Thursday

Foundations & Pre-calculus of Math 10

Unit 4 Lesson 1

An Introduction to the Co-ordinate Plane

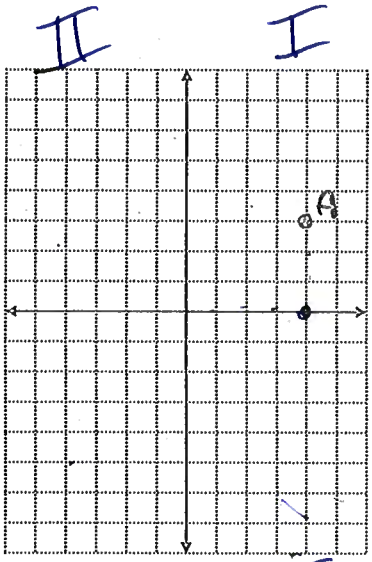
In Mathematics "**Cartesian**" (from the famous mathematician Rene Descartes) means the idea of specifying the position of a point on a surface using two intersecting axes as measuring guides.

The modern version of the Cartesian coordinate system is defined by two axes at right angles to each other forming a plane called the Coordinate plane The horizontal axis is called the x-axis and the vertical axis is called the y-axis.

The point where the two axes intersect is called the origin, labelled 0,0. On each axis (which is like a number line), a unit length is determined and marked off to form a grid. We use a unique ordered pair of numbers called the coordinates. The 1st number in the ordered pair, called the independent variable states the position in regards to the x axis, while the 2nd number in the ordered pair, called the dependent, states the position to the y axis.

The point A(4,3) is shown on the grid below. The intersection of the x-axis and y-axis forms

quadrants (Numbered I – IV counter clockwise)



(x, y)
(4, 3)

Class Ex. 1:

a) Complete the following: Write the coordinates of the points represented by the letters on the grid.

A (1, 2)

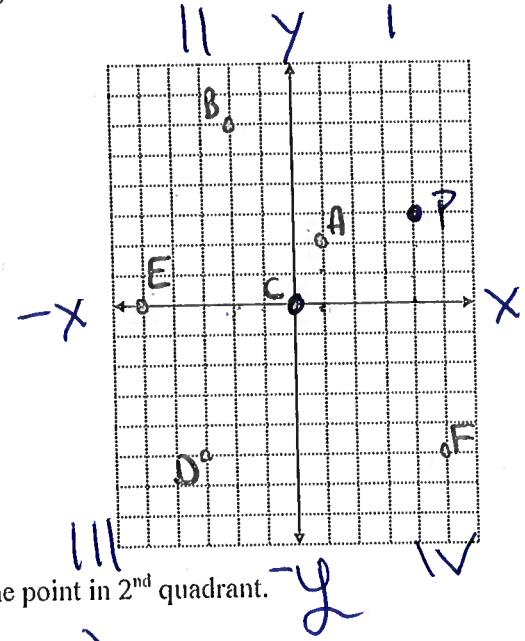
B (−2, 6)

C (0, 0)

D (−3, −5)

E (−5, 0)

P (4, 3)



First ⟷

Second ↕

x y
(1, 2)

x y
(−2, 6)

b) Write the coordinate of the point in 2nd quadrant.

B(−2, 6)

c) Write the coordinate of the point in the 4th quadrant.

F(+5, −5)

d) Complete the following table using "positive" or "negative".

Quadrant	x-coordinate	y-coordinate
I	+	+
II	−	+
III	−	−
IV	+	−

Graphing Review: $y = mx + b$

a) Graphing Linear Equations: Using Table of values

- A set of ordered pairs is known as a relation.
- When graphing linear equations we can write the equation in the form:

$$y = mx + b$$

- All linear equations will have a variable x with a degree of 1.
- Non-linear equations (curves) will have a variable x with a degree not equal to 1.

Class Ex. 2:

Graph the following using a table of values!

$y = 2(-1)$

1. $y = 2x$

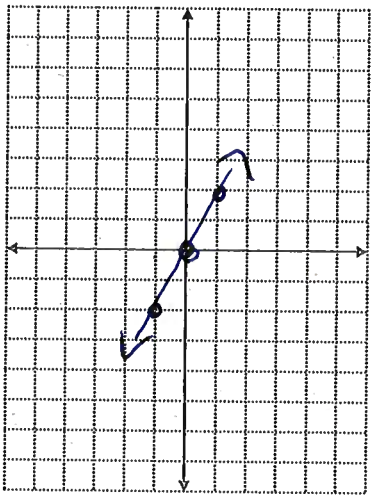
$y = 2(0)$

$y = 2(1)$

x	y
-1	-2
0	0
1	2

2 4

3 6



2. $y = x + 3$

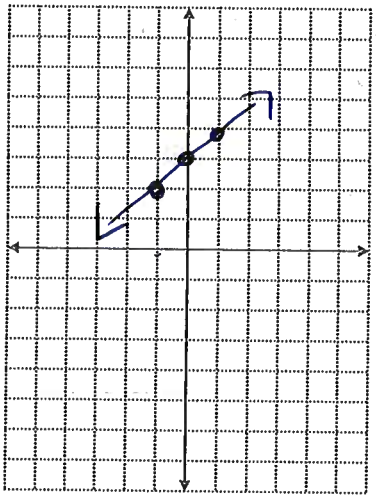
$y = (-1) + 3$

$y = 0 + 3$

$y = 1 + 3$

x	y
-1	2
0	3
1	4

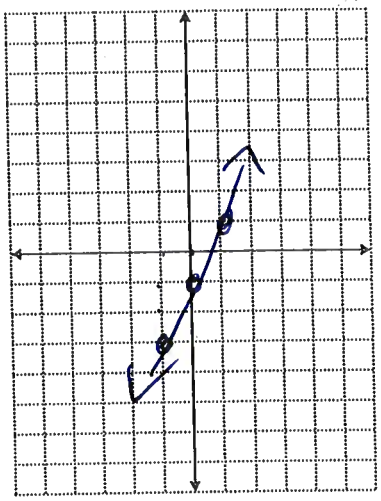
2 5



3. $y = 2x - 1$

$y = 2(-1) - 1$
$y = 2(0) - 1$
$y = 2(1) - 1$

x	y
-1	-3
0	-1
1	1



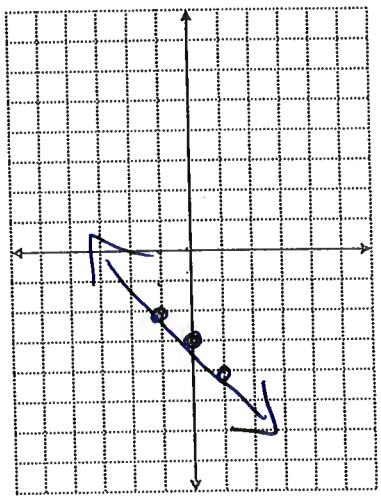
4. $x + y = -3$

$-x \quad -x$

$y = -x - 3$
$y = -(-1) - 3$
$y = 1 - 3$

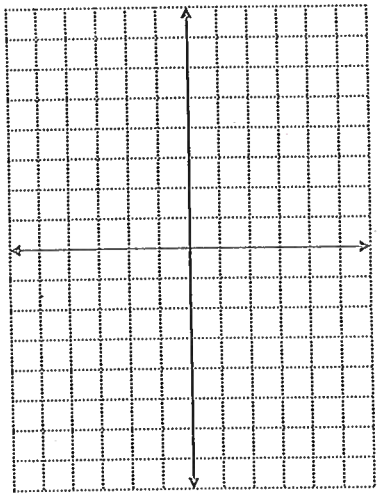
x	y
-1	-2
0	-3
1	-4

$y = -1 - 3$



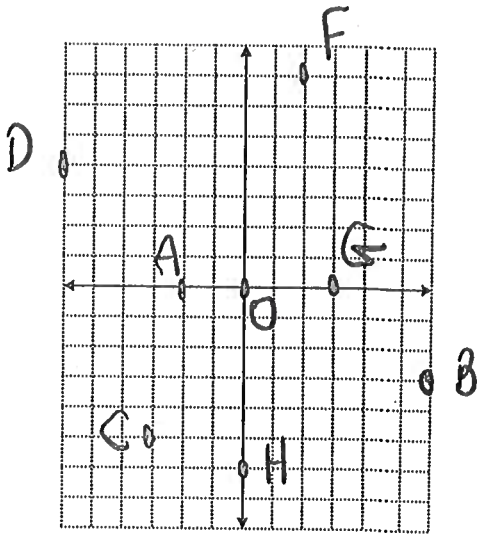
5. $y = x^2$

x	y
-1	
0	
1	



Name:_____ **Foundations & Pre-calculus of Math 10**
Date:_____ **Unit 4 – Assignment 1**

1. Using the graph to answer the following questions:



a) Name the point represented by the following coordinates.

i) $(-6,4)$ ii) $(6,-3)$ iii) $(-2,0)$

b) List the coordinates for each point.

i) C ii) G iii) F iv) O v) H

c) Which points are in

i) Quadrant I ii) Quadrant II

iii) Quadrant III iv) Quadrant IV

d) Which points are in between quadrants?

e) Which points have the same x coordinate?

f) Which points have the same y coordinate?

Name:_____ **Foundations & Pre-calculus of Math 10**

Date:_____ **Unit 4 – Assignment 1**

2. Using ordered pairs unscramble the following message. Plot the ordered pairs on the grid and find the message.

i) Join $(5,-9)$ to $(5,-5)$. Join $(7,-9)$ to $(5,-7)$ to $(7,-5)$.

ii) Join $(-11,-2)$ to $(-10,0)$ to $(-9,2)$ to $(-8,0)$ to $(-7,-2)$. Join $(-8,0)$ to $(-10,0)$.

iii) Join $(0,-10)$ to $(0,-6)$ to $(2,-6)$ to $(2,-8)$ to $(0,-8)$ to $(2,-10)$.

iv) Join $(2,0)$ to $(0,0)$ to $(0,-2)$ to $(2,-2)$ to $(2,-4)$ to $(0,-4)$.

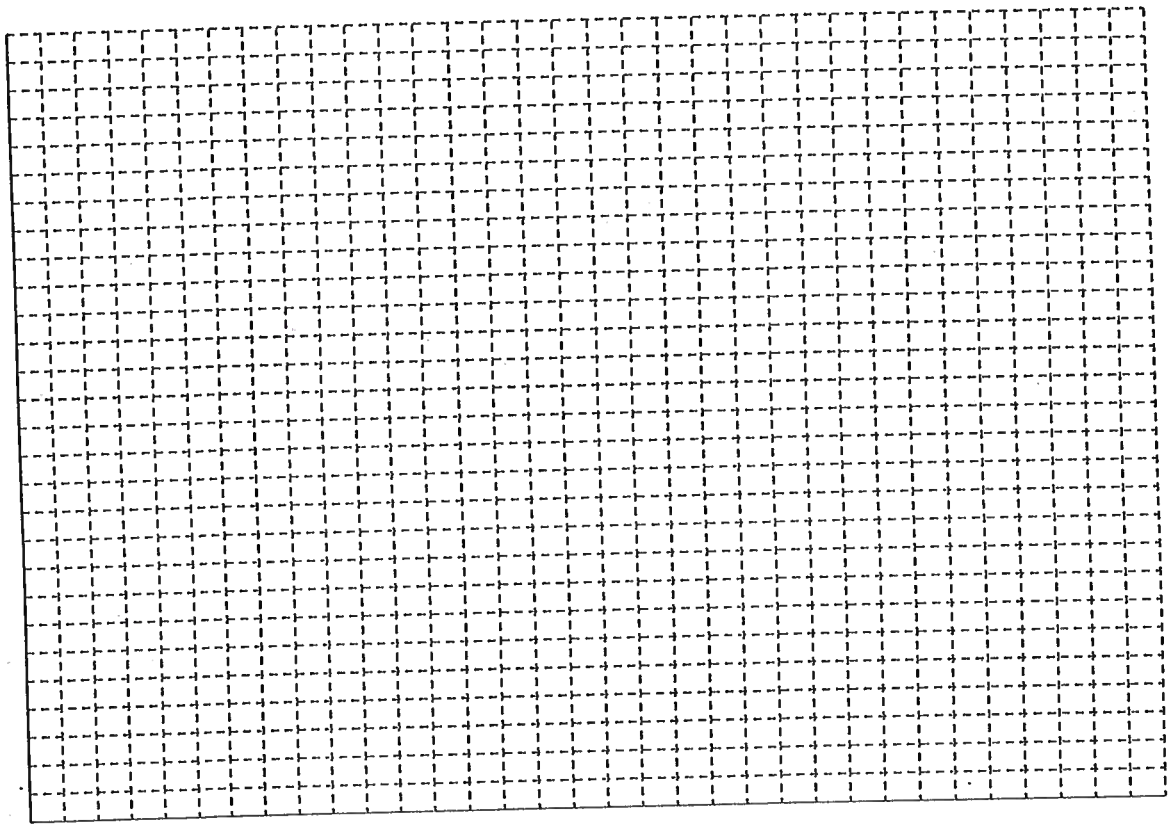
v) Join $(8,5)$ to $(8,9)$. Join $(10,5)$ to $(10,9)$. Join $(8,7)$ to $(10,7)$

vi) Join $(-3,2)$ to $(-2,6)$ to $(-1,4)$ to $(0,6)$ to $(1,2)$.

vii) Join $(3,8)$ to $(5,8)$. Join $(4,8)$ to $(4,4)$.

viii) Join $(6,1)$ to $(4,1)$ to $(4,-3)$ to $(6,-3)$.

ix) Join $(-6,-6)$ to $(-6,-10)$ to $(-4,-10)$ to $(-4,-6)$ to $(-6,-6)$

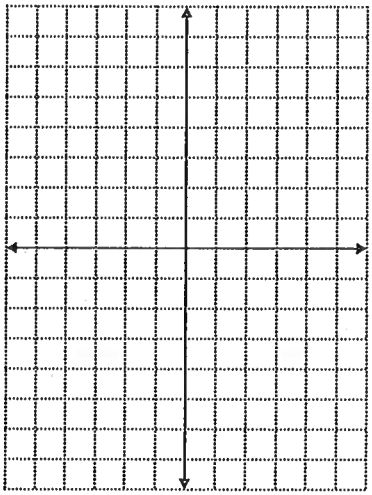


Name:_____ **Foundations & Pre-calculus of Math 10**
Date:_____ **Unit 4 – Assignment 1**

3. Graph the following linear equations using the table of values method.

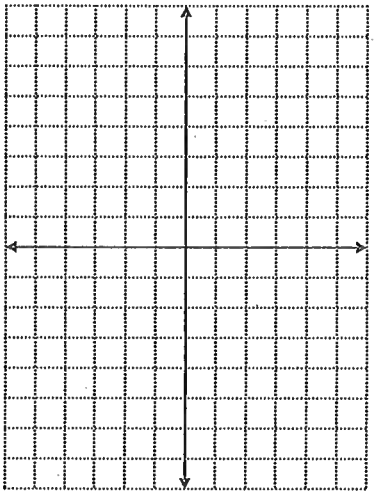
a) $y = 3x$

x	y
-1	
0	
1	



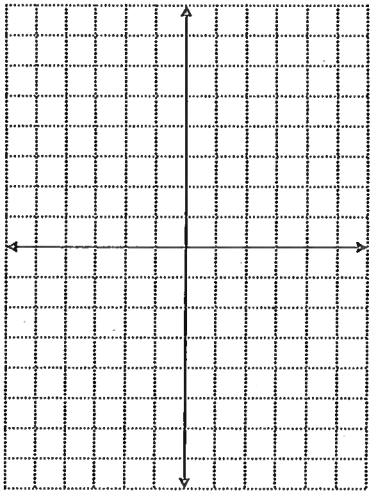
b) $y = x - 1$

x	y
-1	
0	
1	



c) $y = 2x - 1$

x	y
-1	
0	
1	



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Date:_____

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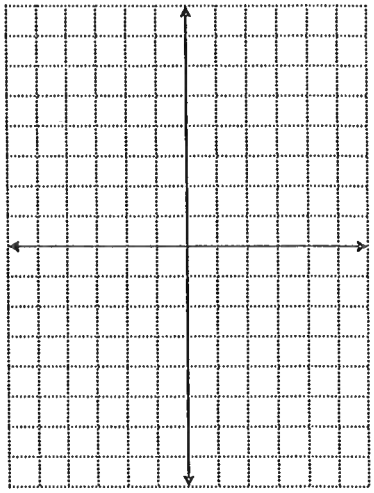
(d) $y = 4 - x^2$

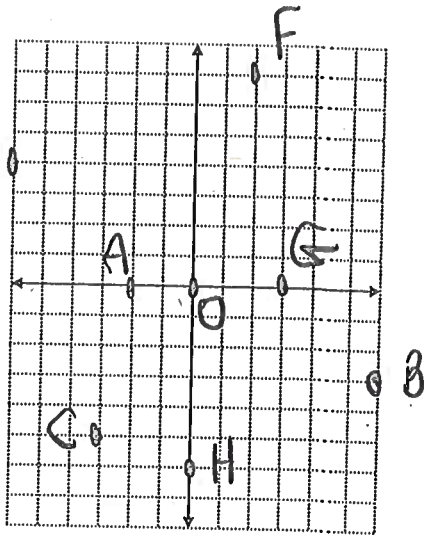
x	y
-1	
0	
1	



Name: Key
Date:

Foundations & Pre-calculus of Math 10
Unit 4 – Assignment 1

1. Using the graph to answer the following questions:



a) Name the point represented by the following coordinates.

i) $(-6,4)$ D ii) $(6,-3)$ B iii) $(-2,0)$ A

b) List the coordinates for each point.

i) C $(3,-5)$ ii) G $(3,0)$ iii) F $(2,7)$ iv) O $(0,0)$ v) H $(0,-6)$

c) Which points are in

i) Quadrant I F ii) Quadrant II D

iii) Quadrant III C iv) Quadrant IV B

d) Which points are in between quadrants?

A, G, H, O

e) Which points have the same x coordinate?

O, H

f) Which points have the same y coordinate?

A, O, G

Name:_____ **Foundations & Pre-calculus of Math 10**
Date:_____ **Unit 4 – Assignment 1**

2. Using ordered pairs unscramble the following message. Plot the ordered pairs on the grid and find the message.

i) Join $(5,-9)$ to $(5,-5)$. Join $(7,-9)$ to $(5,-7)$ to $(7,-5)$.

ii) Join $(-11,-2)$ to $(-10,0)$ to $(-9,2)$ to $(-8,0)$ to $(-7,-2)$. Join $(-8,0)$ to $(-10,0)$.

iii) Join $(0,-10)$ to $(0,-6)$ to $(2,-6)$ to $(2,-8)$ to $(0,-8)$ to $(2,-10)$.

iv) Join $(2,0)$ to $(0,0)$ to $(0,-2)$ to $(2,-2)$ to $(2,-4)$ to $(0,-4)$.

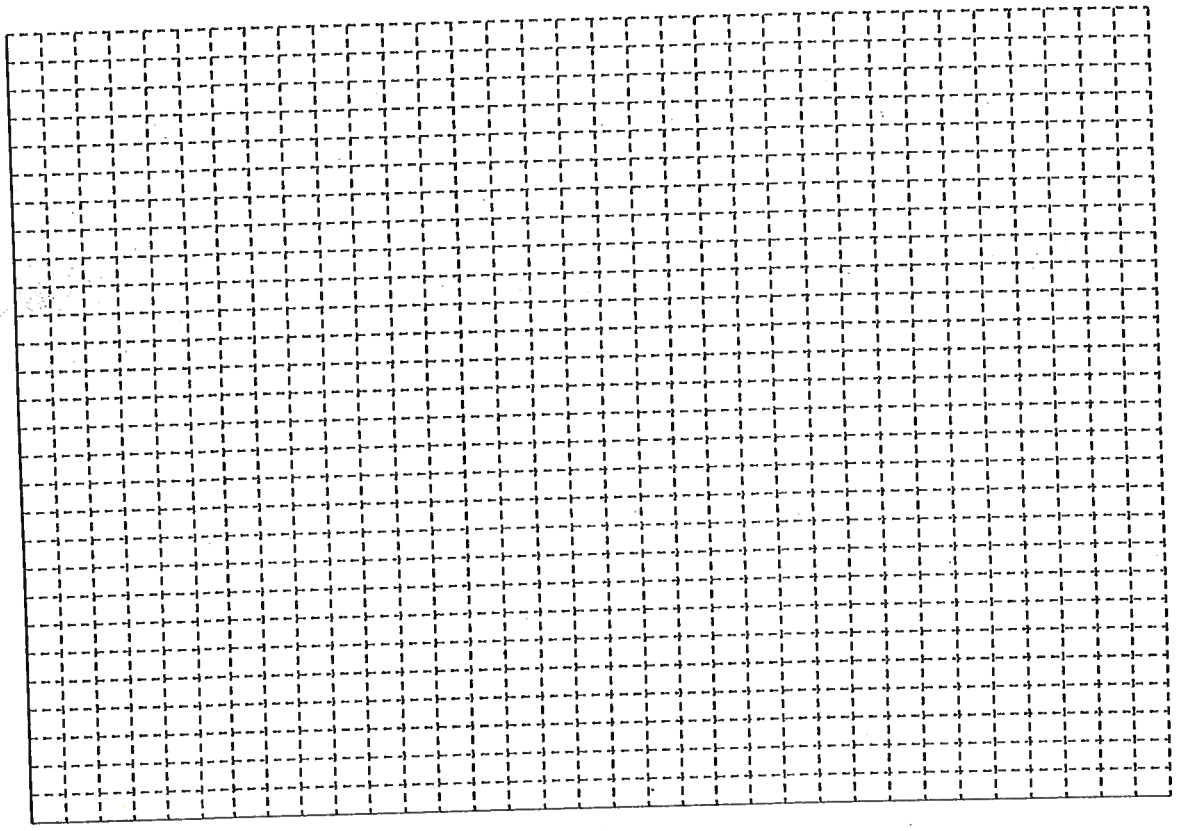
v) Join $(8,5)$ to $(8,9)$. Join $(10,5)$ to $(10,9)$. Join $(8,7)$ to $(10,7)$

vi) Join $(-3,2)$ to $(-2,6)$ to $(-1,4)$ to $(0,6)$ to $(1,2)$.

vii) Join $(3,8)$ to $(5,8)$. Join $(4,8)$ to $(4,4)$.

viii) Join $(6,1)$ to $(4,1)$ to $(4,-3)$ to $(6,-3)$.

ix) Join $(-6,-6)$ to $(-6,-10)$ to $(-4,-10)$ to $(-4,-6)$ to $(-6,-6)$



Draw a T ★

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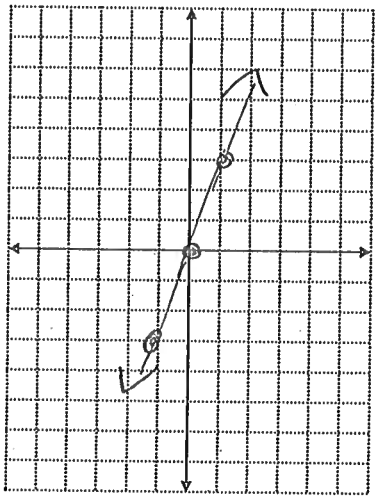
3. Graph the following linear equations using the table of values method.

a) $y = 3x$

x	y
-1	-3
0	0
1	3

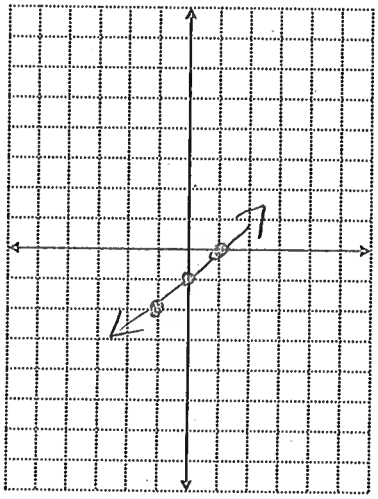


$y = 3x$
$y = 3(-1) = -3$
$y = 3(0) = 0$
$y = 3(1) = 3$

b) $y = x - 1$

$-1 \quad -1$
$y = 0 - 1$
$y = 1 - 1$

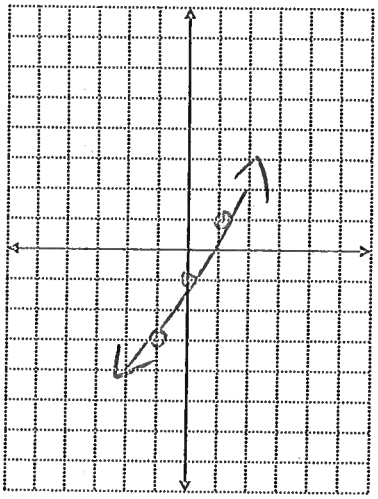
x	y
-1	-2
0	-1
1	0



c) $y = 2x - 1$

$y = 2(-1) - 1$
$y = 2(0) - 1$
$y = 2(1) - 1$
$y = -2 - 1 = -3$

x	y
-1	-3
0	-1
1	1



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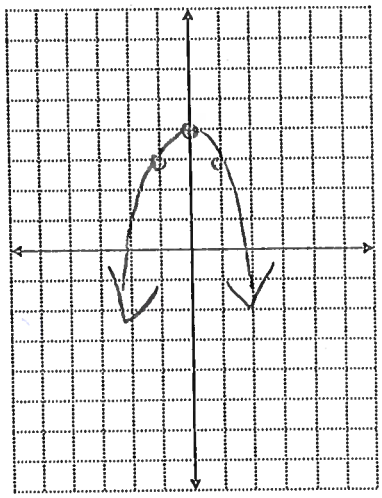
d) $y = 4 - x^2$

x	y
-1	3
0	4
1	3



$y = 4 - (-1)^2$
$y = 4 - (0)^2$
$y = 4 - (1)^2$

$y = 4 - 1$
$y = 4$
$y = 4 - 1$

Thursday

Lesson 2 Relations

Relations

Much of mathematics involves the search for patterns and relationships between sets of data. Many real life applications of mathematics investigate the relationship between two quantities.

For example:

- the value of a computer is related to its age
- the price of a watermelon is related to its weight
- the time taken for a person to walk to school is related to the distance to be walked.

In mathematics, a comparison between two sets of elements is called a **relation**.

List one more example of a relation.

Representing the Relationship Between Two Quantities

In this unit we will consider seven ways in which the relationship between two quantities can be represented. Some of these ways are already familiar to us.

- in words
- a table of values
- a set of ordered pairs
- a mapping (or arrow) diagram
- an equation
- a graph
- function notation (some relations can be represented in this way (see Lessons ~~8, 9, & 10~~)

We will use the relation below as an example.

Table of Values

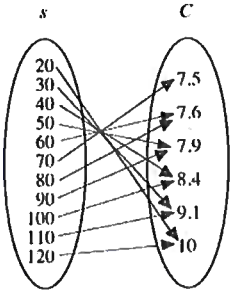
Input (s)	Output (C)
20	10
30	9.1
40	8.4
50	7.9
60	7.6
70	7.5
80	7.6
90	7.9
100	8.4
110	9.1
120	10

Ordered Pairs

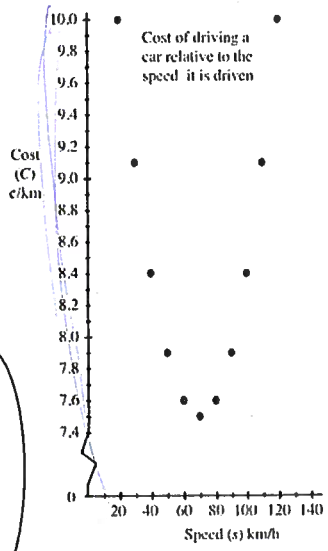
(s, C)

(20, 10)
(30, 9.1)
(40, 8.4)
(50, 7.9)
(60, 7.6)
(70, 7.5)
(80, 7.6)
(90, 7.9)
(100, 8.4)
(110, 9.1)
(120, 10)

Mapping Diagram



Graph



Independent → input

Dependent → output

Independent and Dependent Variables in a Relation

The values of the independent variable represent the inputs, and the corresponding values of the dependent variable are the outputs.

S C
A | B
ind | dep

- In an ordered pair, the values of the first coordinate are those of the independent variable, and the values of the second coordinate are values of the dependent variable. (x, y)
- In a table of values, the independent variable is usually given first - either to the left or above the values of the dependent variable.
- In a mapping diagram, the arrows go from the independent variable to the dependent variable.
- On a graph, the independent variable is on the horizontal axis, often the x-axis, and the dependent variable is on the vertical axis, often the y-axis.
- In an equation, we usually try to isolate the dependent variable to the left side.

The illustration below uses the equation $y = 3x - 5$ as an example to illustrate the independent and dependent variables of an equation.

$$y = 3x - 5$$

- The **dependent variable**.
- Values of the dependent variable represent the outputs of the relation.
- Values of the dependent variable are represented by the **second** coordinate of an ordered pair and are on the **vertical axis**.

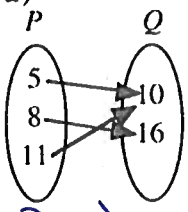
- The **independent variable.**
- Values of the independent variable represent the inputs of the relation.
- Values of the independent variable are represented by the **first** coordinate of an ordered pair and are on the **horizontal axis**.

The diagrams show relations expressed in different ways. In each case

i) state the independent variable ii) state the dependent variable

iii) list the inputs iv) list the outputs

a)



iii) 5, 8, 11

iv) 10, 16 i) P ii) Q

b)

V	A
4	15
10	12
25	15

i) V ii) A

iii) 4, 10, 25 iv) 15, 12, 15

c) (B, c): (3, 7), (4, 11), (5, 15), (6, 19)

xy B C B C B C

i) B ii) C iii) 3, 4, 5, 6

iv) 7, 11, 15, 19

The diagrams show relations expressed in different ways. In each case

i) state the independent variable ii) state the dependent variable

Dep

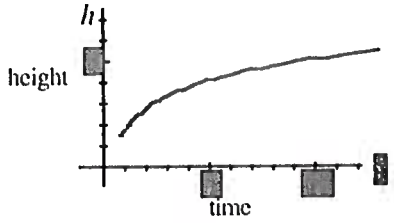
$y = mx + b$

Ind

a) $C = 2\pi r$

i) r ii) C

b)



i) time

ii) h

c) The amount of sap, s, obtained from a maple tree is dependent on the time, t, a container is left attached to the maple tree.

i) t ii) s

Investigating Relationships by Plotting Ordered Pairs

In this section we will consider relations defined by an equation, and sketch a graph by plotting ordered pairs.

- Make a table of inputs by choosing replacements for the independent variable.
- For each of the input values, calculate the corresponding value (the output) of the dependent variable.
- Plot the ordered pairs on a Cartesian plane.

Consider the relation described by the equation $y = 2x - 5$.

a) Complete the first five rows of the following table of values which shows some of the possible input values.

Input (x)	Output (y)	Ordered pair (x, y)
−2	−9	(−2, −9)
−1	−7	(−1, −7)
0	−5	(0, −5)
1	−3	(1, −3)
2	−1	(2, −1)
6	7	(6, 7)

+1 +2

$y = 2x - 5$

$y = 2(-2) - 5$

$y = -4 - 5$

$y = -9$

$y = 2(-1) - 5$

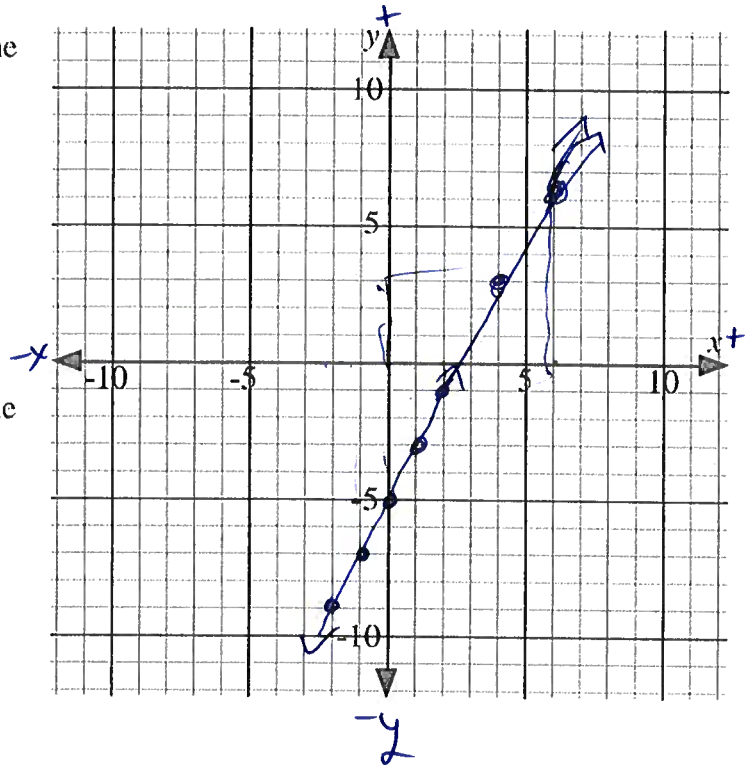
$= -7$

b) Plot the ordered pairs in a) on the grid provided.

c) Connect the points on the grid, and extend the line in both directions with arrows at both ends.

d) Use the graph to determine the value of y when $x = 6$.

e) Use the equation to determine the value of y when $x = 6$, and verify the answer in d).



$y = 2(6) - 5$

$= 12 - 5$

$= 7$

f) Write the value of y when $x = 6$ in the table of values using the first blank space in a).

g) Use the graph to determine the value of x when $y = 3$. Put this information in the last row in a).

h) Complete the following statement:

This relation is called a linear relation because the graph of the relation is a straight line.

Math 10 ★ Do circled ★ Unit 4 Name:_____

Unit 4 Assignment 2:

1. Complete the following.

a) The mathematical relationship between two quantities is called a _____ .

b) The variable used for inputs in a relation is known as the _____ variable.

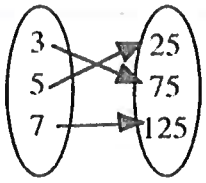
c) The variable used for outputs in a relation is known as the _____ variable.

d) In the equation $A = \pi r^2$, the independent variable is _____, and the dependent variable is _____.

2. The diagrams show relations expressed in different ways. In each case:

i) state the independent and dependent variables **ii)** list the inputs and outputs.

a)



b)

C	n
8	22
20	19
50	35

c)

(f, e): (2, 3), (–2, 19), (8, 17), (0, 2)

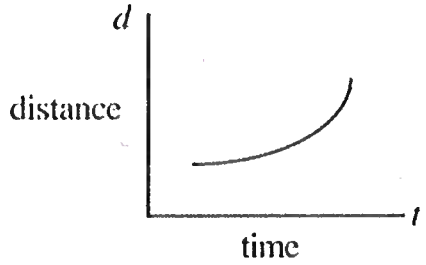
3. For each of the following relations, state

i) the independent variable **ii)** the dependent variable

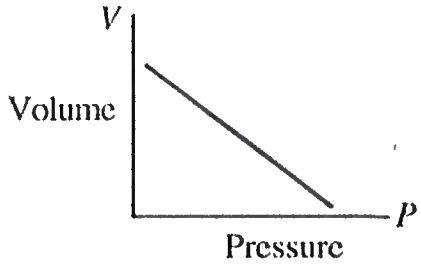
a) $V = \frac{4}{3}\pi r^3$

b) $C = \frac{5}{9}(F - 32)$

c)



d)



e) A truck's value, v, depends on its age, a.

f) The cost, C, of producing business cards is dependent on the number of cards, n, produced.

4. List the different ways a relation may be represented.

5. Consider the relation described by the equation $y = -x - 2$.

a) Identify the independent and dependent variables.

b) Complete the following table of values.

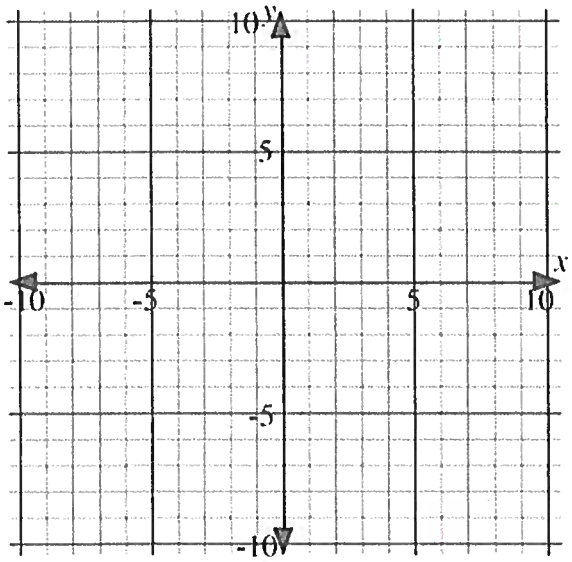
Input (x)	Output (y)	Ordered pair (x, y)
-3		
-1		
0		
1		

c) Plot the ordered pairs in b) on the grid provided.

d) Connect the points on the grid, and then extend the line in both directions with arrows at both ends.

e) Use the graph to determine the value of y when $x = 5$.

f) Use the equation to determine the value of y when $x = 5$, and verify the answer in e).



g) Write the value of y when $x = 5$ in the table of values in b).

h) Use the graph to determine the value of x when $y = 0$. Include this ordered pair in the table of values.

i) Use the graph to determine the value of x when $y = 4$. Include this ordered pair in the table of values.

j) Verify the answer in i) using the equation.

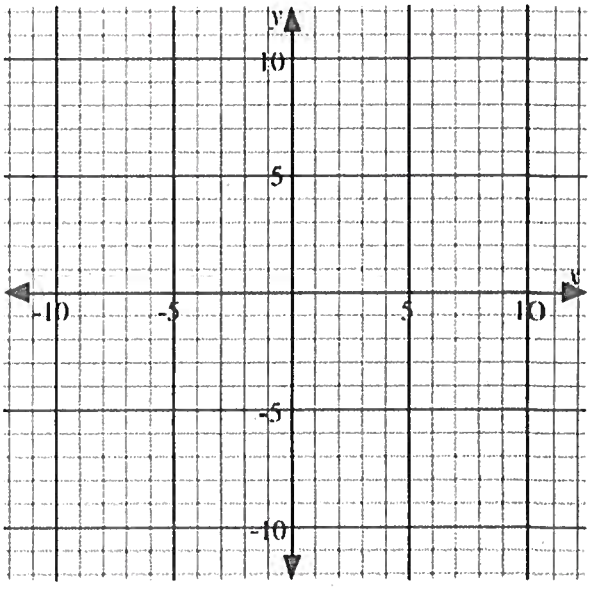
k) Is this a linear or a nonlinear relation?

7. For the following relations:

i) Complete the table of values choosing your own input values where necessary.
ii) Plot the ordered pairs on the grid, and sketch the graph of the relation.
iii) State whether the relation is linear or nonlinear.

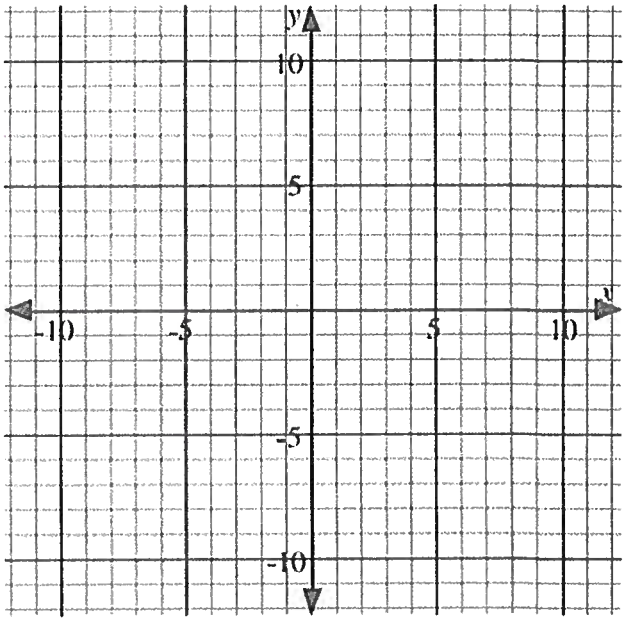
a) $y = -2x + 3$

Input (x)	Output (y)	Ordered pair (x, y)
0		
3		



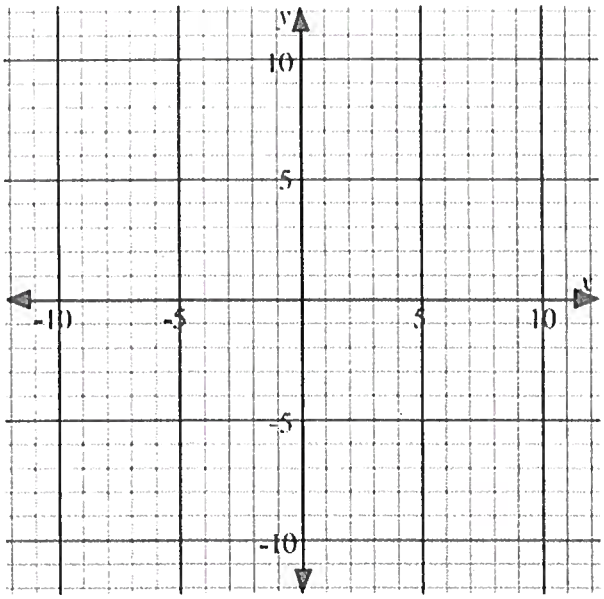
b) $y = 0.5x - 8$

Input (x)	Output (y)	Ordered pair (x, y)
–8		
0		
6		



c) $y = -x^2 + 5$

Input (x)	Output (y)	Ordered pair (x, y)
4		
3		
2		
1		
0		
–1		
–2		
–3		
–4		



Multiple Choice **8.** Which of the following statements is false?

A. The dependent variable is represented on the vertical axis of a Cartesian Plane.
B. The independent variable is represented by the first coordinate of an ordered pair
C. The outputs of a relation are shown on the horizontal axis of a Cartesian Plane.
D. The independent variable is usually shown on the right side of an equation.

Numerical Response **9.** Consider the relation described by the equation $y = 1.5^{x-2}$. If the input is 4, then the output is _____ .

(Record your answer in the numerical response box from left to right)

Answer Key

1. a) relation b) independent c) dependent d) r, A

2. a) i) independent - C; dependent - S; ii) input - 3, 5, 7; output - 25, 75, 125
b) i) independent - C; dependent - n; ii) input - 8, 20, 50; output - 22, 19, 35
c) i) independent - f; dependent - e; ii) input - 2, –2, 8, 0; output - 3, 19, 17, 2

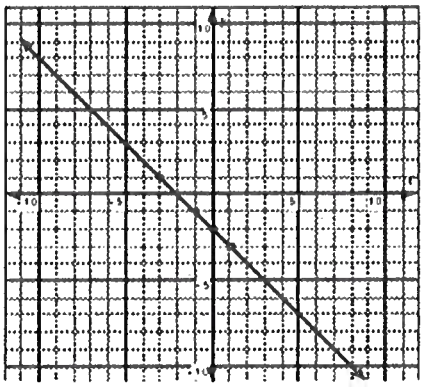
3. a) i) independent - r; ii) dependent - V
b) i) independent - F; ii) dependent - C
c) i) independent - time; ii) dependent - distance
d) i) independent - pressure; ii) dependent - volume
e) i) independent - a; ii) dependent - v
f) i) independent - n; ii) dependent - C

4. words, table of values, set of ordered pairs, mapping, equation, graph, function notation

5. a) Independent → x, Dependent → y

b) See table below **c), d)** See graph below **e)** –7 **f)** –7

Input (x)	Output (y)	Ordered pair (x, y)
–3	1	(–3, 1)
–1	–1	(–1, –1)
0	–2	(0, –2)
1	–3	(1, –3)
g) 5	–7	(5, –7)
h) –2	0	(–2, 0)
i) –6	4	(–6, 4)

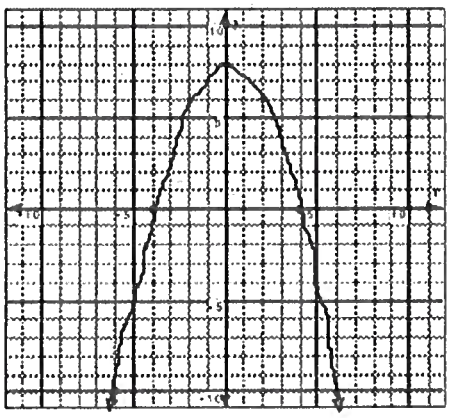


k) linear

6. a) Independent → x Dependent → y

b) See table below. **c), f)** See graph below. **d)** –10 **e)** $y = -0.5(6)^2 + 8$ $y = -10$ **g)** non-linear

Input (x)	Output (y)	Ordered pair (x, y)
–6	–10	(–6, –10)
–4	0	(–4, 0)
–2	6	(–2, 6)
0	8	(0, 8)
2	6	(2, 6)
4	0	(4, 0)

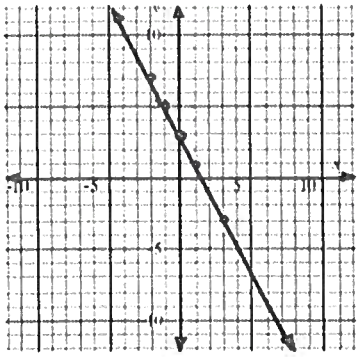


h) $x = \pm 3$

7. a) i) See table below. Inputs may vary.

Input (x)	Output (y)	Ordered pair (x, y)
–2	**7**	**(–2, 7)**
–1	**5**	**(–1, 5)**
0	**3**	**(0, 3)**
1	**1**	**(1, 1)**
3	**–3**	**(3, –3)**

ii) See grid below.

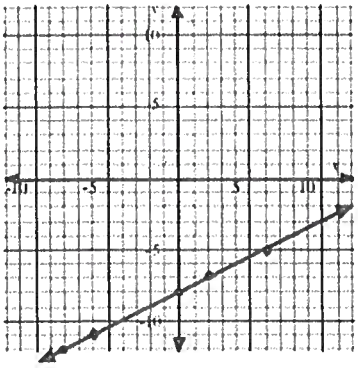


iii) linear

b) i) See table below. Inputs may vary.

Input (x)	Output (y)	Ordered pair (x, y)
–8	**–12**	**(–8, –12)**
–6	**–11**	**(–6, –11)**
0	**–8**	**(0, –8)**
2	**–7**	**(2, –7)**
6	**–5**	**(6, –5)**

ii) See grid below.

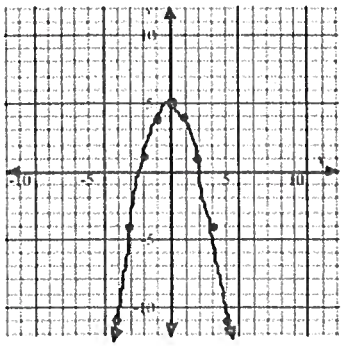


iii) linear

c) i) See table below.

Input (x)	Output (y)	Ordered pair (x, y)
4	**–11**	**(4, –11)**
3	**–4**	**(3, –4)**
2	**1**	**(2, 1)**
1	**4**	**(1, 4)**
0	**5**	**(0, 5)**
–1	**4**	**(–1, 4)**
–2	**1**	**(–2, 1)**
–3	**–4**	**(–3, –4)**
–4	**–11**	**(–4, –11)**

ii) See grid below.



iii) non-linear

8. C

9.

2	.	2	5