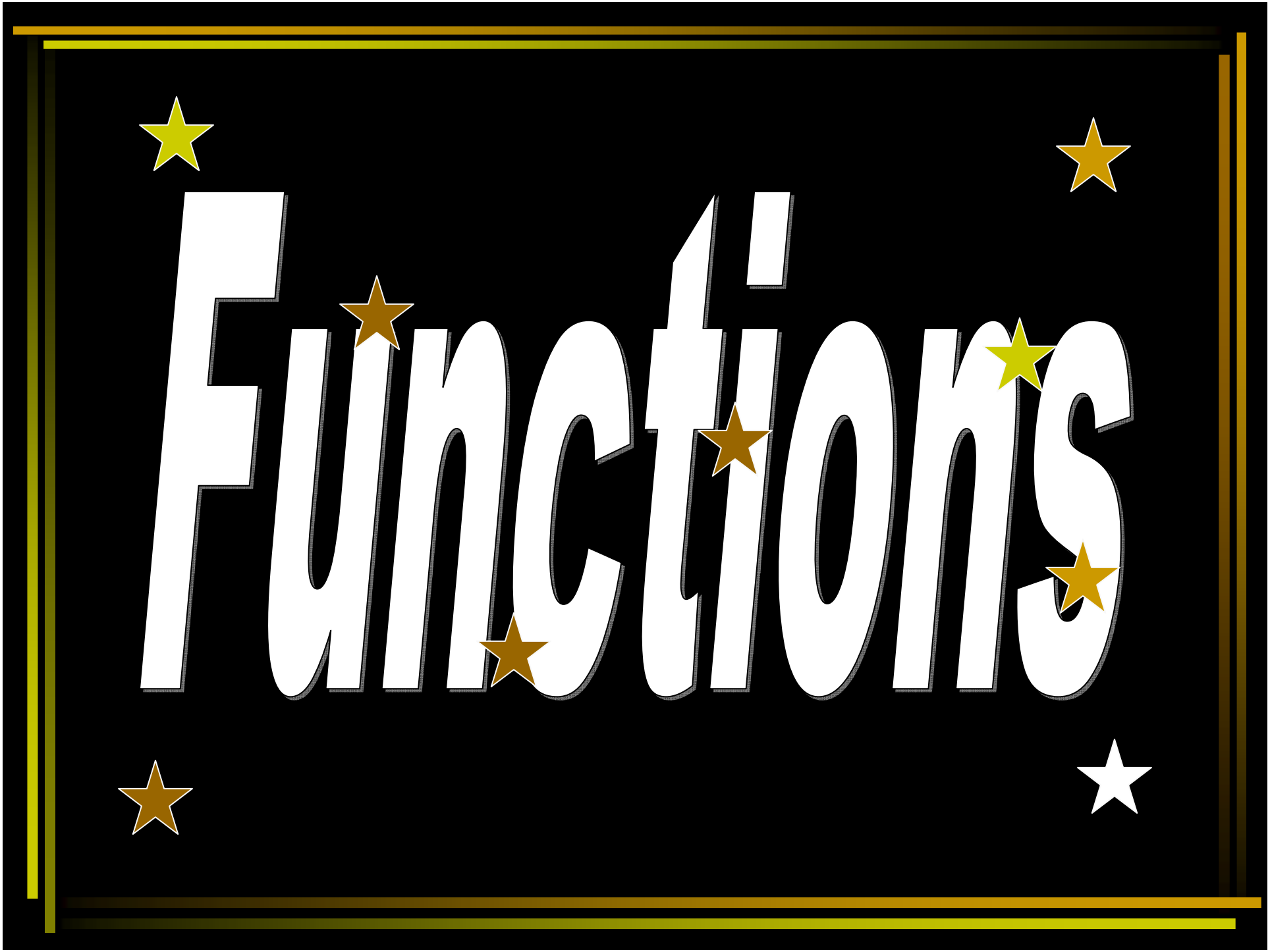
Notice that both 7 and 0 in the domain are paired with 2 in the range.



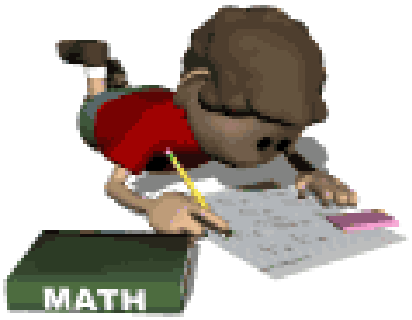
Answer: $\{(5, 1), (7, 2), (4, -9), (0, 2)\}$

Inverse ***Exchange X and Y in each ordered pair to write the inverse relation.***

Answer: $\{(1, 5), (2, 7), (-9, 4), (2, 0)\}$


Functions

- **FUNCTION: a relation when each element of the domain is paired with exactly one element of the range.**
- ***For every x there is exactly one y.***
- ***The x-coordinate cannot repeat.***

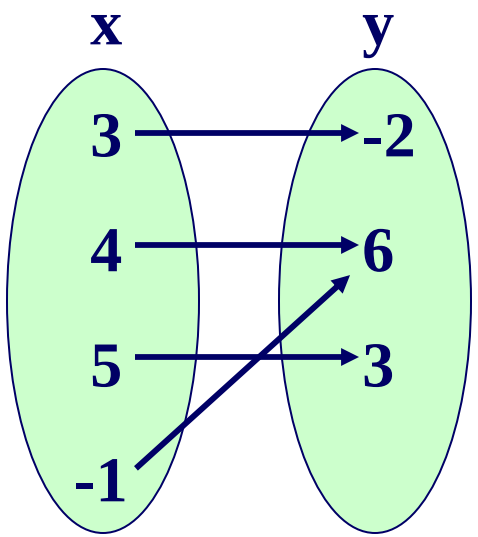


Examples that are functions:

{(3, 2), (4, -1), (-3, -2), (9, 0)}

{(9, -1), (6, -1), (-9, 2), (-7, -1)}

x	y
-2	3
1	4
0	3
2	2

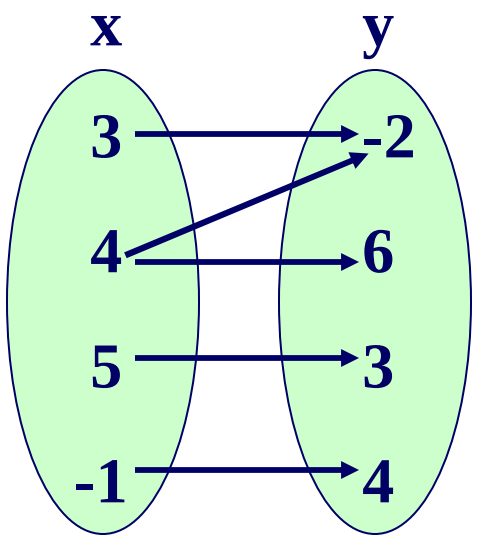


Examples that are NOT functions:

{(1, 2), (2, 4), (1, 5)}

{(-9, 2), (-9, 1), (3, 4), (5, -6)}

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



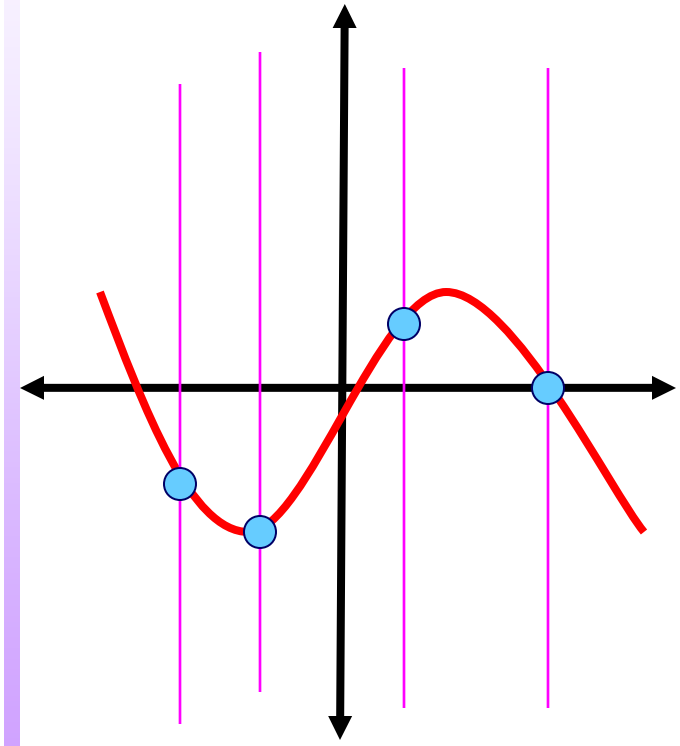
- **VERTICAL LINE TEST: test used to decide if a graph is a function.**

  If no vertical line can be drawn so that it intersects the graph more than once, then the graph IS a function.

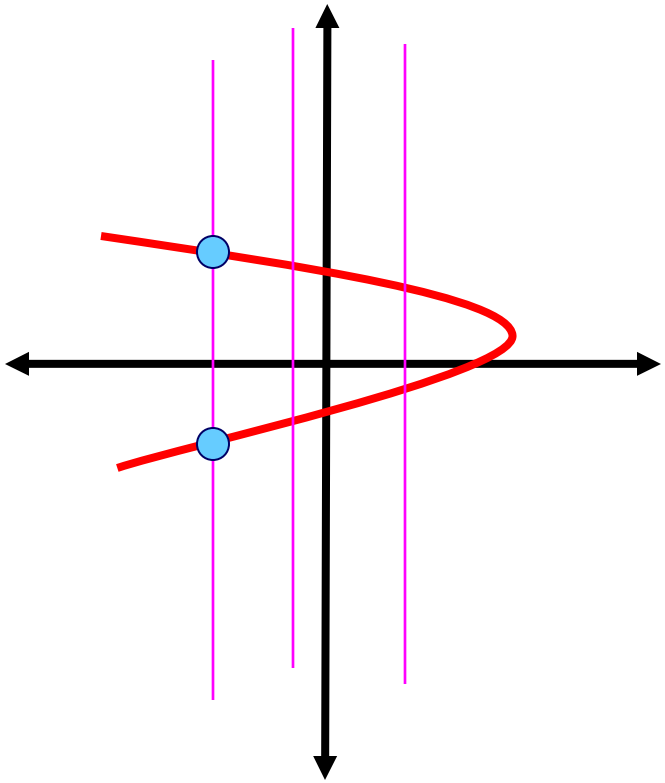
  If any vertical line can be drawn so that it intersects the graph at two or more points, then the relation IS NOT a function.

- **Examples:**

FUNCTION!



Not a FUNCTION!



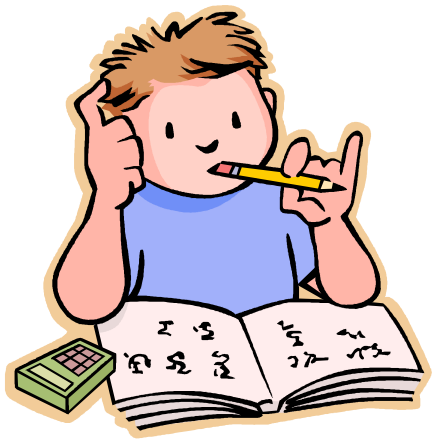
- **FUNCTION NOTATION:** ***the y is replaced with f(x), read "f of x"***

Equation Notation

$$y = 3x + 7$$

Function Notation

$$f(x) = 3x + 7$$



Evaluating functions:

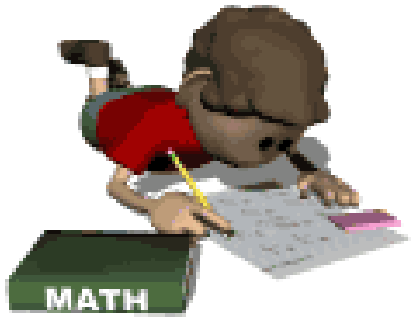
- **If f(x) = 4x + 1, find f(-2).**

❖ **Substitute -2 in for x.**

❖ ***f(-2) = 4(-2) + 1***

-8 + 1

Answer: f(-2) = -7



Example:

- If $f(x) = 2x^2 - 4$, find $f(-3)$.

  - Substitute (-3) in for x.
  - $f(-3) = 2 \bullet (-3)^2 - 4$

    $2 \bullet 9 - 4$

    $18 - 4$

  - ***Answer: $f(-3) = 14$***

Example:

- **If f(x) = 3x + 6, find f(x - 1).**

❖ **Substitute (x - 1) in for x.**

❖ **$f(x - 1) = 3(x - 1) + 6$**

$$3x - 3 + 6$$

❖ ***Answer: $f(x - 1) = 3x + 3$***

Examples:

If $f(x) = 2x - 7$, find each of the values.

1. $f(-3) = 2(-3) - 7 = -6 - 7 = -13$

2. $f(5) = 2(5) - 7 = 10 - 7 = 3$

3. $f(x+2) = 2(x+2) - 7$

$= 2x + 4 - 7 = 2x - 3$

4. $f(x-4) = 2(x-4) - 7$

$= 2x - 8 - 7 = 2x - 15$