**Pre-calculus 10**

**Chapter 3**

**Relations and Functions**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mr. Formaran**

**3.1 Relations**

**Coordinate System**



c

|  |  |  |
| --- | --- | --- |
|  | **x** | **y** |
| a |  |  |
| b |  |  |
| c |  |  |
| d |  |  |
| e |  |  |
|  |  |  |
|  |  |  |



a

e



|  |  |  |
| --- | --- | --- |
|  | **x** | **y** |
|  | 2 | 4 |
|  | -3 | -3 |
|  | -4 | 2 |
|  | -5 | 0 |
|  | 0 | -5 |
|  |  |  |
|  |  |  |



b



d



Relations are sets of ordered pairs (x , y)



X-value is the \_\_\_\_\_\_\_\_\_\_\_\_ of the relation. X is independent variable



Y-value is the \_\_\_\_\_\_\_\_\_\_\_\_ of the relation. Y is dependent variable



Relation can be represented as

|  |  |
| --- | --- |
| **Ordered Pairs** | **Mapping Notation** |
| (1,2), (2,3), (-2,-1), (-3,-4) | 1 2  2 3  -2 -1  -3 -4 |
| **Table** | **Graph** |
| |  |  | | --- | --- | | x | y | | 1 | 2 | | 2 | 3 | | -2 | -1 | | -3 | -4 | | Blank Coordinate Grid With Grid Lines Shown | ClipArt ETC |

**My Own Examples**

|  |  |
| --- | --- |
| **Ordered Pairs** | **Mapping Notation** |
|  |  |
| **Table** | **Graph** |
| |  |  | | --- | --- | | x | y | |  |  | |  |  | |  |  | |  |  | | Blank Coordinate Grid With Grid Lines Shown | ClipArt ETC |

Example 1

Determine the domain and range of the ordered pairs.

A = { (1,2), (-3,5), (4, -2) } B = { (-3,4), (1,0), (0,2), (3,2) }

Domain of A: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Domain of B: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Range of A: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Range of B: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

C = { (-2,1), (1,0), (3,3), (1,4) } D = { (-3,-1), (-3,3), (2,3), (4,0) }

Domain of A: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Domain of B: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Range of A: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Range of B: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



**My Own Examples**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

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



Example 2 **My Own Examples**





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



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



p

Example 3 **My Own Examples**





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



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



Example 4 **My Own Examples**



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



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

Example 5 **My Own Examples**





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



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



Example 6 **My Own Examples**





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

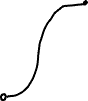
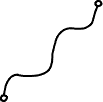


Range: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Range: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Range: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Example 7 **My Own Examples**





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



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



Example 8 **My Own Examples**





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



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

Example 9 **My Own Examples**





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



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



Example 10 **My Own Examples**





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



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



**3.2 Functions**

For every value of the domain (x-value), there is one, and only one, value for the range (y-value)



Hierarchy of Relations of Functions and of One-to-One Functions

Relation Function One-to-one Function



Example



Domain Range Domain Range Domain Range

(Input) (Output) (Input) (Output) (Input) (Output)

A one-to-one function A function, Not a function,



but not one-to-one. just a relation,



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**My Own Examples**

Domain Range Domain Range Domain Range

(Input) (Output) (Input) (Output) (Input) (Output)

A one-to-one function A function, Not a function,

but not one-to-one. just a relation,

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example 1



Given ordered pairs: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



When x is \_\_\_\_, the value of y is \_\_\_\_.



\_\_\_\_ \_\_\_\_



\_\_\_\_ \_\_\_\_



\_\_\_\_ \_\_\_\_



**My Own Example**

Given ordered pairs: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

When x is \_\_\_\_, the value of y is \_\_\_\_.

\_\_\_\_ \_\_\_\_

\_\_\_\_ \_\_\_\_

\_\_\_\_ \_\_\_\_

Vertical Line Test for Function



An equation defines y as a function of x if and only if every vertical line in the coordinate plane intersects the graph of the equation once.



Horizontal Line Test for One-to-One functions

A function y is one-to-one function of x if and only if every horizontal line in the coordinate plane

intersects the function at most only once

Example 2

State whether each of the following relations is a function, one-to-one function or neither.





\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**My Own Examples**

State whether each of the following relations is a function, one-to-one function or neither.



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Function Notation y = x2 or f(x) = x2

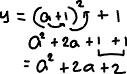


Example 3

a. Let f(x) = x2 + 1. Evaluate the function as an ordered pairs.



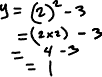
a. f(2) b. f(-3) c. f(a + 1)



b. Let f(x) = \_\_\_\_\_\_\_\_\_\_\_\_\_. Evaluate the function as an ordered pairs.



a. f(2) b. f(-3) c. f(a + 1)



**My Own Examples**



Let f(x) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Evaluate the function as an ordered pairs.

a. f(2) b. f(-3) c. f(a + 1)

**3.3 Linear Equations**

An expression is a collection of numbers, variables, and operation signs



Examples **My Own Examples**

a. a.



b. b.



c. c.



d. d.



An equation is a mathematical statement that two expressions are equal.



Examples **My Own Examples**

a. a.



b. b.



c. c.



d. d.



A linear equation is any equation of the form Ax + By = C, where A, B and C are constants and x and y are variables. All linear equations are functions except a vertical line.



Examples **My Own Examples**

a. a.



b. b.



c. c.



d. d.



Graphing Linear Equations of the Type Ax + Bx = C

Example 1



A. Graph 3x + 2y = 6



Method 1 Solve for they y-value



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |



Method 2



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |







B. Graph \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Method 1 Solve for they y-value

|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |



Method 2



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |



**My Own Example**





Graph \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Method 1 Solve for they y-value



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |



Method 2

|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |



Graphing Linear Equations of the Type y = mx + b



Example 2





2

3

A. Graph y = - x + 4



Method 1 Solve for they y-value

|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |



Method 2

|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |





B. Graph \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Method 1 Solve for they y-value

|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |



Method 2



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |



**My Own Example**





Graph \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Method 1 Solve for they y-value

|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |



Method 2



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |

**3.4 Non-Linear Equations**

Example 1





Is x = y2 a function?



Solution:



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |



The graph is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Example 2



Is y = x2 – 1 a function?



Solution:



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |



The graph is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Example 3





Is y = x2 + y2 = 9 a function?



Solution:



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |



The graph is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example 4







Is y = 2x a function?



Solution:



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |



The graph is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Example 5



1

x

Is y = a function?



Solution:



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |



The graph is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



**My Own Examples**



Is y = \_\_\_\_\_\_\_\_\_\_\_ a function?

Solution:

|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

The graph is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**My Own Examples**



Is y = \_\_\_\_\_\_\_\_\_\_\_ a function?



Solution:



|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |



The graph is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



**My Own Examples**



Is y = \_\_\_\_\_\_\_\_\_\_\_ a function?

Solution:

|  |  |
| --- | --- |
| x | y |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

The graph is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_