

M9

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.

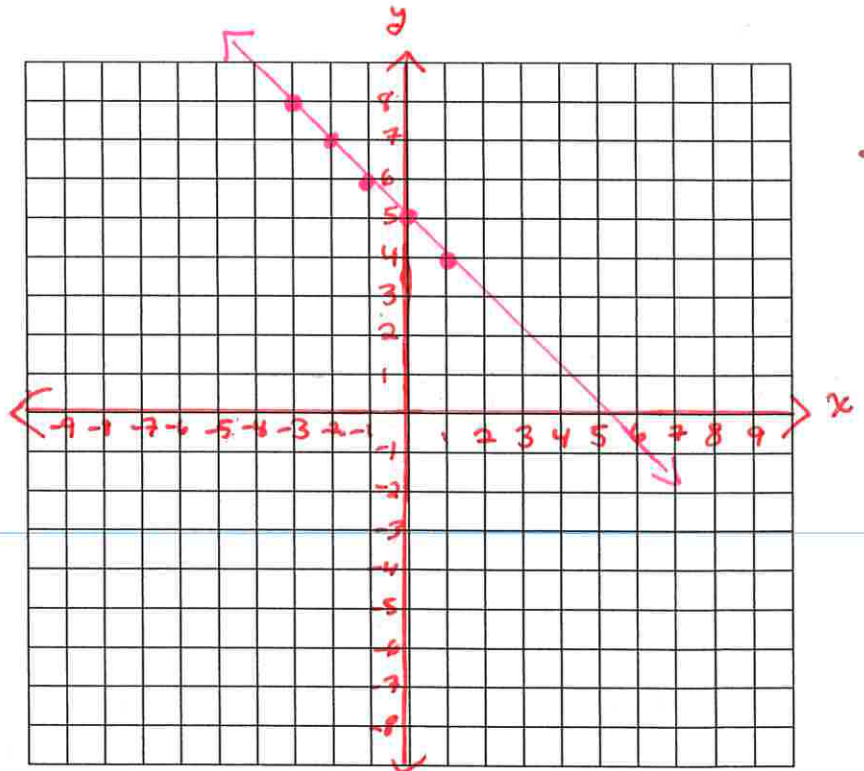
C) List 5 ordered pairs of the points that are on the graph.

D) Graph the relation.

A)

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

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

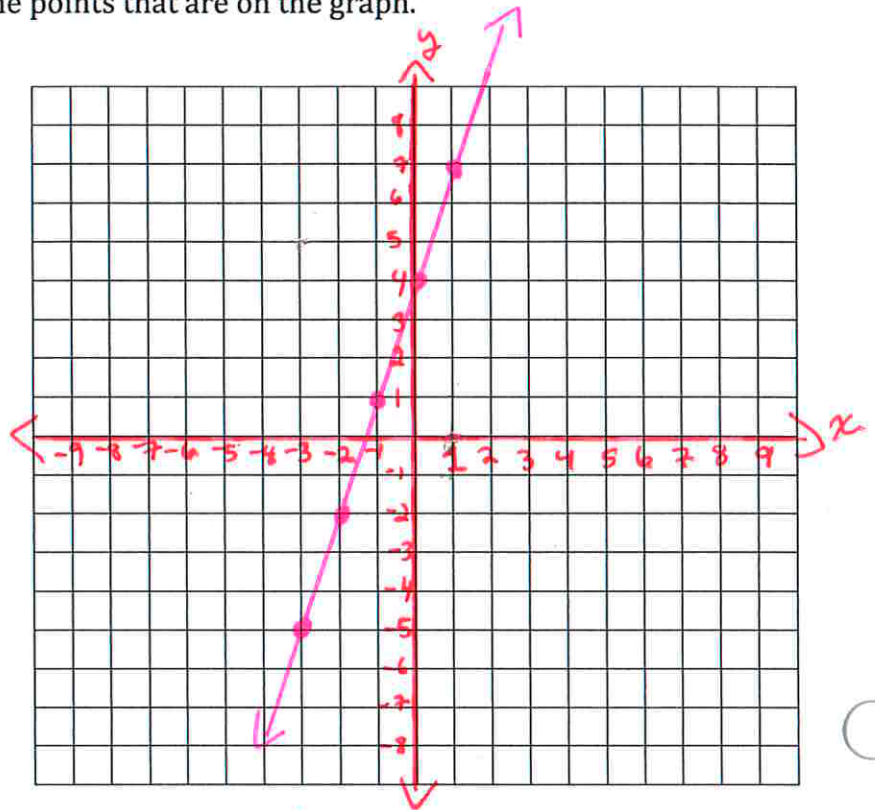
- Example 2: A) Given an equation, complete a table of values.
 B) Using the table of values, describe the pattern between "x" and "y" values in a sentence.
 C) List 5 ordered pairs of the points that are on the graph.
 D) Graph the relation.

A)

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

- ①
 ②
 ③
 ④
 ⑤
- $\downarrow +3$
 $\downarrow +3$
 $\downarrow +3$
 $\downarrow +3$

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 $y = 3(1) + 4$
 $y = 3 + 4$
 $y = 7$

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.

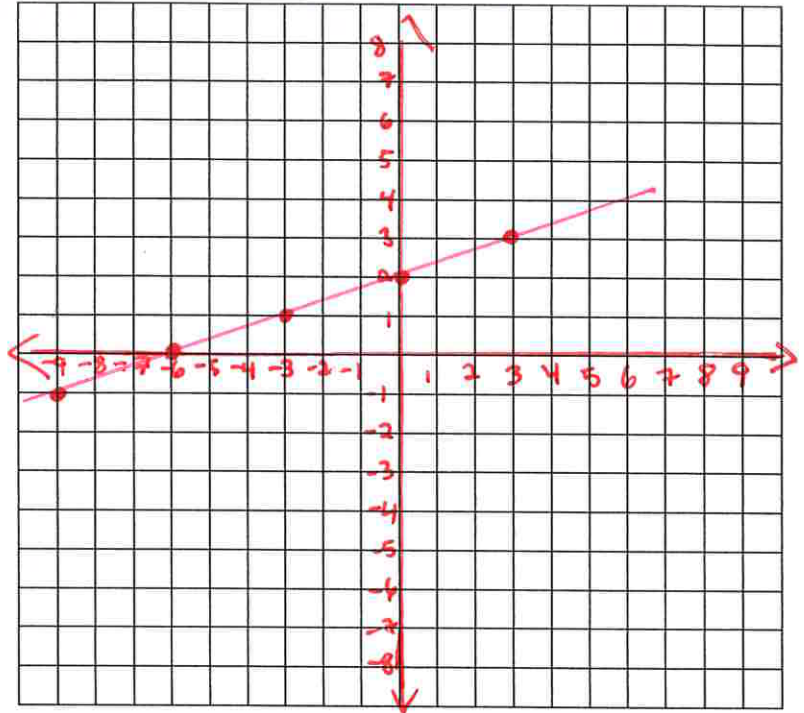
C) List 5 ordered pairs of the points that are on the graph.

D) Graph the relation.

A)

D)

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



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

C) $(-9, -1)$, $(-6, 0)$, $(-3, 1)$, $(0, 2)$, $(3, 3)$

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

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

① $y = \frac{-9}{3} + 2$
 $y = -1$

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

③ $y = \frac{-3}{3} + 2$
 $y = 1$

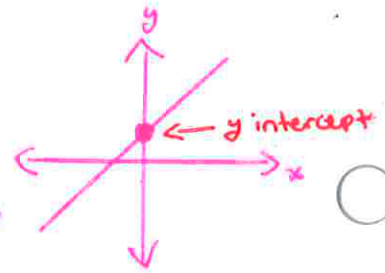
⑤ $y = \frac{3}{3} + 2$
 $y = 3$

x	y
+3	→ +1
$\frac{3}{3}$	$\frac{1}{3}$
1	→ $\frac{1}{3}$

② $y = \frac{-6}{3} + 2$
 $y = 0$

④ $y = \frac{0}{3} + 2$
 $y = 2$

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:

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

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.

Determining the Equation from a Table of Values

Steps:

- ① 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.
- ② 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.
- ③ Write the question in the form: $y = \text{pattern number} \cdot x + \text{yintercept}$

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:

When x increases by 1, y increases by 0.25

The y-intercept is:

(0, 3)

∴ The equation is

$$y = 0.25 \cdot x + 3$$

↑
Pattern
for y

↑
y intercept

or $y = \frac{1}{4}x + 3$
or $y = \frac{x}{4} + 3$

b)

x	y
0	<u>7</u>
1	10
2	13
3	16
4	19
5	22

Handwritten annotations: On the left, arrows indicate x increases by 1 (+1) for each row. On the right, arrows indicate y increases by 3 (+3) for each row. The value 7 in the first row is underlined.

The pattern is: *When $x \uparrow$ by 1, $y \uparrow$ by 3.*

The y-intercept is:

(0, 7)

∴ The equation is

$y = \underline{3}x + \underline{7}$

c)

x	y
0	<u>4</u>
1	3.5
2	3
3	2.5
4	2
5	1.5

Handwritten annotations: On the left, arrows indicate x increases by 1 (+1) for each row. On the right, arrows indicate y decreases by 0.5 (-0.5) for each row. The value 4 in the first row is underlined.

The pattern is:

When $x \uparrow$ by 1, $y \downarrow$ by 0.5

The y-intercept is:

(0, 4)

∴ The equation is

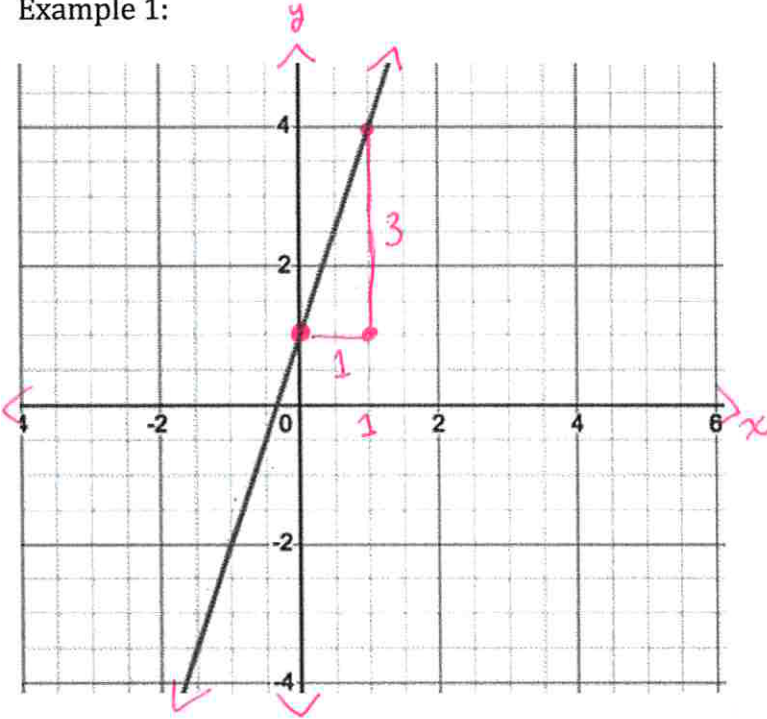
$y = \underline{-0.5}x + \underline{4}$ $\underline{0.5} \rightarrow y = -\frac{1}{2}x + 4$

Determining the Equation from a Graph

Steps:

- ① Identify the y-intercept
- ② Identify the pattern: when x increase by 1, the value of "y" increases/decreases by a #
- ③ Put the two pieces of information into an equation: $y = \text{pattern number} \cdot x + \text{yintercept}$

Example 1:



The pattern is:

when $x \uparrow$ by 1, $y \uparrow$ by 3

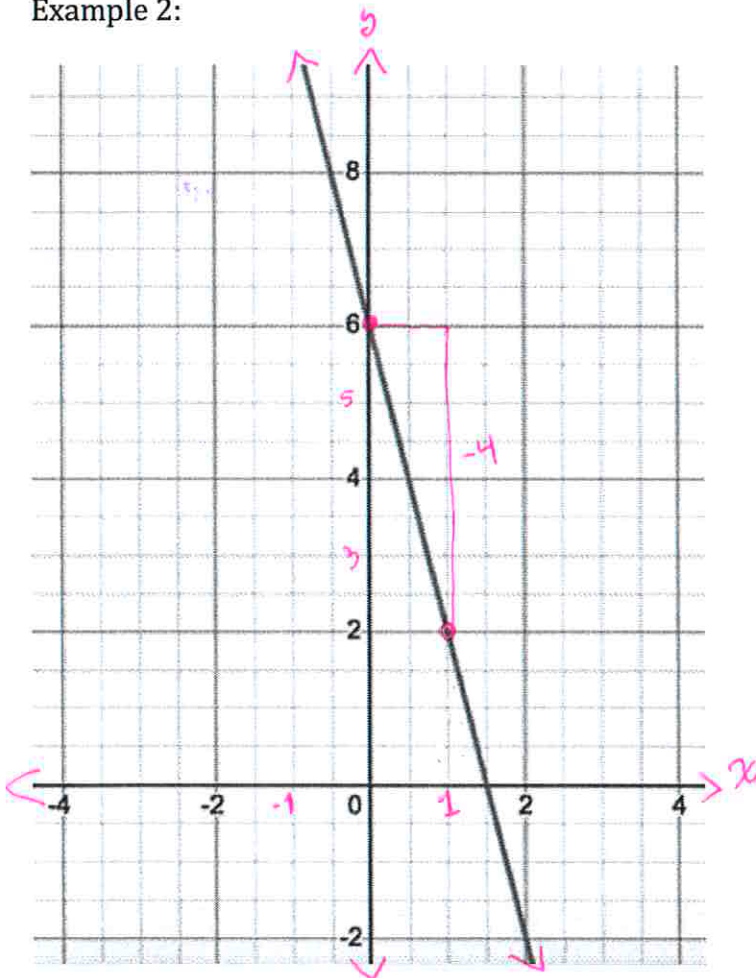
The y-intercept is:

$(0, 1)$

\therefore The equation is

$$y = 3x + 1$$

Example 2:



The pattern is:

When $x \uparrow 1$, $y \downarrow$ by 4

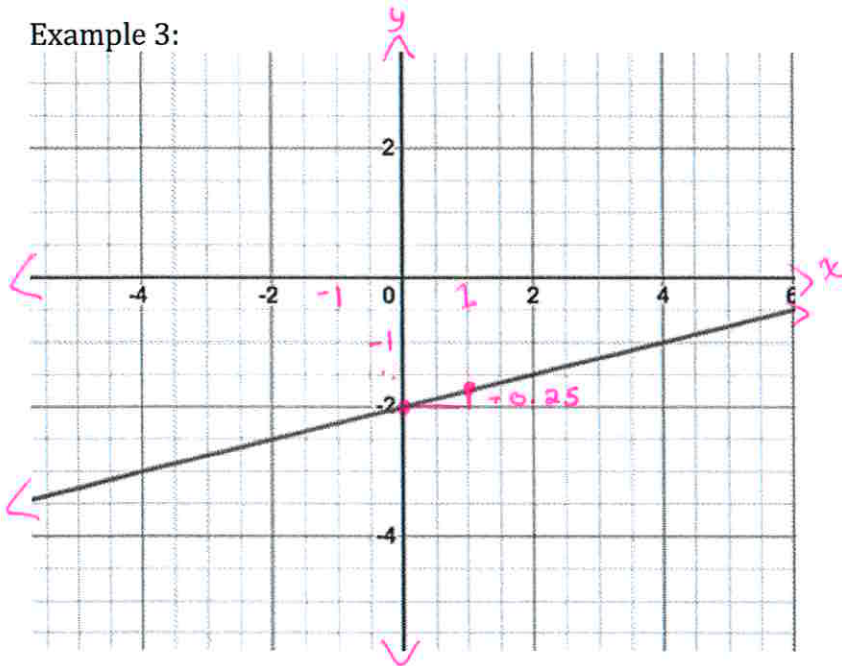
The y-intercept is:

$(0, 6)$

\therefore The equation is

$$y = -4x + 6$$

Example 3:



The pattern is:

When $x \uparrow$ by 1, $y \uparrow$ by 0.25

The y-intercept is:

$(0, -2)$

\therefore The equation is

$$y = 0.25x - 2$$