Determine whether a Relation is a function.

i) a set of points or ii) an equation.

Definition: A **Function** is a set of **ordered pairs** that assigns to each **x-value** exactly one **y-value**.

i) Set of points

- To determine if a Set of Points is a Function, examine the entire set and decide if it meets the definition requirements.

EXAMPLES

a. {(-1,1) , (2,3) , (7,3) , (8,6)} **b.** {(0,-2) , (1,5) , (0,3) , (7,7)}

a. Although the ordered pairs (2,3) and (7,3) have the same y-value, each x-value is assigned to only one y-value so this set of ordered pairs is a function.

b. The x-value 0 is assigned to two y-values, -2 and 3, so this set of ordered pairs is not a function.

TRY IT!

1. {(4,1) , (3,-2) , (8,5) , (-5,3)}
2. {(1,2) , (-4,3) , (0,8) , (1,4)}

ii) Equations

- In order to determine if an equation is a function we can look at two categories, linear and non-linear relations. Let's look at each category separately.

- Linear Relations – There are five types of linear relations we are familiar with; $y = mx + b$, $Ax + By = C$, $y - y_1 = m(x - x_1)$, $y = b$, and $x = a$. The first 4 are all functions. We can deduct this conclusion knowing that each of those equations forms non-vertical straight lines which, by the vertical line test, are all functions. The fifth relation is certainly not a function since it is the equation of a vertical line (Thus failing the vertical line test).

- **o** Non-Linear Relations – There are many non-linear relations to potentially consider. Here are a few general rules to help sort them out.

    1. Graphing the Relation by plotting ordered pairs is always a good option. The Vertical Line Test can then be used.
    2. Is the relation solved for y? If so, test to make sure that each x-value is assigned exactly one y-value. If not, it's not a function.
    3. Solving the equation for y is useful. Use #2 above to determine if it is a function.
    4. Are there any y^2 or even-powered y terms? If so, be very cautious. These relations are not functions. (This is not true for x^2 or even-powered x terms)

EXAMPLES

FUNCTIONS	NOT FUNCTIONS
$y = x^2$	$x = y^2$
$y = \frac{1}{x}$	$x^2 + y^2 = 9$
$xy = 4$	$y = \pm\sqrt{x+1}$

TRY IT!

3. $x = 2$
4. $y = -4$
5. $y^2 = x + 2$
6. $2x = 3y + 6$
7. $x = \frac{5}{y}$

Answers to TRY IT Sections:

1. Function
2. Not a Function
3. Not a Function
4. Function
5. Not a Function
6. Function
7. Function