Grade 10 Mathematics
Analytical Geometry
Exercises for home

Exercise 1

Determine the length of the line segment between the following points:

a) $P(-3; 5)$ and $Q(-1; -5)$

b) $R(0,75; 3)$ and $S(0,75; -4)$

c) $T(2x; y - 2)$ and $U(3x + 1; y - 2)$

Answer Exercise 1

a.
$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$= \sqrt{(-1 + 3)^2 + (-5 - 5)^2}$$
$$= \sqrt{(2)^2 + (-10)^2}$$
$$= \sqrt{4 + 100}$$
$$= \sqrt{104}$$

b.
$$RS = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$= \sqrt{(0,75 - 0,75)^2 + (-4 - 3)^2}$$
$$= \sqrt{(0)^2 + (-7)^2}$$
$$= \sqrt{49}$$
$$= 7 \text{ units}$$

c.
$$TU = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$= \sqrt{(3x + 1 - 2x)^2 + (y - 2 - y + 2)^2}$$
$$= \sqrt{(x + 1)^2 + (0)^2}$$
$$= \sqrt{(x + 1)^2}$$
$$= x + 1 \text{ units}$$

Exercise 2

Find the Gradient between the following points

$A(x - 3; y)$ and $B(x; y + 4)$

Let the coordinates of A be $(x_1; y_1)$ and the coordinates of B be $(x_2; y_2)$

$$x_1 = x - 3 \quad y_1 = y \quad x_2 = x \quad y_2 = y + 4$$

$$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{y + 4 - y}{x - (x - 3)}$$
$$= \frac{4}{3}$$

Answer to Exercise 3 and Exercise 4

Exercise 3

$$M_{CD} = \left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2} \right)$$
$$= \left(\frac{5 + 23}{2}; \frac{9 + 55}{2} \right)$$
$$= \left(\frac{28}{2}; \frac{64}{2} \right)$$
$$= (14; 32)$$

Exercise 4

$$M_{EF} = \left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2} \right)$$
$$= \left(\frac{x + 2 + x - 5}{2}; \frac{y - 1 + y - 4}{2} \right)$$
$$= \left(\frac{2x - 3}{2}; \frac{2y - 5}{2} \right)$$

Exercise 3

Determine the Midpoint between the following points:
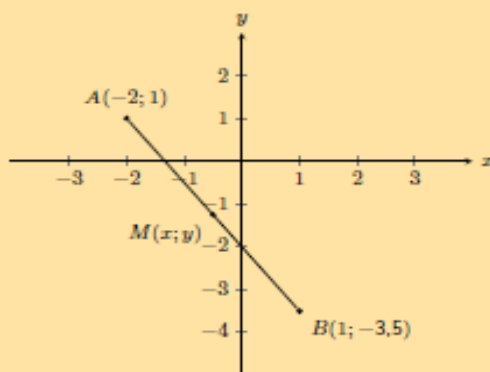
$C(5; 9), \ D(23; 55)$

Exercise 4

Determine the Midpoint between the following points:

$E(x + 2; y - 1), F(x - 5; y - 4)$

Exercise 5

You are given the following diagram:

Calculate the coordinates of the mid-point (M) between point $A(-2; 1)$ and point $B(1; -3,5)$.

Exercise 5 Answer

Let the coordinates of A be $(x_1; y_1)$ and the coordinates of B be $(x_2; y_2)$.

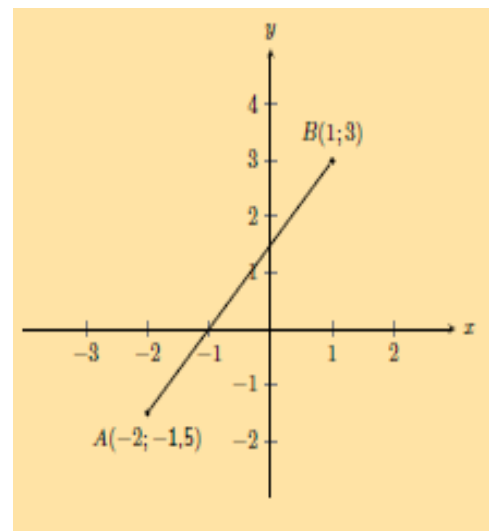$$x_1 = -2 \quad y_1 = 1 \quad x_2 = 1 \quad y_2 = -3,5$$

Substitute values into the mid-point formula:

$$M(x; y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$x = \frac{x_1 + x_2}{2}$$
$$= \frac{-2 + 1}{2}$$
$$= -0,5$$

$$y = \frac{y_1 + y_2}{2}$$
$$= \frac{1 + (-3,5)}{2}$$
$$= -1,25$$

The mid-point is at $M(-0,5; -1,25)$.

Exercise 6

Calculate the gradient (m) of line AB.

Exercise 6 Answer
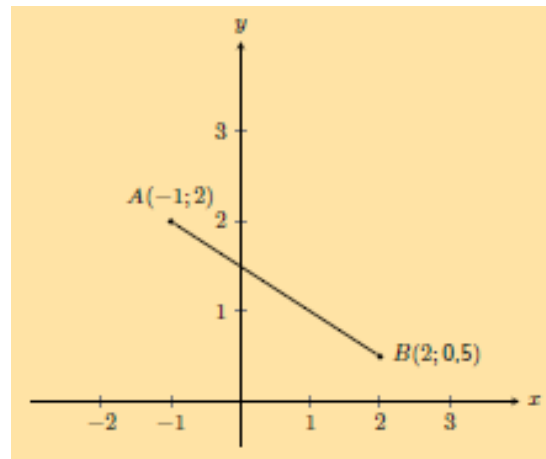
$$x_1 = -2 \quad y_1 = -1,5 \quad x_2 = 1 \quad y_2 = 3$$

$$m = \frac{y_B - y_A}{x_B - x_A}$$
$$= \frac{(3) - (-1,5)}{(1) - (-2)}$$
$$= \frac{4,5}{3}$$
$$= 1,5$$

Exercise 7

Calculate the gradient (m) of line AB.

Exercise 7 Answer

$$x_1 = -1 \quad y_1 = 2 \quad x_2 = 2 \quad y_2 = 0,5$$

$$m = \frac{y_B - y_A}{x_B - x_A}$$
$$= \frac{(0,5) - (2)}{(2) - (-1)}$$
$$= \frac{-1,5}{3}$$
$$= -0,5$$

EQUATION OF STRAIGHT LINE

Summary

If you know	Formulae to use
The gradient and the y-intercept	$y = mx + c$
The gradient and the coordinates of at least one point on the graph.	$y - y_1 = m(x - x_1)$ or $y = mx + c$
Two points on the line: first calculate the gradient and then substitute into $y = mx + c$.	$m = \frac{y_2 - y_1}{x_2 - x_1}$ and $y = mx + c$