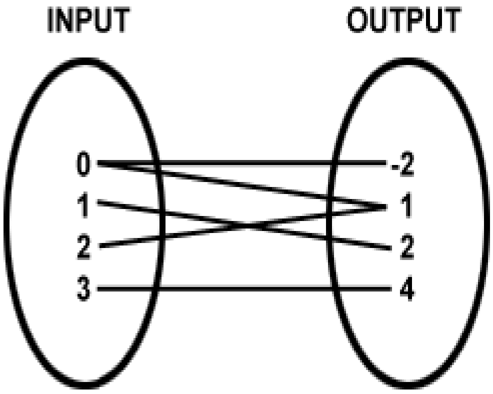
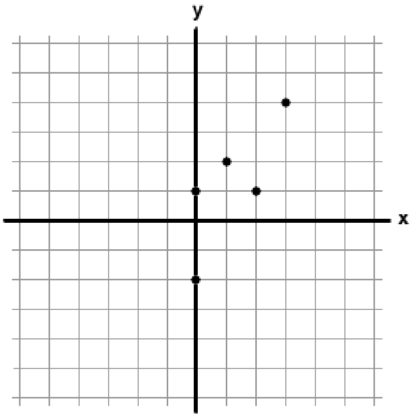
Math Worksheet 1– **FUNCTION versus RELATION**

Relations

A relation is a set of inputs and outputs, often written as ordered pairs (input, output). We can also represent a relation as a mapping diagram or a graph. For example, the relation can be represented as:



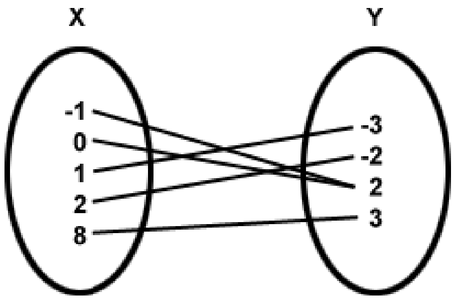


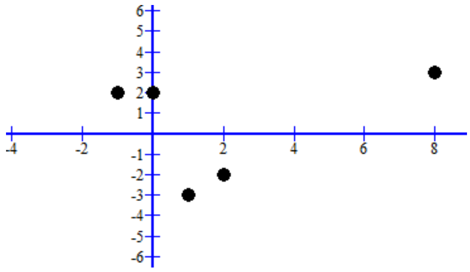
Mapping Diagram of Relation **Graph of Relation**

y is not a function of x (x = 0 has multiple outputs)

Functions

A <u>function</u> is a relation in which each input *x* (**domain**) has **only one** output *y*(**range**).



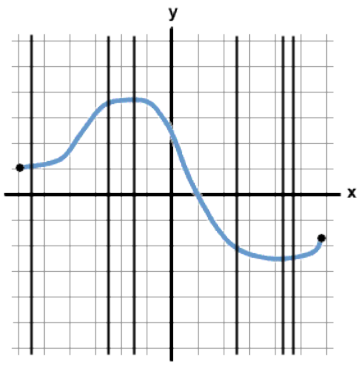
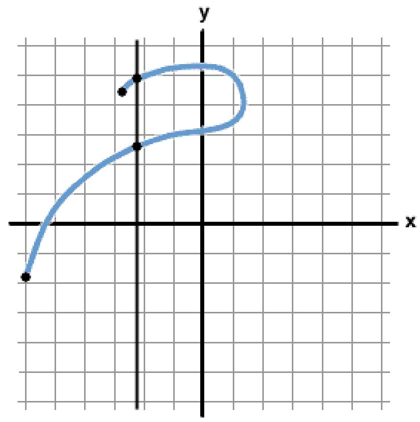


To check if a relation is a function, given a mapping diagram of the relation, use the following criterion:

1. *If each input has only one line connected to it, then the outputs are a function of the inputs.*
2. *The Vertical Line Tests for Graphs*

To determine whether y is a function of x, given a graph of a relation, use the following criterion: if every vertical line you can draw goes through only 1 point, y is a function of x. If you can draw a vertical line that goes through 2 points, y is not a function of x. This is called the ***<u>vertical line test</u>.***

In the following graphs:

y is a function of x (passes vertical line trest)	y is not a function of x (fails vertical line test)
	

Function notation

There is a special notation, that is used to represent this situation:
if the function name is ***f***, and the input name is ***x*** ,then the unique corresponding output is called ***f*(*x*)** (which is read as " ***f*** of ***x*** ".)

We can also use letters: ***g***(*x*), ***h***(*x*) or simply ***y***

Question: What does the function notation $g(7)$ represent?
Answer: the output from the function g when the input is 7

Question: Suppose $f(x) = x + 2$. What is $f(3)$?
Answer: $f(3) = 3 + 2 = 5$ (simply substitute number 3 for the variable x)

Question: Suppose $f(x) = x + 2$. What is $f(x+5)$?
Answer: $f(x+5) = (x + 5) + 2 = x + 7$

Operations with functions

Given $f(x) = 3x + 2$ and $g(x) = 4 – 5x$, find $(f + g)(x)$, $(f – g)(x)$, $(f\times g)(x)$, and $(f / g)(x)$.

$(f + g)(x) = f(x) + g(x) = [3x + 2] + [4 – 5x] = 3x – 5x + 2 + 4 = \mathbf{–2x + 6}$

$(f – g)(x) = f(x) – g(x) = [3x + 2] – [4 – 5x] = 3x + 5x + 2 – 4 = \mathbf{8x – 2}$

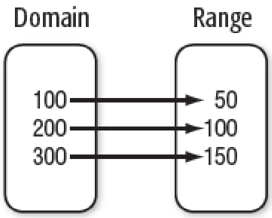
$(f\times g)(x) = [f(x)][g(x)] = (3x + 2)(4 – 5x) = 12x + 8 – 15x^2 – 10x = \mathbf{–15x^2 + 2x + 8}$

$$\left(f/g\right)(x) = f(x)/g(x) = \frac{\mathbf{3x+2}}{\mathbf{4-5x}}$$

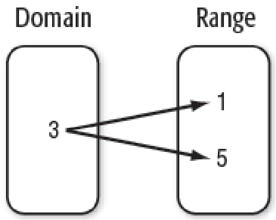
Exercises

State the domain and range of each relation. Then determine whether each relation is a *function*

1.



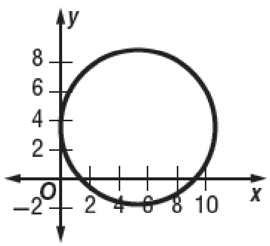
2.



3.

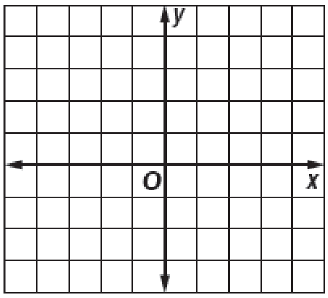
x	y
1	2
2	4
3	6

4.

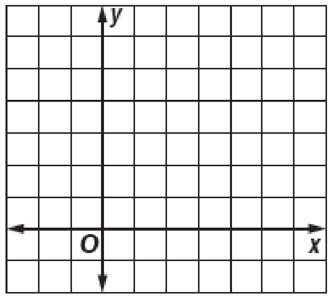


Graph each relation or equation and determine the domain and range.

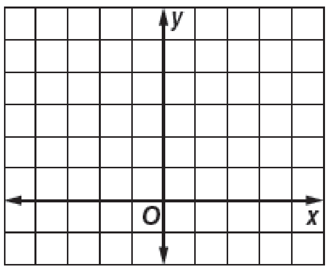
5. $\{(2, -3), (2, 4), (2, -1)\}$



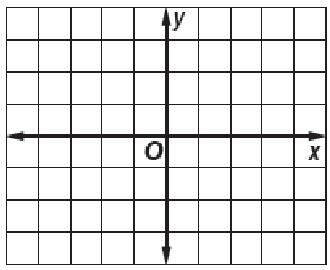
6. $\{(2, 6), (6, 2)\}$



7. $\{(-3, 4), (-2, 4), (-1, -1), (3, -1)\}$



8. $x = -2$



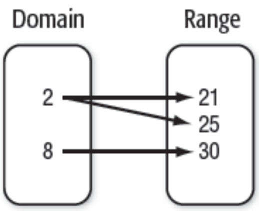
Find each value if $f(x) = 2x - 1$ and $g(x) = 2 - x2$.

9. $f(0)$ **10.** $f(12)$ **11.** $g(4)$
12. $f(-2)$ **13.** $g(-1)$ **14.** $f(d)$

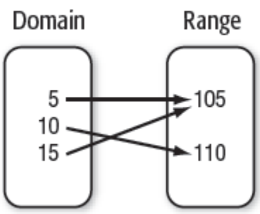
Homework

State the domain and range of each relation. Then determine whether each relation is a *function*

1.



2.



3.

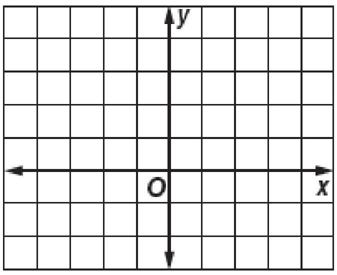
x	y
−3	0
−1	−1
0	0
2	−2
3	4

4.

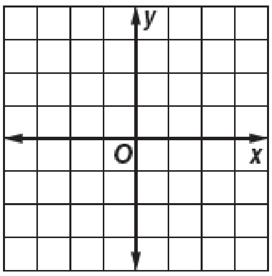
x	y
−2	−1
−2	1
−1	0
1	0
2	1

Graph each relation or equation and determine the domain and range.

5. $x = -1$



6. $y = 2x - 1$



Find each value if *f*(*x*) = − 5*x* + 2 and *g*(*x*) = −2*x* + 3.

7. *f*(3) **8.** *f*(-4) **9.** *g*(−1 2)

10. *f*(-2) **11.** *g*(-6) **12.** *f*(*m* - 2)

13. Use the functions below to perform the following operations:

f(x) = 2x g(x) = x – 2 h(x) = x^2 k(x) = x/2

k(x) *x* f(x)
g(x) - h(x)
f(x) - k(x)
h(x) + k(x)
f(x) ÷ k(x)
g(x) *x* h(x)