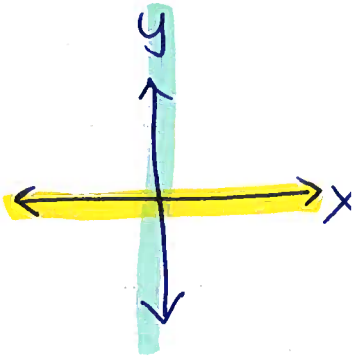
Lesson 3: X and Y Intercepts

Review

a) A **relation** is a connection between two quantities. A relation can be represented graphically by a set of ordered pairs.

b) The first component of a set of ordered pairs is the x coordinate, also known as the input. Values of the input are values of the independent variable.

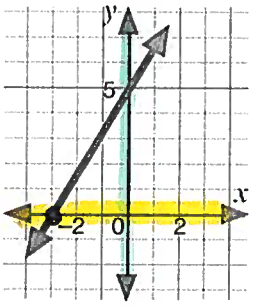
c) The second component of a set of ordered pairs is the y coordinate, also known as the output. Values of the output are values of the dependent variable.



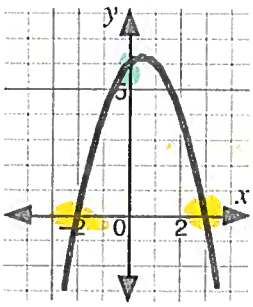
Exploring x- and y-intercepts

Consider the following graphs.

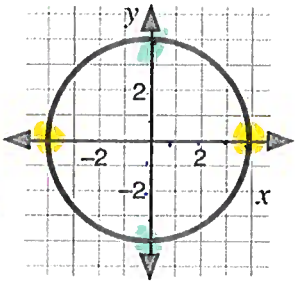
Graph 1



Graph 2



Graph 3



a) List the coordinates of the point(s) where each graph crosses the *x*-axis.

- Graph 1 crosses the *x*-axis at (-3, 0).
- Graph 2 crosses the *x*-axis at (-2, 0) and (3, 0).
- Graph 3 crosses the *x*-axis at (-4, 0) and (4, 0).

b) What do all the points in a) have in common?

y coordinate is 0

c) List the coordinates of the point(s) where each graph crosses the *y*-axis.

- Graph 1 crosses the *y*-axis at (0, 5).
- Graph 2 crosses the *y*-axis at (0, 6).
- Graph 3 crosses the *y*-axis at (0, 4) and (0, -4).

d) What do all the points in c) have in common?

x coordinate is 0

x- and y- Intercepts of a Graph

The ***x*-intercept** of a graph is the x-coordinate of the ordered pair where the graph intersects the x-axis. An x-intercept occurs at a point on the graph where the y-coordinate is zero. The x-intercept can be given as a value or as an ordered pair.

The ***y*-intercept** of a graph is the y-coordinate of the ordered pair where the graph intersects the y-axis. A y-intercept occurs at a point on the graph where the x-coordinate is zero. The y-intercept can be given as a value or as an ordered pair.

1. Given the equation of the graph of a relation:
   - to determine the x-intercept, set $y = 0$ and solve for x.
   - to determine the y-intercept, set $x = 0$ and solve for y.

2. The equation of a graph can be written in different form:, all of which are equivalent. The equation of Graph 1 on the previous page is $y = \frac{5}{3}x + 5$, which can be written as $3y = 5x + 15$ or $5x - 3y + 15 = 0$. Equivalent forms of an equation will be studied in detail, in a later unit. For the time being, use the instruction in note 1 to find the x- and y-intercepts of the graph of an equation given in any form.

The equation of Graph 1 on the previous page is $3y = 5x + 15$.
Algebraically determine the values of the x-intercept and the y-intercept of Graph 1.

1) replace y with 0
2) solve for x

x-intercept $y=0$	y-intercept $x=0$
$3(0) = 5x + 15$	$3y = 5(0) + 15$
$0 = 5x + 15$	$\frac{3y}{3} = \frac{15}{3}$
$-15 \quad -15$	
$\frac{-15}{5} = \frac{5x}{5}$	
$x = -3$	$y = 5$

- replace x with 0
- solve for y

The equation of Graph 3 on the previous page is $x^2 + y^2 = 16$.
Calculate the x-intercept and the y-intercept of the graph of $x^2 + y^2 = 16$. Give the answers as ordered pairs.

x-intercept $y=0$	y-intercept $x=0$
$x^2 + 0^2 = 16$	$0^2 + y^2 = 16$
$\sqrt{x^2} = \pm\sqrt{16}$	$y^2 = 16$
$x = \pm 4$	$y = \pm\sqrt{16}$
$x = 4, -4$	$y = \pm 4$

$4^2 = 16$

$(-4)^2 = 16$

Name: _____ Score: _____

x-intercept and y-intercept

Sheet 1

Find the x-intercept and y-intercept for each equation.

1) $-33y + 66x = -132$

x-intercept: _____

y-intercept: _____

2) $6 = x - 3y$

x-intercept: _____

y-intercept: _____

3) $72 + 8y = -9x$

x-intercept: _____

y-intercept: _____

4) $x + 18 = 9y$

x-intercept: _____

y-intercept: _____

5) $42y + 36 = -18x$

x-intercept: _____

y-intercept: _____

6) $44 + 22x = 11y$

x-intercept: _____

y-intercept: _____

7) $-90y + 45x = 45$

x-intercept: _____

y-intercept: _____

8) $24x = 4y - 48$

x-intercept: _____

y-intercept: _____

9) $3y = -12x + 9$

x-intercept: _____

y-int

10) $-10 = -5y + x$

x-intercept: _____

y-int

Name : _____ **Answer key** Score : _____

x-intercept and y-intercept

Sheet 1

Find the x-intercept and y-intercept for each equation.

1) $-33y + 66x = -132$

x-intercept : **(−2, 0)**

y-intercept : **(0, 4)**

2) $6 = x - 3y$

x-intercept : **(6, 0)**

y-intercept : **(0, −2)**

3) $72 + 8y = -9x$

x-intercept : **(−8, 0)**

y-intercept : **(0, −9)**

4) $x + 18 = 9y$

x-intercept : **(−18, 0)**

y-intercept : **(0, 2)**

5) $42y + 36 = -18x$

x-intercept : **(−2, 0)**

y-intercept : $\left(0, -\frac{6}{7}\right)$

6) $44 + 22x = 11y$

x-intercept : **(−2, 0)**

y-intercept : **(0, 4)**

7) $-90y + 45x = 45$

x-intercept : **(1, 0)**

y-intercept : $\left(0, -\frac{1}{2}\right)$

8) $24x = 4y - 48$

x-intercept : **(−2, 0)**

y-intercept : **(0, 12)**

9) $3y = -12x + 9$

x-intercept : $\left(\frac{3}{4}, 0\right)$

y-intercept : **(0, 3)**

10) $-10 = -5y + x$

x-intercept : **(−10, 0)**

y-intercept : **(0, 2)**

Friday

Functions and Relations
Unit 4 Lesson 4
Domain and Range

Warm-Up:

Use the chart below to represent the given relation in all the ways shown:

Table of Values

x	y
-5	1
-3	3
0	6
3	9
5	11

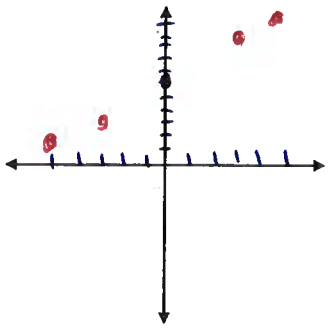
List of ordered pairs

(-5, 1), (-3, 3) (0, 6), (3, 9) (5, 11)

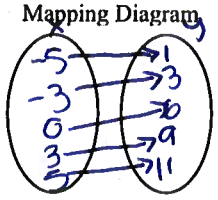
Rule in words

starting @ (0, 6) every x increase, y increases

Graph



Mapping Diagram



Equation

$y = x + 6$

Relation / **Function** (Function circled)

x	y
-5	1
-3	3
0	6
3	9
5	11

+2, +2; +3, +3; +3, +2

Functions:

A function is a special type of relation. For a relation to be a function, each element in the domain (x) is related to exactly 1 element in the range (y). Every x value gives only one y value,

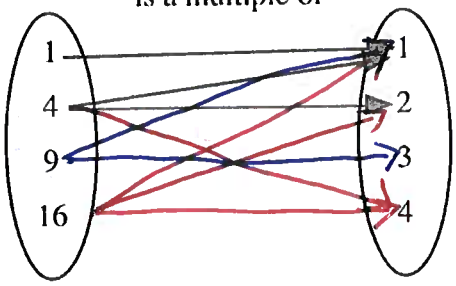
To illustrate the concept of function, we will look at two relations described in words with domain $D = \{1, 4, 9, 16\}$ (x) and range $R = \{1, 2, 3, 4\}$ (y).

i) "is a multiple of "

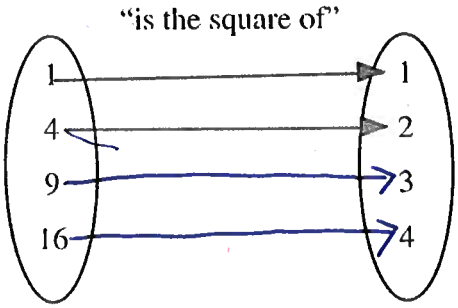
ii) "is the square of"

a) Complete the arrow diagrams.

i) "is a multiple of"



ii) "is the square of"



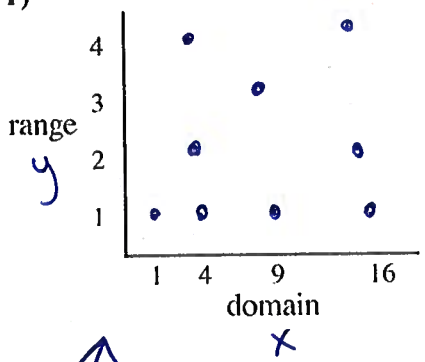
b) Complete the set of ordered pairs.

i) (1, 1), (4, 1), (4,2) (4,4) (9,1), (9,3), (16,1) (16,2) (16,4)

ii) (1,1), (4,2), (9,3) (16,4)

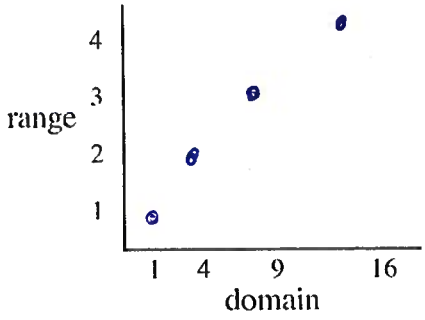
c) Plot the ordered pairs on the grid.

i)



not a function. x values have more than 1 y value

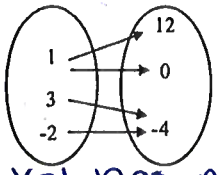
ii)



is a function ✓

Ex 2: Look at the following representations of relations, and state the domain, the range, and whether or not it is a function:

a.



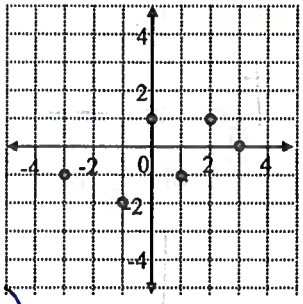
no, x=1 has multiple ys
D: 1, 3, -2 R: 12, 0, -4

b.

x	y
-3	9
-2	4
-1	1
3	9
4	16

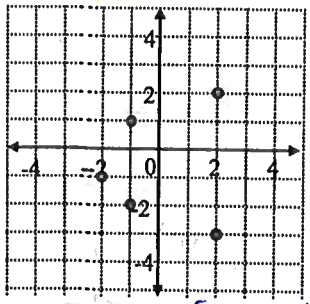
yes
D: -3, -2, -1, 3, 4
R: 9, 4, 1, 16

c.



yes
D: -3, -1, 0, 1, 2, 3
R: -2, -1, 0, 1

d.



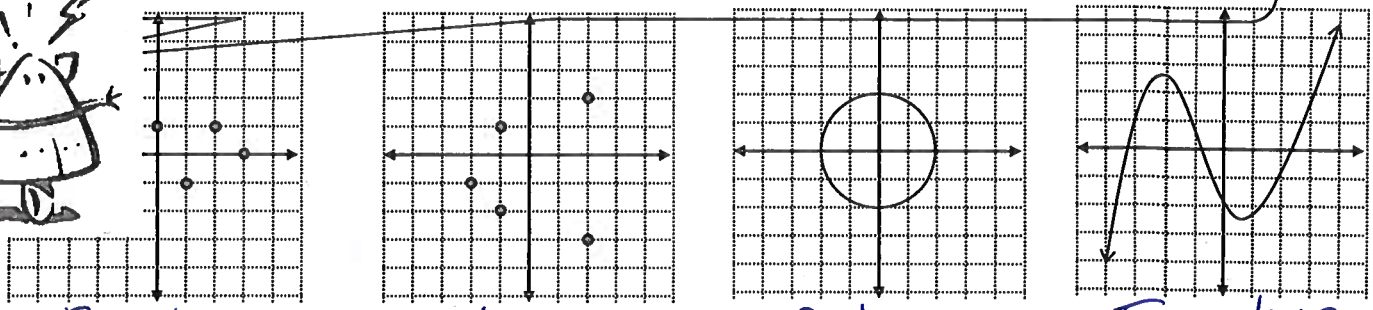
not a function
D: -2, -1, 2
R: -3, -2, -1, 1, ...

e)

X	Y
-2	3
1	3
3	2
-2	3
0	5

A function must pass the vertical line test!

HINT: When deciding whether or not a graph is a function or not, you can employ the "*vertical line test*". Very simply, drag a **vertical** line across the grid, if it hits more than one point at a time, *the relation is **not** a function*

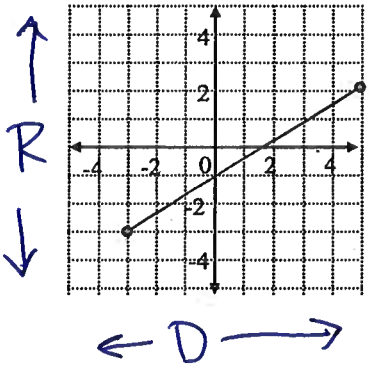


Function not not Function

Homework Sheet "Identifying Functions Practice"

So far, we've only looked at the domain and range of "discrete" relations. These relations have specific points. Now, let's look at "continuous" relations. These have lines connecting their points.

⇒ Look at the graph, ask yourself:

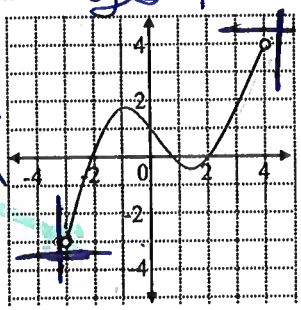


"What is the lowest (left most *) and highest (* right most *) x value. The domain is* between *these two numbers.*

"What is the lowest, and highest y values. The range *is* between *these two numbers.*

Ex 3: Look at the following graphs, and state the domain ①, the range ②, and whether or not ③ the graph is a function.

a. yes F



open circle not included

$\leftrightarrow$ D: $-3 < x < 4$

$\updownarrow$ R: $-3 < y < 4$

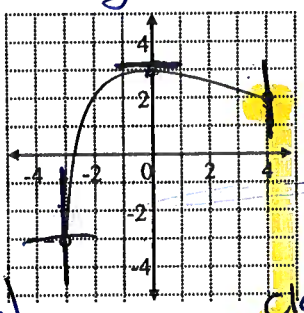
not a function

D: $x = -2$ R: $y \in \mathbb{R}$ ← all real #'s

$y \in \mathbb{R}$

↑ includes

b. yes F

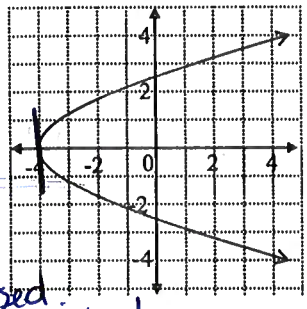


D: $-3 < x \leq 4$ (closed circle)

R: $-3 < y \leq 3$ ← highest point

↑ includes the point

c. not



$x \geq -4$

$y \in \mathbb{R}$

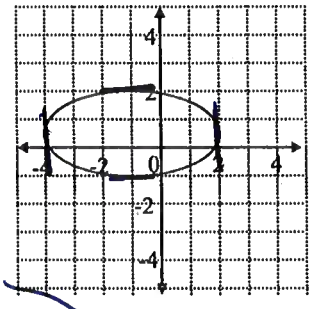
not a function

$x \in \mathbb{R}$

$y \leq -1$

$y \geq 2$

d. not



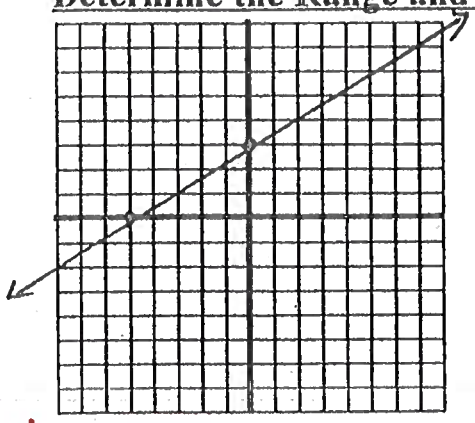
D: $-4 \leq x \leq 6$

R: $-1 \leq y \leq 2$

Name _____ **Range and Domain**

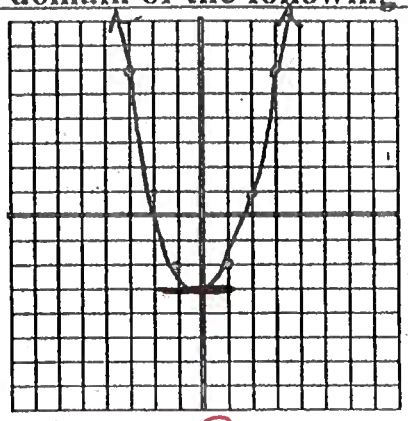
Block _____

Determine the Range and domain of the following graphs.



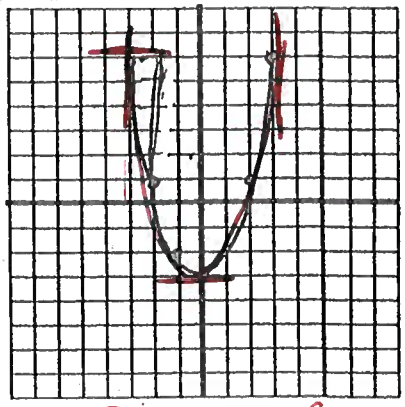
↕ R: $y \in \mathbb{R}$

↔ D: $x \in \mathbb{R}$



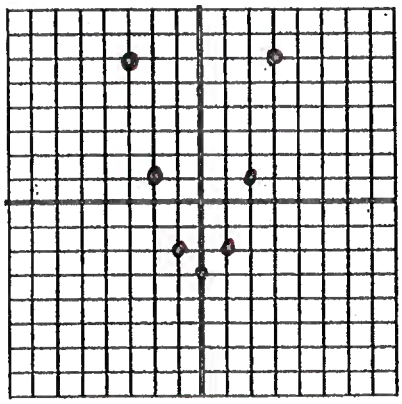
R: $y \geq -3$

D: $x \in \mathbb{R}$



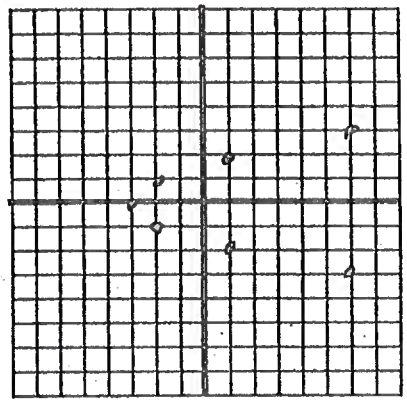
R: $-3 \leq y \leq 6$

D: $-3 \leq x \leq 3$



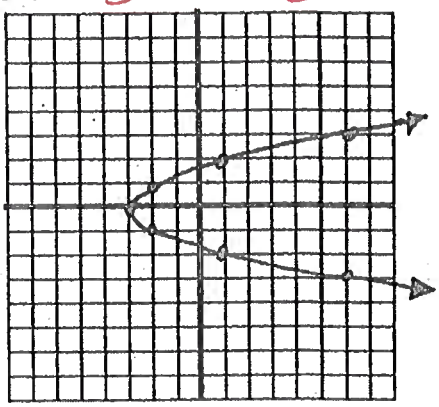
R: $-3, -2, 1, 6$

D: $-3, -2, -1, 0, 1, 2, 3$



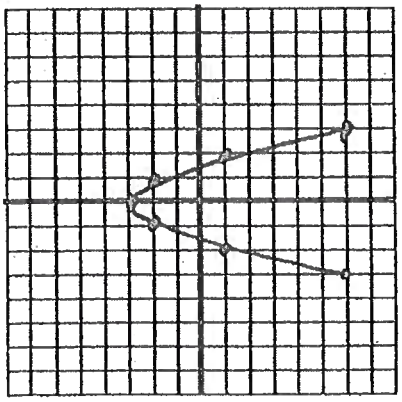
R:

D:



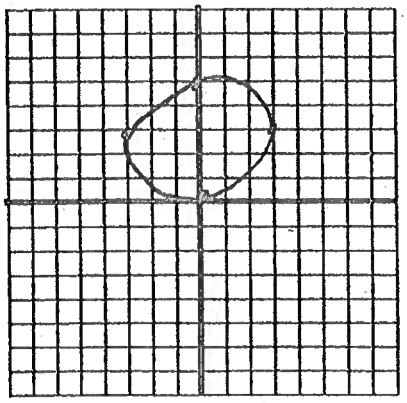
R:

D:



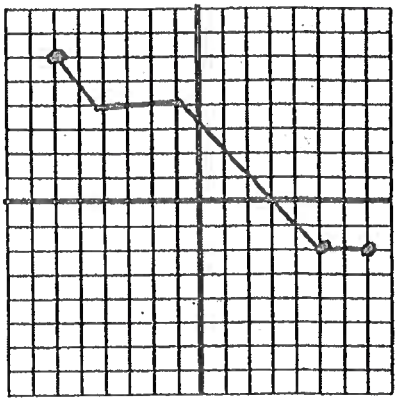
R:

D:



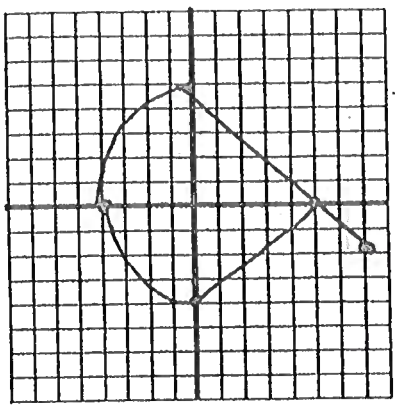
R:

D:



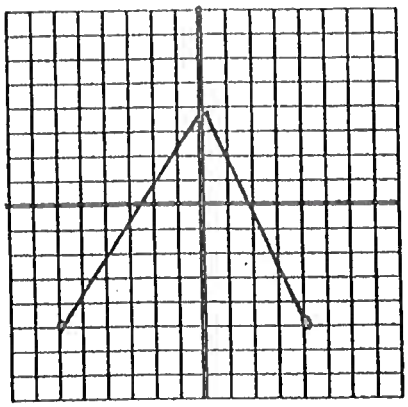
R:

D:



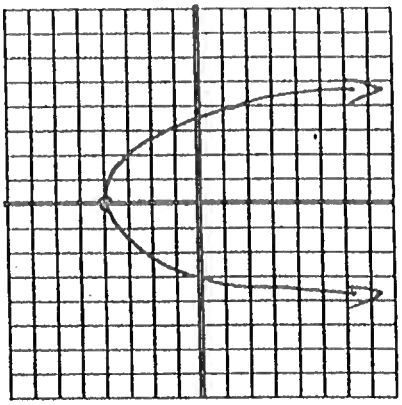
R:

D:



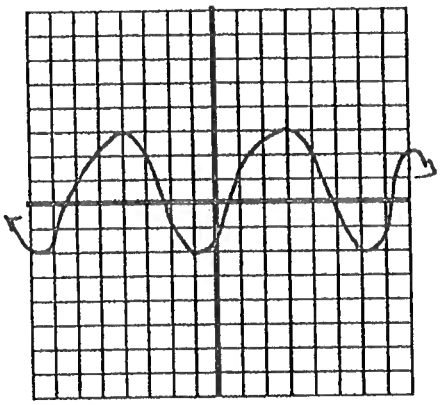
R:

D:



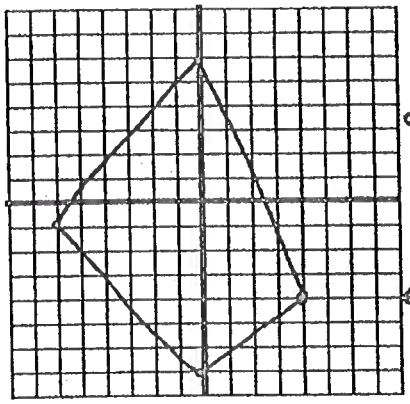
R:

D:



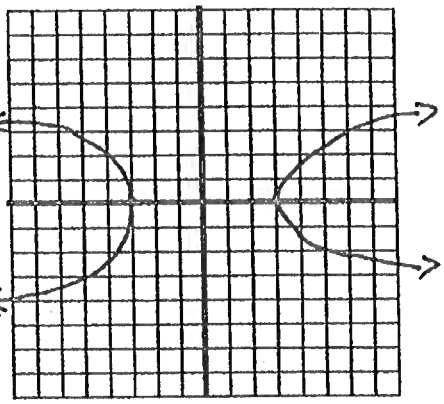
R:

D:



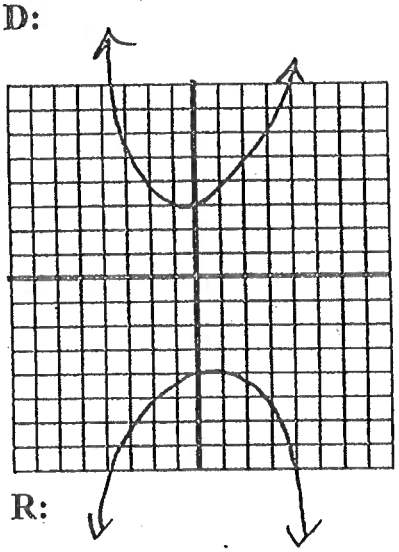
R:

D:



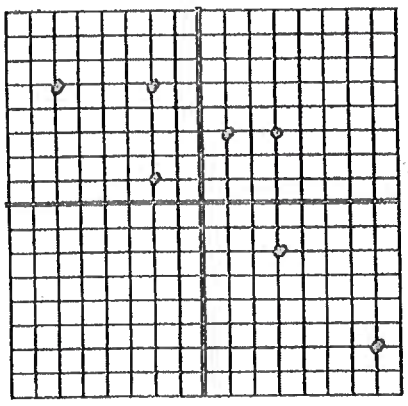
R:

D:



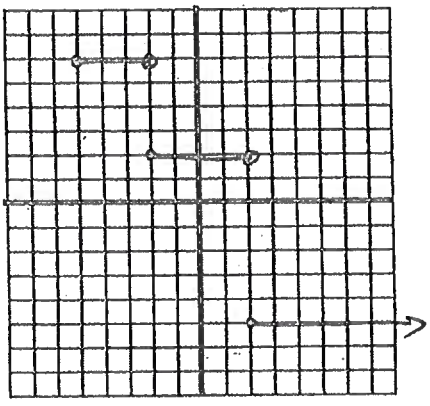
R:

D:



R:

D:



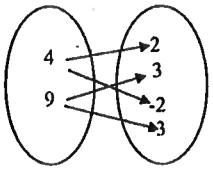
R:

D:

Assignment:

1. For each of the following representations, state the domain, the range, and whether or not it is a function:

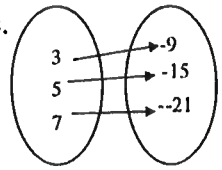
a.



b.

x	y
1	6
2	7
3	8
4	9
5	10

c.

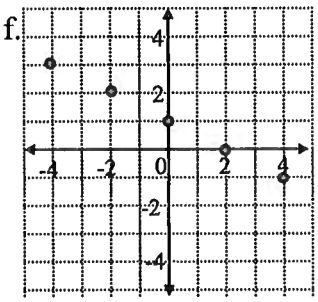


d.

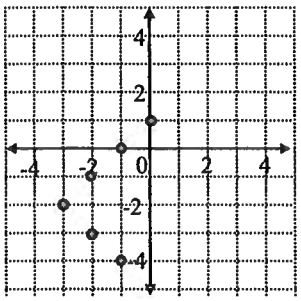
x	y
-1	-2
-1	2
1	-5
1	5
3	2

e. {(3,5),(1,10),(0,15)

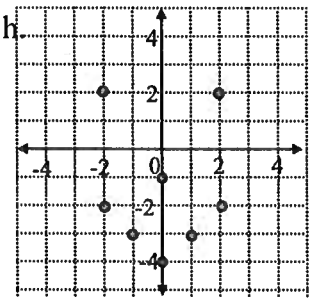
f.



g.

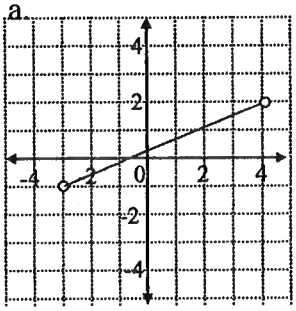


h.

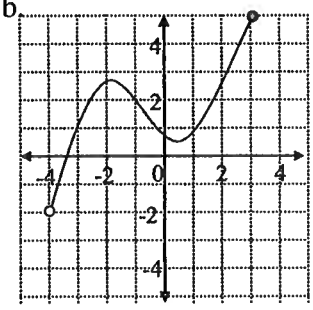


2. For each of the following, state the domain, the range, and whether or not it is a function.

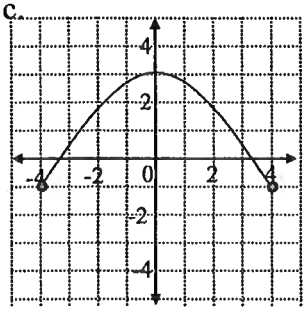
a.



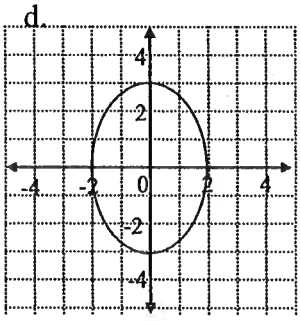
b.



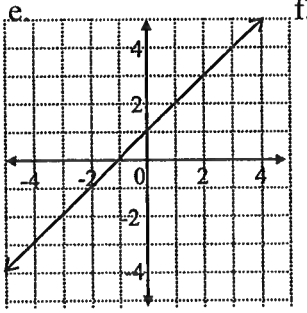
c.



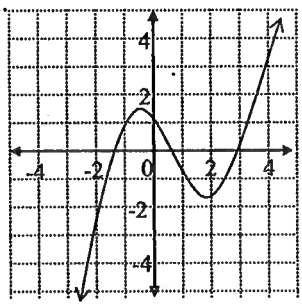
d.



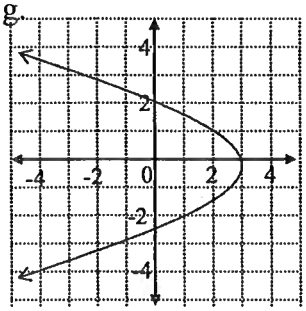
e.



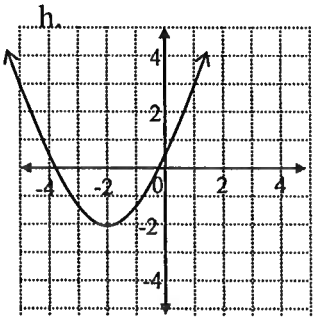
f.



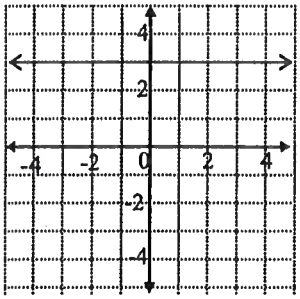
g.



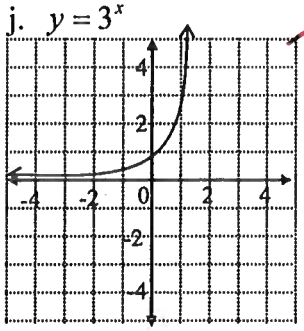
h.



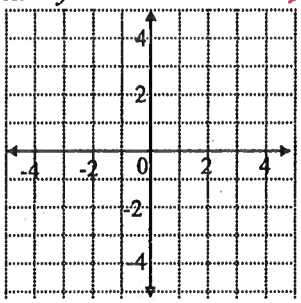
i.



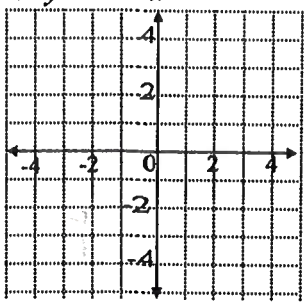
j. $y = 3^x$



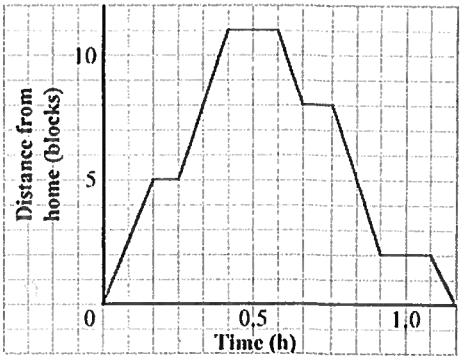
k. $y = -x + 2$



l. $y = 5 - x^2$



3. Tanis walks in her neighbourhood for exercise. The graph below describes her walk.



a. The domain represents the time Tanis walked. Determine the domain of the relation.

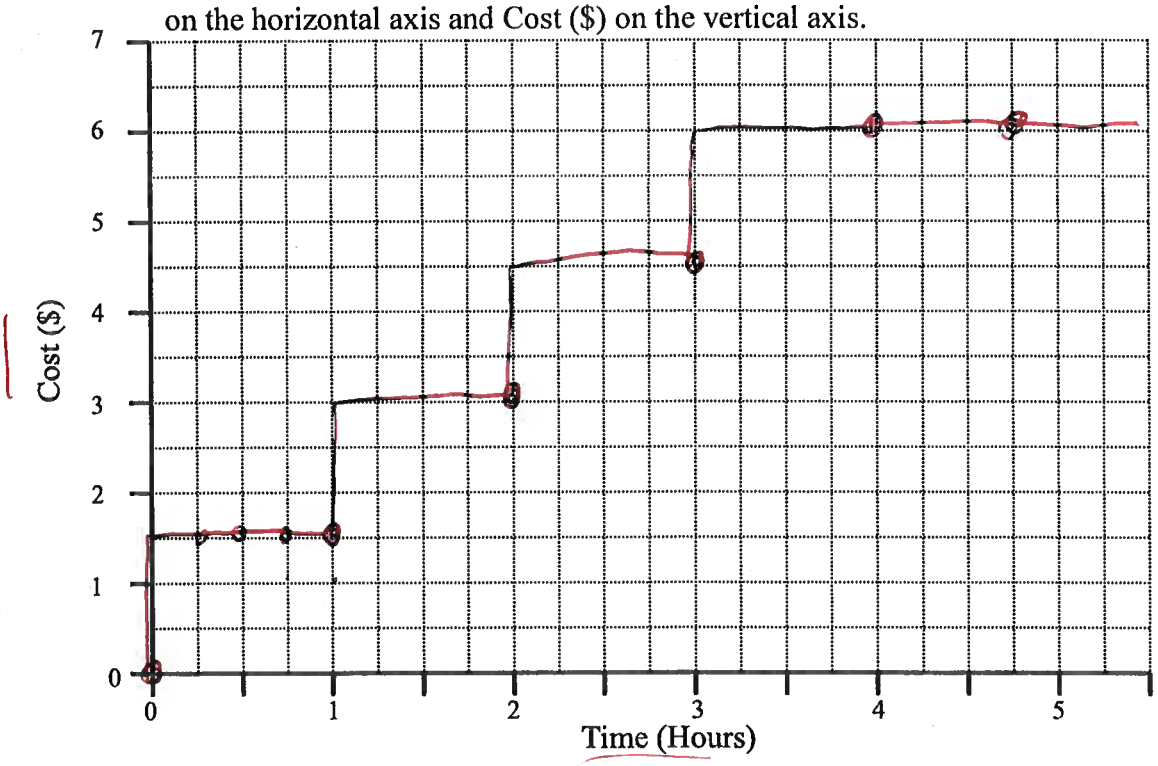
b. The range represents how far she is from home at any time during her walk. Determine the range of this relation.

4. To park in a downtown parking lot, it costs $1.50 for each hour or part thereof up to a maximum of $6.00.

   a. Complete the table of values below to determine the cost of parking.

Time (hrs)	0	0.25	0.50	0.75	1.0	1.5	2.0	2.5	3.0	4.0	5.0
Cost ($)	0	1.50	1.50	1.50	1.50	1.50	3.00	1.50	4.50	6	6

   b. Draw a graph to show the cost of parking. The graph should have Time (h) on the horizontal axis and Cost ($) on the vertical axis.



   c. What are all possible values for parking time? What are these numbers called?

   d. What are all possible values for the cost? What are these numbers called?

5. Kenny throws a ball from his balcony. The diagram below represents the height of the ball over time. Which of the statements below are true?

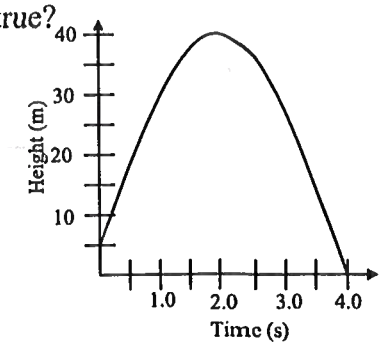
I.	The domain is all numbers between 5 and 35
II.	The domain is all numbers between 0 and 4.0
III.	The range is all numbers between 5 and 35
IV.	The range is all numbers between 0 and 4.0

A. I and III only

B. II and III only

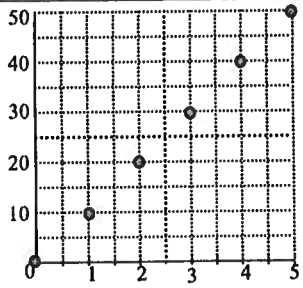
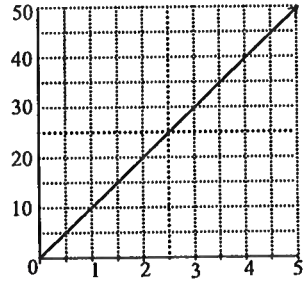
C. II and IV only

D. I, III, and IV only



7.

Match each graph on the right with the correct domain and Range on the left. Each domain may be used once, more than once, or not al all. Record your answers to the right of the graphs.

Domain / Range	Graph
A. {0, 1, 2, 3, 4, 5}	 D: R:
B. {10, 20, 30, 40, 50}	
C. {0, 10, 20, 30, 40, 50}	
D. 1 to 5	
E. 1 to 50	 D: R:
F. {1, 2, 3, 4, 5}	
G. all #'s greater than or equal to 0	
H. all numbers from 1 to 5	

8. Use the following situations to give the domain of each:

Situation 1
$y=50x$ (distance travelled on a trip) where: y= distance travelled 50 = car's speed (km/h) x = number of hours travelled

Situation 2
$y=50x$ (revenue from traffic tickets given) where: y= revenue ($) 50 = price of each ticket ($/ticket) x = number of tickets written

The domains of each situation are as follows:

A. Situation 1 = 0, 1, 2, 3, 4, …
Situation 2 = 0, 1, 2, 3, 4, …

B. Situation 1 = 0, 1, 2, 3, 4, …
Situation 2 = all numbers greater than or equal to 0

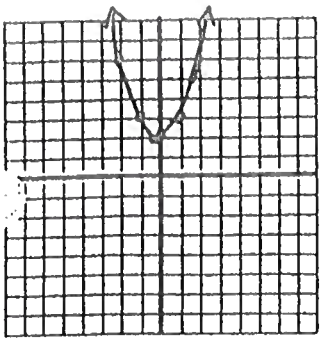
C. Situation 1 = all numbers greater than or equal to 0
Situation 2 = 0, 1, 2, 3, 4, …

D. Situation 1 = all numbers greater than or equal to 0
Situation 2 = all numbers greater than or equal to 0

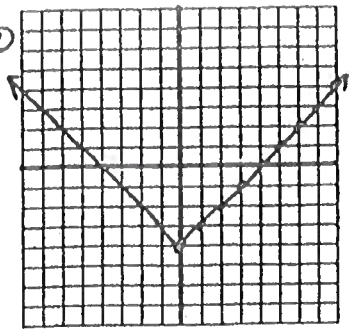
Answer Key:

1a) D{4,9} R{-3,-2,2,3} no
1b) D{1,2,3,4,5} R{6,7,8,9,10} yes
1c) D{3,5,7} R{-21,-15,-9} yes
1d) D{-1,1,3} R{-5,-2,2,5} no
1e) {0,1,3} R{5,10,15} yes
1f) D{-4,-2,0,2,4} R{-1,2,3,10} yes
1g) D{-3,-2,-1,0} R{-4,-3,-2,-1,0,1} no
1h) {-2,-1,0,1,2} R(-4,-3,-2,-1,2) no
2a) D: all #'s from –3 to 4 exclusive R: all #'s from –1 to 2 exclusive, yes
2b) D: all #'s from –4 exclusive to 3 inclusive R: all #'s from –2 exclusive to 5 inclusive, yes
2c) D: all #'s from –4 to 4 inclusive R: all #'s from –1 to 3 inclusive, yes
2d) D: all #'s from –2 to 2 inclusive R: all #'s from –3 to 3 inclusive, no
2e) D: all #'s R: all #'s , yes
2f) D: all #'s R: all #'s, yes
2g) D: all #'s less than or equal to 3 R: all #'s, no
2h) D: all #'s R: all #'s greater than or equal to –2, yes
2i) D: all #'s R: 3, yes
2j) D: all #'s R: all #'s greater than or equal to 0, yes
2k) D: all #'s R: all #'s, yes
2l: D: all #'s R: all #'s, yes
3a) from 1 – 1hour 10min 3b) from 1 to 11 km
4c) all #'s greater or equal to 1 (domain) 4d) 1.5, 3.0, 5.4, 6.0 (Range)
5b) 0 5b) 0 5d) 4 5e) 20 5f) from 1 to 4 seconds 5g) from 1 to 20 meters
6) C 7) A, C, G, G 8) C

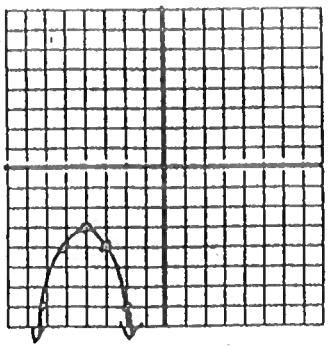
App. Math 10 Domain and Range ①

①


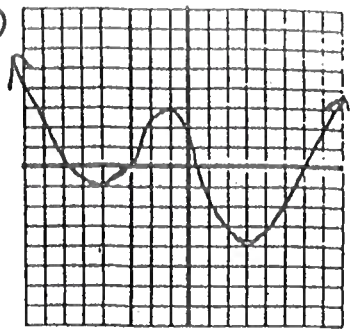
domain: _____
range: _____

②


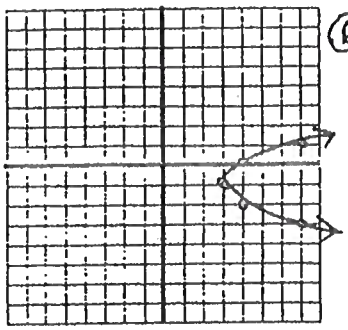
domain: _____
range: _____

③


domain: _____
range: _____

④


domain: _____
range: _____

⑤


domain: _____
range: _____

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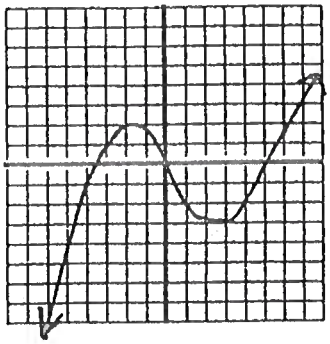
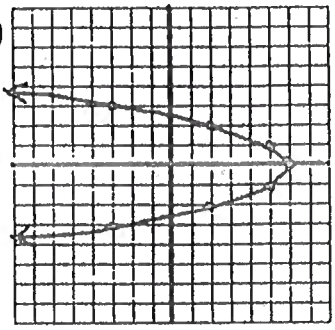
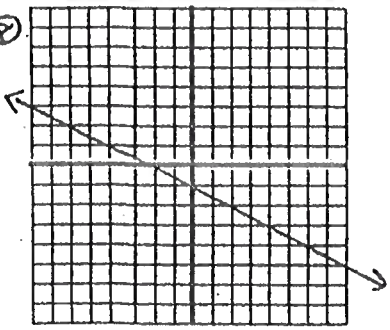


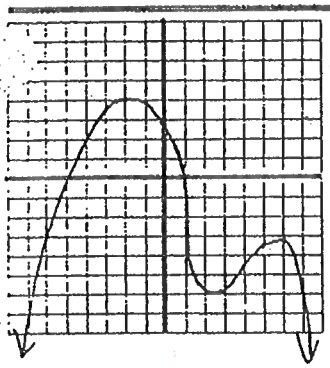
domain: _____
range: _____

⑦


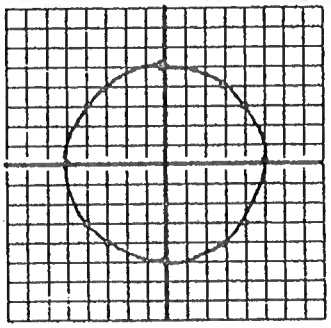
domain: _____
range: _____

⑧


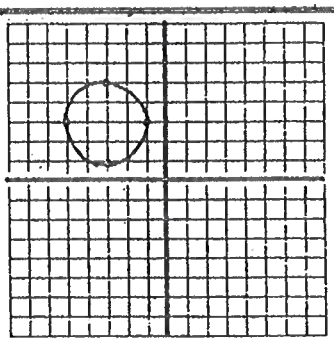
domain: _____
range: _____

⑨


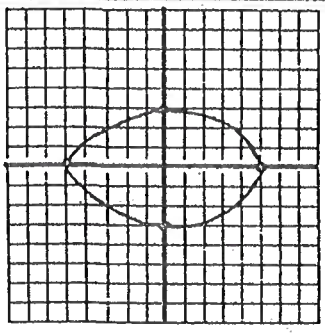
domain: _____
range: _____

⑩


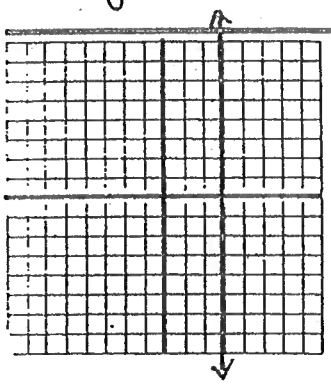
domain: _____
range: _____



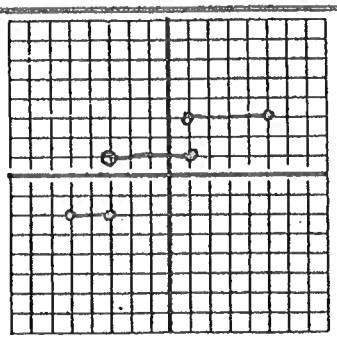
domain: _____
range: _____



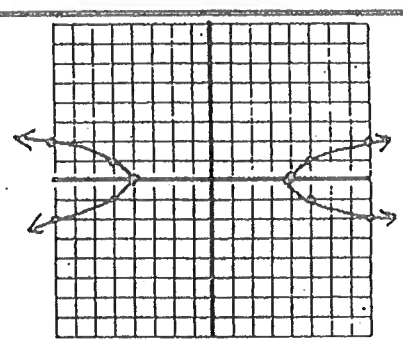
domain: _____
range: _____



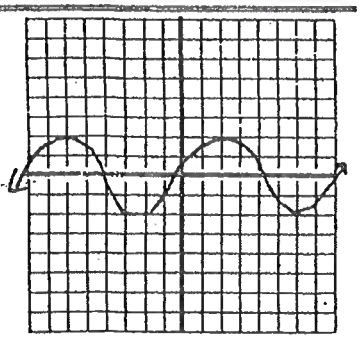
domain: _____
range: _____



domain: _____
range: _____



domain: _____
range: _____



domain: _____
range: _____

Friday

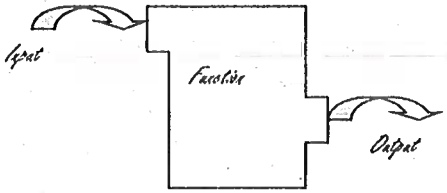
Functions and Relations

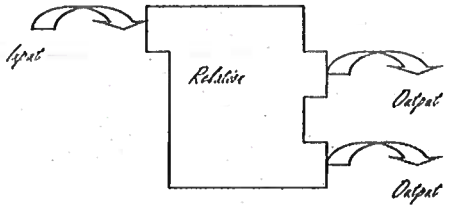
Unit 4 Lesson 6

Name: _____

Representing Functions/ Relations

So far, we've talked about this idea of a function, and a relation without actually defining the two terms. A function or a relation is just *anything* that connects one set of numbers to another. The numbers going in to the function or relation are called the input (these are the domain), and the numbers coming out of the function or relation are called the output (these are called the range). Let's look at the difference between a function and a relation by looking at the two diagrams below:





So, a function has 1 output for each input

A relation has more than 1 output for an input

There are many different ways of representing functions and relations. Let's look at representing the equation: $y = x + 2$

describing the function

Table of Values

x	y
-1	1
0	2
1	3

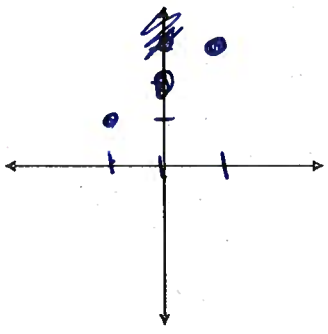
List of ordered pairs

(-1, 1)
(0, 2)
(1, 3)

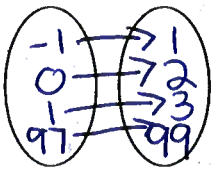
Rule in words

add 2 to the input

Graph



Mapping Diagram

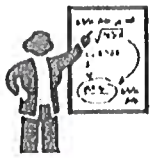


Equation

$y = x + 2$

Function: Yes or No

Yes



Ex 1: Fill in the missing representations of the following relation / functions:

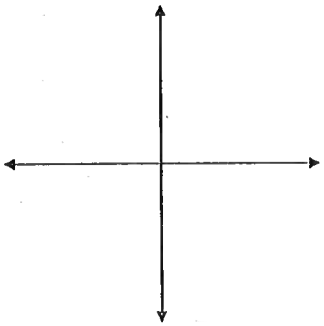
Table of Values

x	y
-2	6
-1	3
0	0
1	-3
2	-6

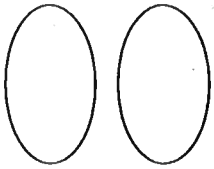
List of ordered pairs

Rule in words

Graph

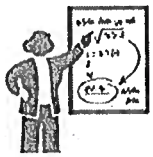


Mapping Diagram



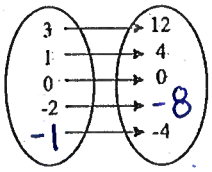
Equation

Relation Function



Ex 2: For each of the following representations, complete the pattern, then state if it represents a function or a relation:

a.



multiplying input by 4

$y = 4x$

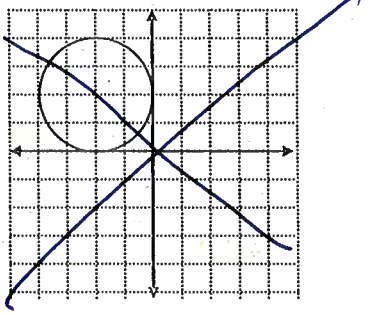
b.

x	y
-3	9
-2	4
-1	1
3	9
4	16

$y = x^2$

square the input

c.



Ex 3:For a bike-a-thon, Natalie has pledges totalling $1.40 per kilometre. The maximum distance she can cycle is 100 km.

a) Fill in the table of values relating the distance in kilometres that Natalie cycles, d, and the amount of money, A, she collects.

X

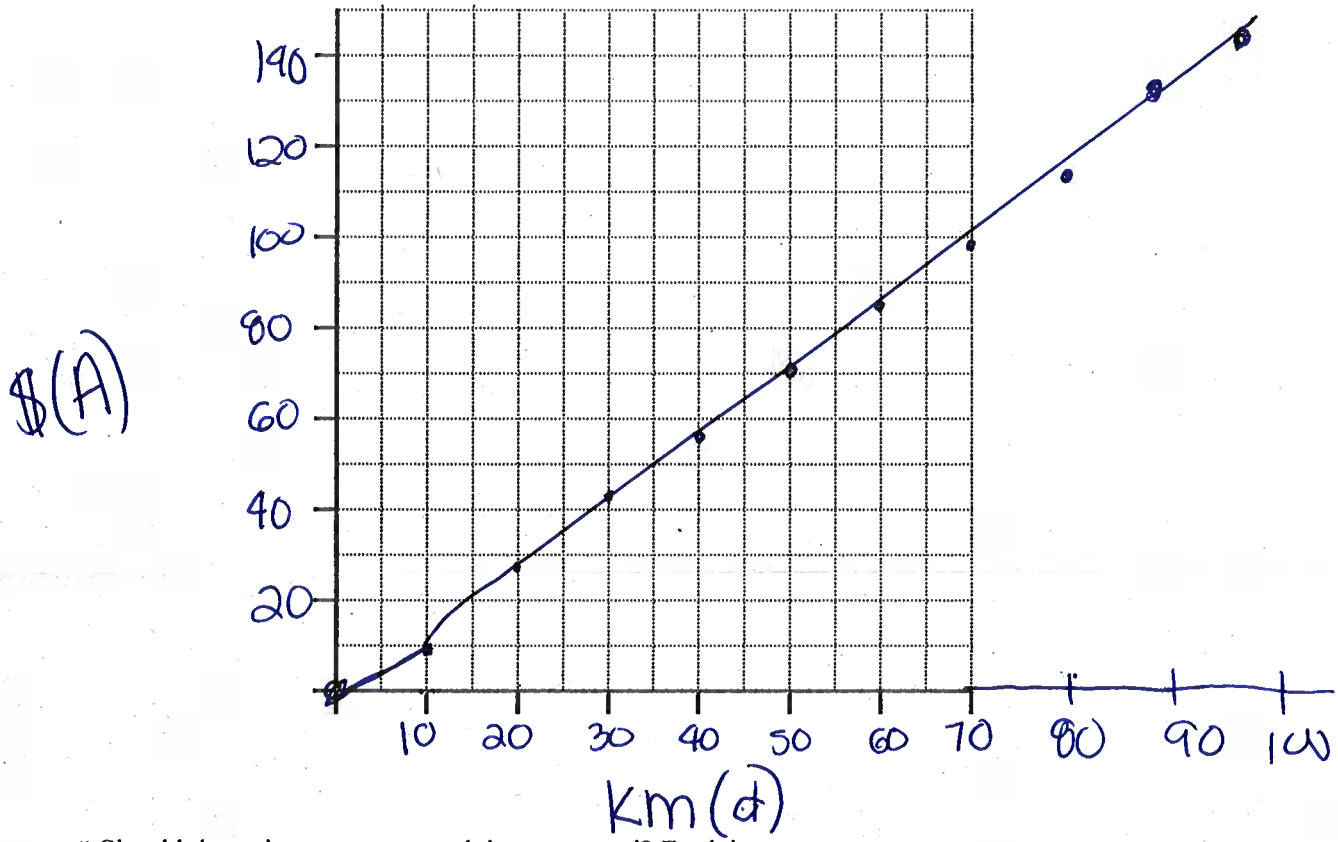
y

d (km)	10	20	30	40	50	60	70	80	90	100	110	120
A ($)	14.00	28	42	56	70	84	98	112	126	140		

b) Write the equation relating the amount collected and the distance cycled.

$A = 1.4d$

c) Use your table from part a to graph the relation with Distance Cycled (km) on the horizontal axis and Amount Collected ($) on the vertical axis.

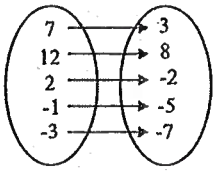


d) Should the points on your graph be connected? Explain.

Assignment:

1. The following mapping diagrams represent functions. For each diagram, state a rule in words, state the equation (in terms of y and x), and state the table of values:

a.



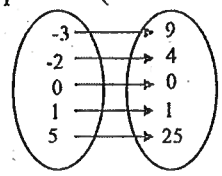
Words:

Equation:

Table:

x	y

b.



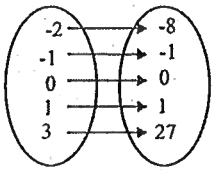
Words:

Equation:

Table:

x	y

c.



Words:

Equation:

Table:

x	y

2. Complete the tables below. Then, write in words the relationship between the input and the output. Finally, write an equation that relates the output to the input.

a.

M	N
-3	15
-2	10
-1	5
0	
1	
2	
3	

Words:

Equation:

b.

P	Q
-8	-4
-6	-3
0	0
4	
7	
10	
16	

Words:

Equation:

c.

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

Words:

Equation:

d.

z	z^2
-2	
-1	
0	
1	
2	
3	

e.

k	k^2-2
-5	
-3	
-1	
1	
3	
5	

f.

x	y
-3	-7
-1	-3
1	
3	5
5	
7	

3. Recall that a function is a relation with only one output for every input. State if each of the following representations is a function or not. State the input value that has two or more output values:

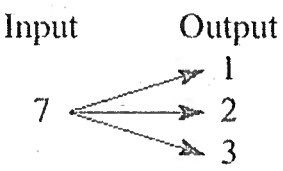
a.

x	y
–3	9
–2	4
2	4
3	9

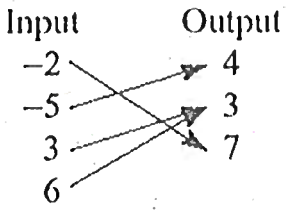
b.

x	y
1	6
1	7
2	8
2	9

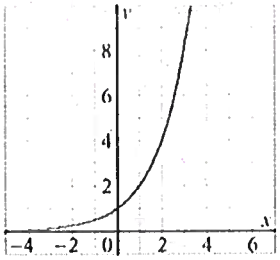
c.



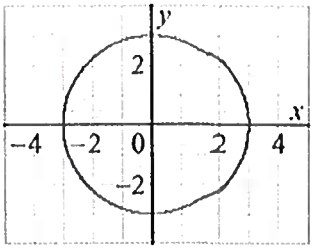
d.



c.



f.

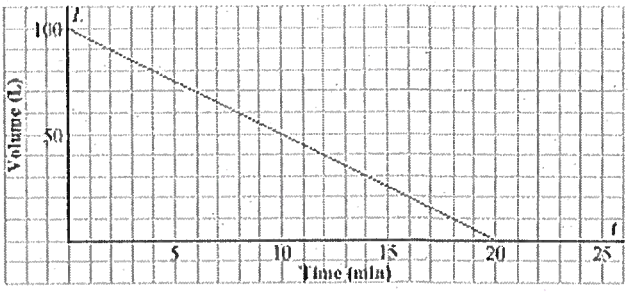


4.

Match each equation on the left with the equivalent phrase on the right. Each phrase may be used once, more than once, or not at all. Record your answers in the box provided.

Equation	Graph
$y = 3x + 2$ ☐	A. 3 less than double a number
$y = \frac{1}{2}x - 3$ ☐	B. 3 more than double a number
$y = 2x - 3$ ☐	C. 2 more than triple a number
	D. 2 less than triple a number
	E. 5 more than a number
	F. 5 less than a number
	G. 3 less than half a number
	H. 3 more than half a number

5. The graph below illustrates the volume of water left in a tank as the tank is being emptied over time.



a. What was the initial volume of water in the tank?

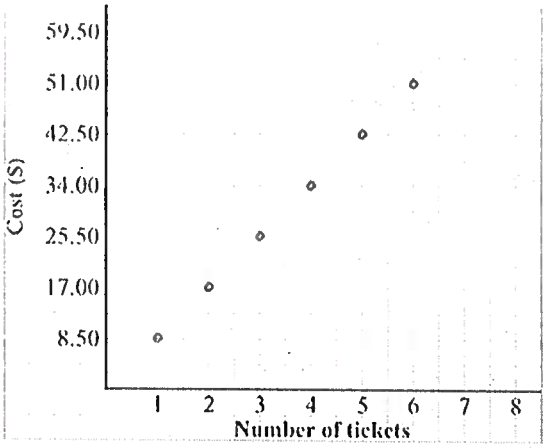
b. Use the graph above to complete the table below:

Time (min)	Volume (L)
0	
2	
5	
	50
	40
	25
20	

c. Describe the relationship between time and volume in words.

d. Write an equation to represent the relation.

6. The graph shows the cost of movie tickets at a local cinema.



a. Why are the points not joined?

b. Describe in words how the cost (C) is related to the # of tickets (n)

c. Write an equation that relates the cost (C) to the # of tickets (n).

d. Fill in the table below by using the points on the graph, or by using the equation found in question c.

# of tickets (n)	2	6	20		
Cost ($)				8.5	110.5

Answer Key:

1a) output is 4 less than input, $y=x-4$ 1b) output is input squared, $y=x^2$
1c) output is input cubed, $y=x^3$ 2a) 0, -5, -10, -15, N is –5 times M, $N=-5M$
2b) 2, 3.5, 5, 8, Q is half P, $Q=\frac{1}{2}P$ 2c) 0, 1, 2, y is 3 less than x, $y=x-3$
2d) 4, 1, 0, 1, 4, 9 2e) 23, 7, -1, -1, 7, 23 2f) 1, 9, 13 3a) function
3b) no (x=1, and x=2 have 2 outputs) 3c) no (x=7 has 3 outputs) 3d) function
3e) function 3f) no (x=-2 has 2 outputs)
4) C, G, A
5a) 100L 5b) 100, 90, 75, 10, 12, 15, 0 5c) Volume is 100 minus 5L for every minute
5d) $V=100-5t$ 6a) can't have ½ a ticket 6b) Cost is 8.5 times the number of tickets
6c) $C=8.5n$ 6d) 17, 51, 170, 1, 13 7) E, C, B