Equations, Tables & Graphs

There are several ways to describe a pattern/relationship in mathematics:
  ➤ A sentence: When x increases by one, y increases/decreases by __a number__

  ➤ A table of values

  ➤ An equation

  ➤ A graph

We can use one type of description to create the others.

Example 1: A) Given an equation, complete a table of values.
         B) Using the table of values, describe the pattern between "x" and "y" values in a sentence.
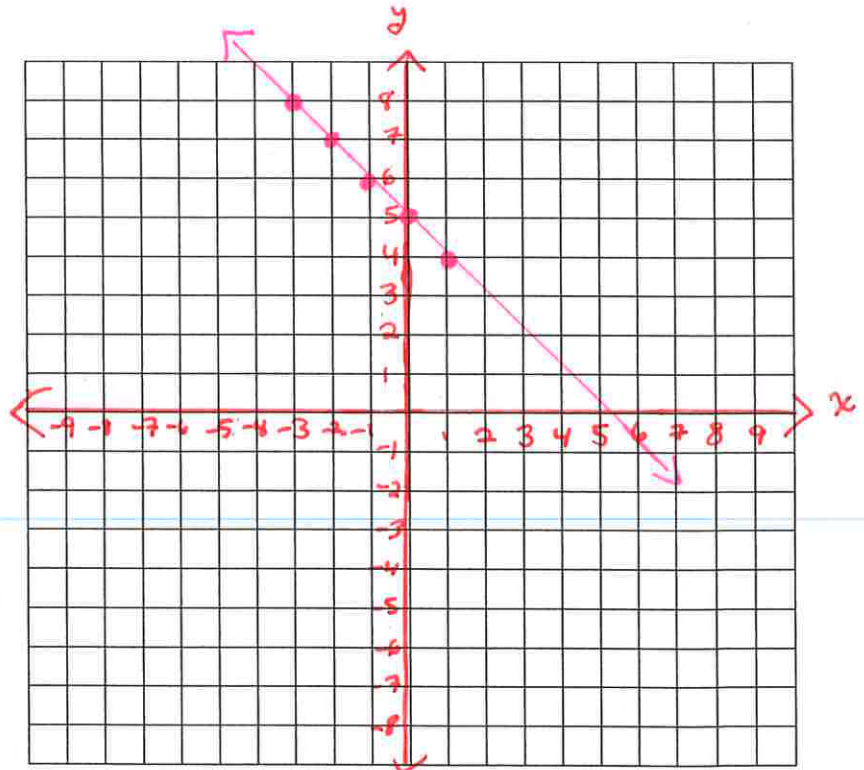   C) List 5 ordered pairs of the points that are on the graph.
         D) Graph the relation.

A)

$y = -x + 5$	
x	y
① −3	8
② −2	7
③ −1	6
④ 0	5
⑤ 1	4

(brackets between y-values each marked -1)

D)

B) __When x increases by 1, y decreases by 1__

C) __(−3,8)__ , __(−2,7)__ , __(−1,6)__ , __(0,5)__ , __(1,4)__ ,

① $y = -(-3) + 5$
  $y = 3 + 5$
  $y = 8$

② $y = -(-2) + 5$
  $y = 2 + 5$
  $y = 7$

③ $y = -(-1) + 5$
  $y = 1 + 5$
  $y = 6$

④ $y = -(0) + 5$
  $y = 0 + 5$
  $y = 5$

⑤ $y = -(1) + 5$
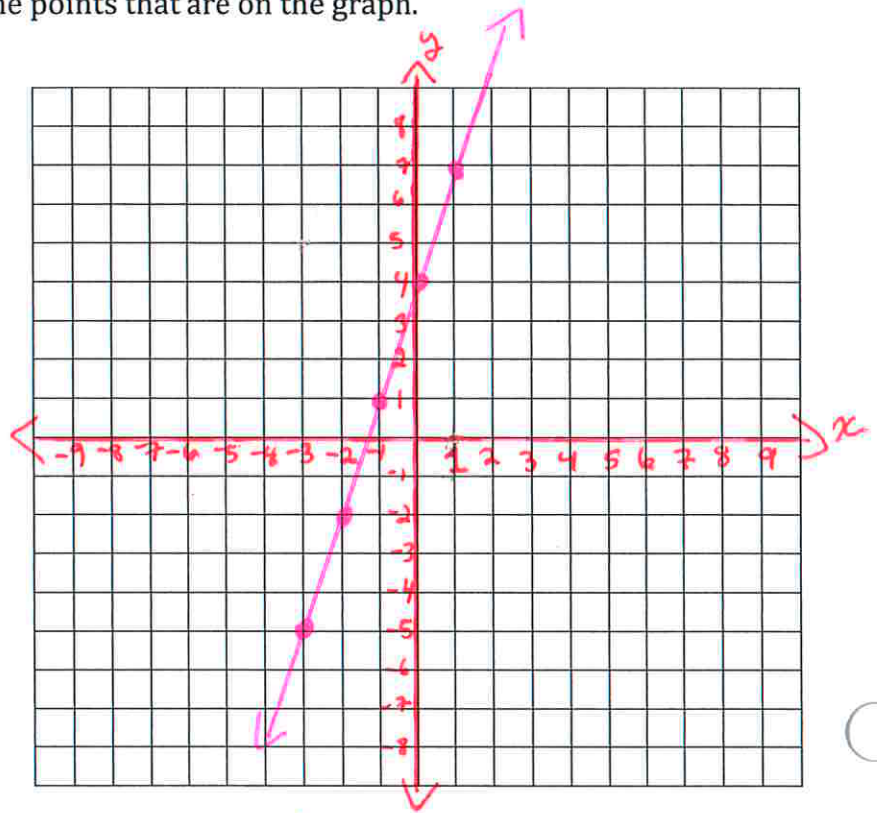 $y = -1 + 5$
  $y = 4$

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Example 2: A) Given an equation, complete a table of values.
B) Using the table of values, describe the pattern between "x" and "y" values in a sentence.
C) List 5 ordered pairs of the points that are on the graph.
D) Graph the relation.

A)

$y = 3x + 4$	
x	y
① −3	−5
② −2	−2
③ −1	1
④ 0	4
⑤ 1	7

+3
+3
+3
+3

D)

B) __when x increases by 1, y increases by 3.__

C) __(−3,−5)__ , __(−2,−2)__ , __(−1,1)__ , __(0,4)__ , __(1,7)__ ,

① $y = 3(-3) + 4$
$y = -9 + 4$
$y = -5$

② $y = 3(-2) + 4$
$y = -6 + 4$
$y = -2$

③ $y = 3(-1) + 4$
$y = -3 + 4$
$y = 1$

④ $y = 3(0) + 4$
$y = 0 + 4$
$y = 4$

⑤ $y = 3(1) + 4$
$y = 3 + 4$
$y = 7$

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Example 3: A) Given an equation, complete a table of values. **Hint: change the equation in such a way so it starts with 1y. *)**
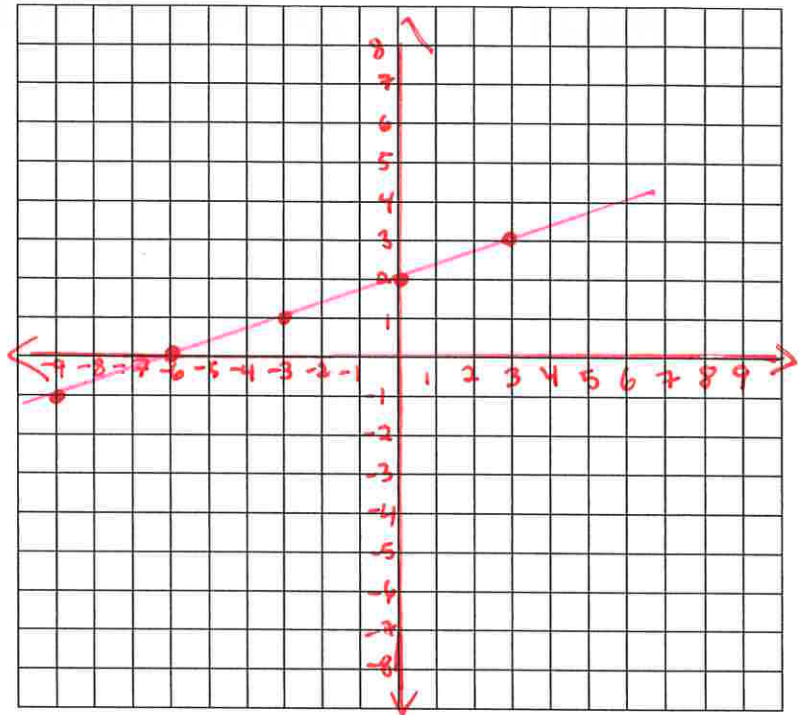B) Using the table of values, describe the pattern between "x" and "y" values in a sentence.
C) List 5 ordered pairs of the points that are on the graph.
D) Graph the relation.

A)

$3y = x + 6$	
x	y
−9	−1
−6	0
−3	1
0	2
3	3

(handwritten annotations: ① +3, ② +3, ③ +3, ④ +3, ⑤ on x-column; +1, +1, +1, +1 on y-column)

D)

B) _When x increases by 1, y increases by $\frac{1}{3}$_

C) _(−9, −1)_ , _(−6, 0)_ , _(−3, 1)_ , _(0, 2)_ , _(3, 3)_ ,

*)   **Change** $\dfrac{3y}{3} = \dfrac{x}{3} + \dfrac{6}{3}$

$y = \dfrac{x}{3} + 2$

① $y = \dfrac{-9}{3} + 2$
$y = -1$

② $y = \dfrac{-6}{3} + 2$
$y = 0$

③ $y = \dfrac{-3}{3} + 2$
$y = 1$

④ $y = \dfrac{0}{3} + 2$
$y = 2$

⑤ $y = \dfrac{3}{3} + 2$
$y = 3$

Pattern: when x increases by 3, y increases by 1.

x	y
$+3 \longrightarrow +1$	
$\overline{\quad 3 \quad}$	$\overline{\quad 3 \quad}$
$1 \longrightarrow \frac{1}{3}$	

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y-intercept

➢ y-intercept is a point where a graph intersects or touches the y-axis.

➢ y-intercept has coordinates of the form: $(0, \#)$

➢ A very convenient way to find the coordinates of the y-intercept when you know the equation is to substitute x=0 into the equation and solve for "y".

Example 1: Determine the y-intercept for each equation:

$y = 2x + 4$	$5y = -2x + 11$	$y = \dfrac{7}{8}x + 6$	$y = \dfrac{x}{9} + 4$	$-y - 1.5 = -0.6x$
$y = 2(0) + 4$ $y = 0 + 4$ $y = 4$	$\dfrac{5y}{5} = \dfrac{-2(0)}{5} + \dfrac{11}{5}$ $y = 0 + \dfrac{11}{5}$ $y = \dfrac{11}{5}$	$y = \dfrac{7}{8}(0) + 6$ $y = 0 + 6$ $y = 6$	$y = \dfrac{(0)}{9} + 4$ $y = 0 + 4$ $y = 4$	$-y - 1.5 = -0.6(0)$ $-y - 1.5 = 0$ $\quad +1.5 \quad +1.5$ $\dfrac{-y}{-1} = \dfrac{1.5}{-1}$ $y = 1.5$
The y-intercept is: $(0, 4)$	The y-intercept is: $\left(0, \dfrac{11}{5}\right)$	The y-intercept is: $(0, 6)$	The y-intercept is: $(0, 4)$	The y-intercept is: $(0, -1.5)$

Conclusion: When the equation starts with "1y", the y-coordinate of the y-intercepts is the constant term on the other side of the equal sign.

To find the y-intercept in a table of values, find the row that has x=0.

To find the y-intercept on a graph, find the y-coordinate of the point of intersection of the graph and the y-axis.

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Determining the Equation from a Table of Values

Steps:

➤ Determine the pattern: when x increases by 1, y increases (+)/decreases(-) by _____

• This will be the "pattern" number that will be written in front of the "x" in the equation.

➤ Using the pattern detected in the table of values, find the value of "y" when x=0.

• This is the y-intercept that will be written at the end of the equation.

➤ Write the question in the form: $y = pattern\ number \cdot x + yintercept$

Example 1: Determine the equation given a table of values.

a)

x	y
−1	2.75
0	3
1	3.25
2	3.50
3	3.75

The pattern is:

The y-intercept is:

∴ The equation is

b)

x	y
1	10
2	13
3	16
4	19
5	22

The pattern is:

The y-intercept is:

∴ The equation is

c)

x	y
1	3.5
2	3
3	2.5
4	2
5	1.5

The pattern is:
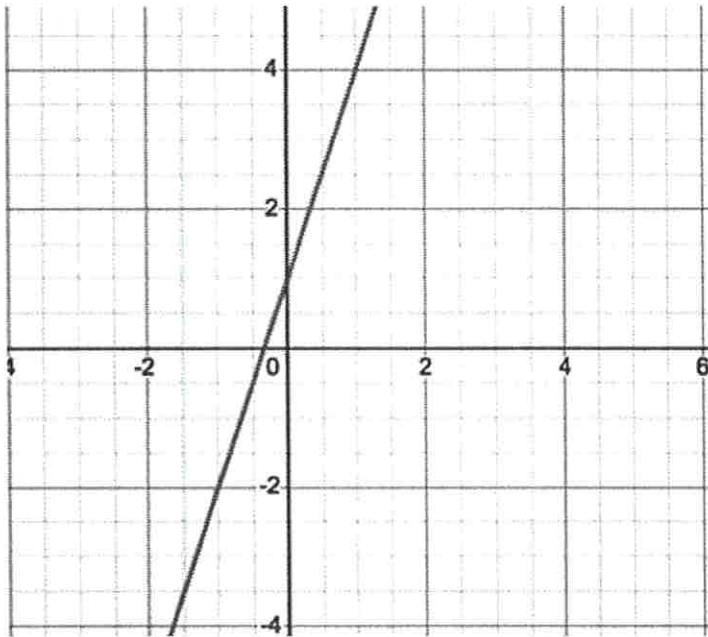
The y-intercept is:

∴ The equation is

Determining the Equation from a Graph

Steps:
- ➢ Identify the y-intercept

- ➢ Identify the pattern: when x increase by 1, the value of "y" increases/decreases by _____

- ➢ Put the two pieces of information into an equation: $y = pattern\ number \cdot x + yintercept$
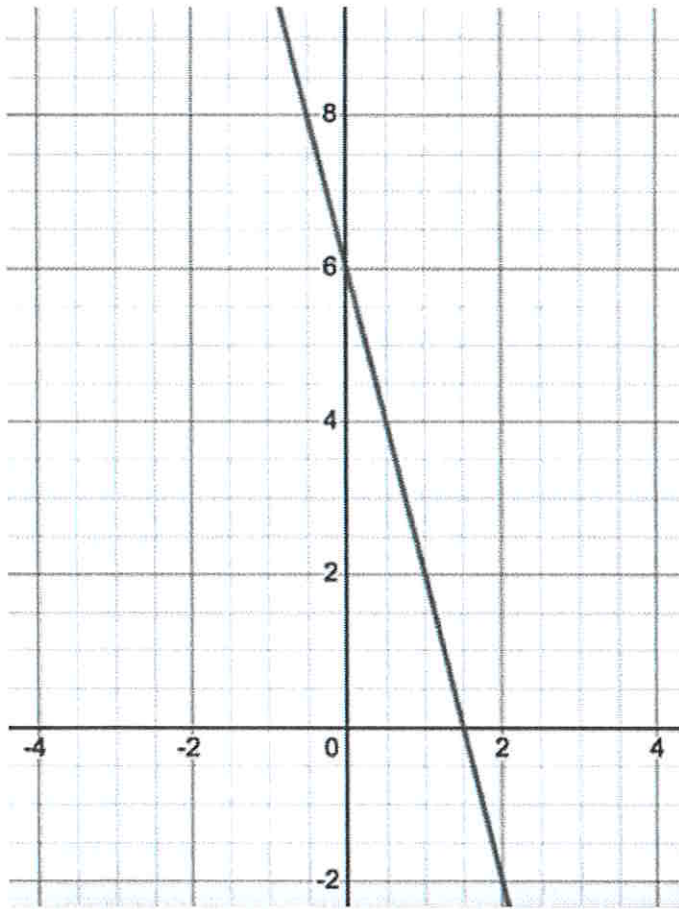
Example 1:

The pattern is:

The y-intercept is:
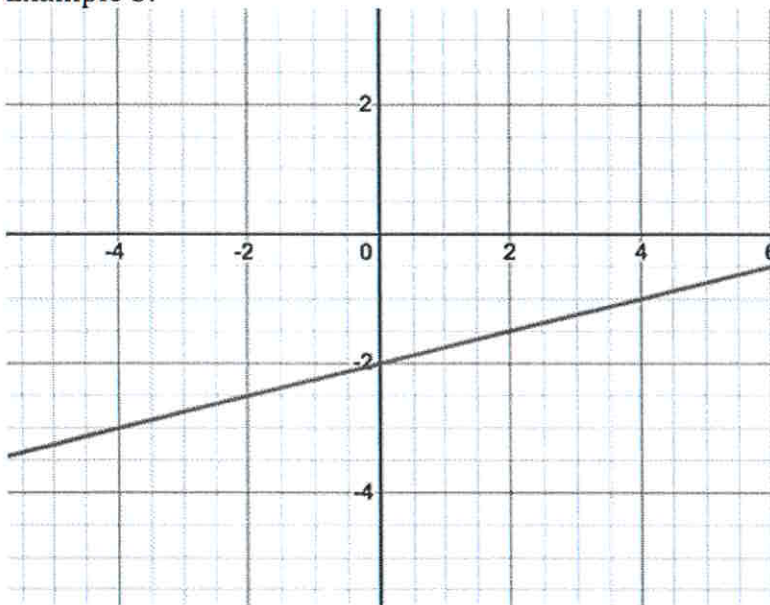
∴ The equation is

Example 2:

The pattern is:

The y-intercept is:

∴ The equation is

Example 3:

The pattern is:

The y-intercept is:

∴ The equation is