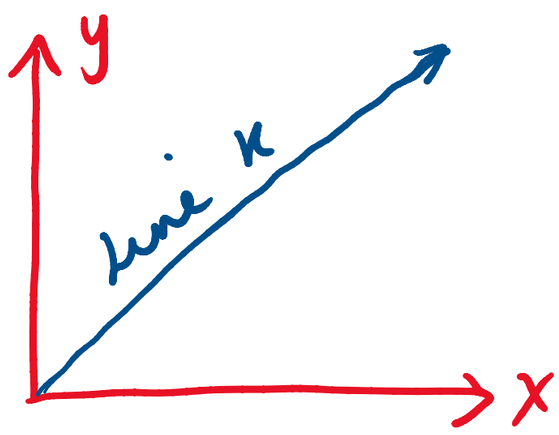
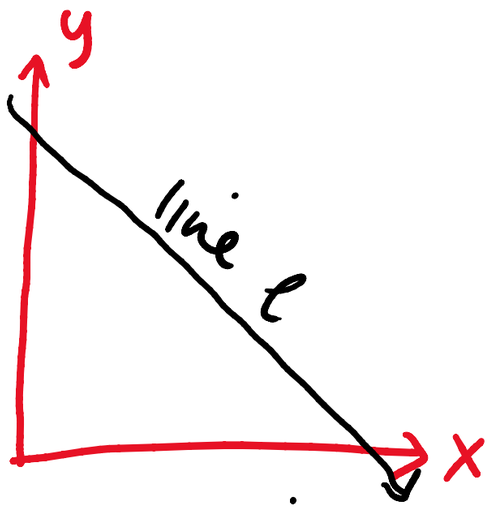
Slope

06 March 2019 12:20



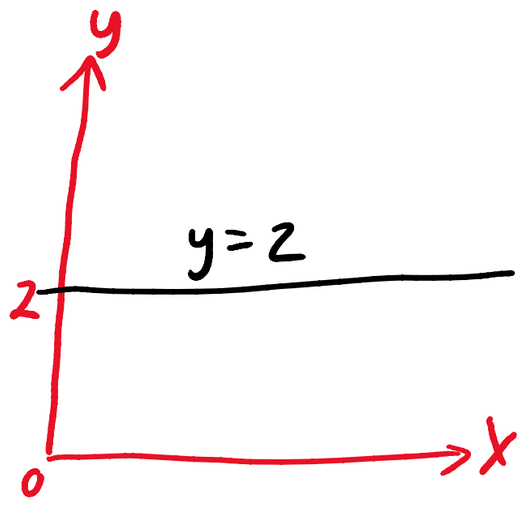
Positive Slope

- Rising from left to right



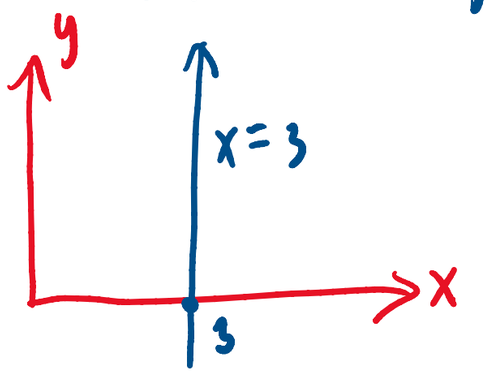
Negative slope

- Falling from left to right



No slope

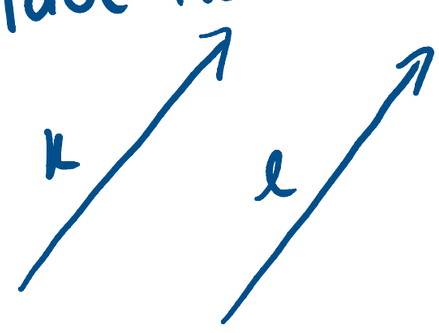
- horizontal / parallel to the x axis



Slope is undefined

Parallel lines

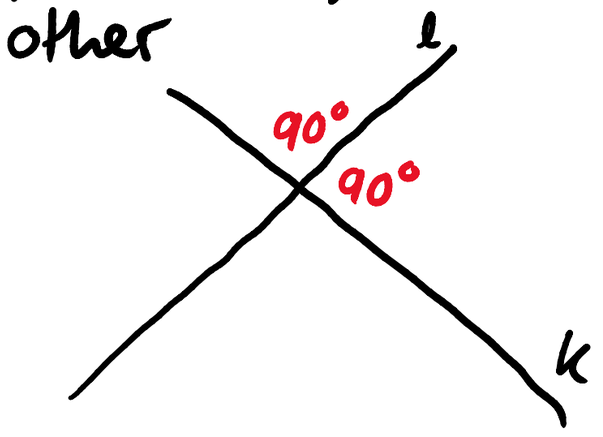
Have the same slope.



k // ℓ
the same slope.

Perpendicular Line

at 90° angles to each other



To find the perpendicular slope.

1) Turn the slope upside down
2) Change the sign.

To find the slope when given two points

1) Label the points (x_1, y_1) (x_2, y_2)
2) Sub values into the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$

Find the slope of AB when $A(\overset{x_1\ y_1}{3,1})$ and $B(\overset{x_2\ y_2}{5,3})$

$$m = \frac{3-1}{5-3} = \frac{2}{2} = 1$$

Class work → Friday

Homework

Pg 58 Q 4 → 8

PROJECT MATHS

Text & Tests 3

Leaving Certificate

Coordinate Geometry – The Line

chapter 3

Key words

Cartesian plane origin axis quadrant vertex horizontal
vertical slope parallel perpendicular positive negative
linear equation area translation intersection collinear

Section 3.4 The slope of a line

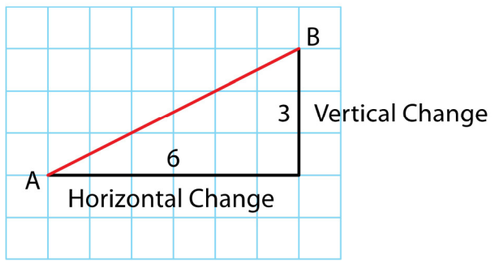
Notes

Section 3.4 The slope of a line

The slope of the line AB is defined as

$$\frac{\text{the vertical change}}{\text{horizontal change}} \quad \text{or} \quad \frac{\text{rise}}{\text{run}}$$

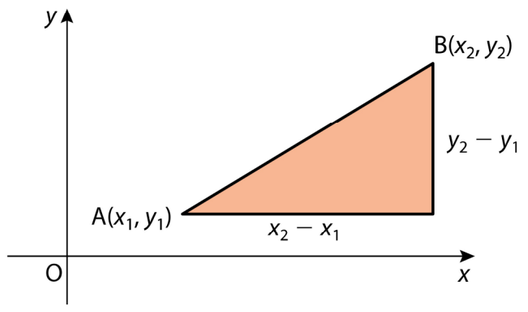
The slope of AB $= \frac{3}{6} = \frac{1}{2}$.



In the diagram on the right, the slope of AB is found by getting the

$$\frac{\text{vertical change}}{\text{horizontal change}} = \frac{y_2 - y_1}{x_2 - x_1}$$

Thus the slope, m, of AB is $= \frac{y_2 - y_1}{x_2 - x_1}$.



The slope, m, of the line passing through (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

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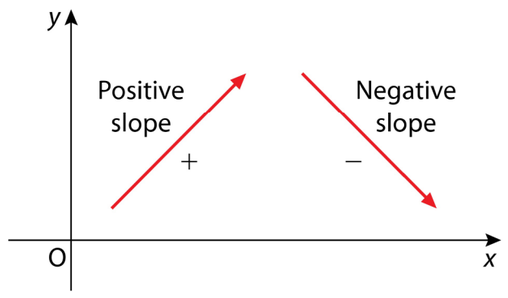
Notes

Positive and negative slopes

As we go from left to right, the slope is positive if the line is rising and the slope is negative is the line is falling.



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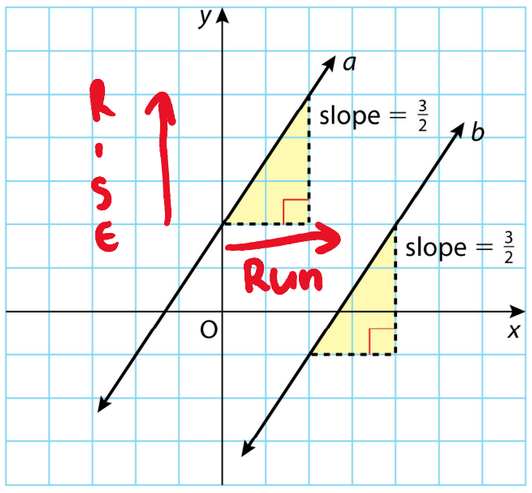
Notes

Parallel lines

The lines a and b in the diagram below both have the slope $\frac{3}{2}$.

These lines are parallel.

Rise / Run. 3/2



Parallel lines have equal slopes

Notes

Perpendicular lines

The given lines a and b are perpendicular.

The slope of a is $\frac{3}{2}$.

The slope of $b = -\frac{2}{3}$.

3/2 ⊥ -2/3

Notice that one slope is minus the reciprocal of the other.

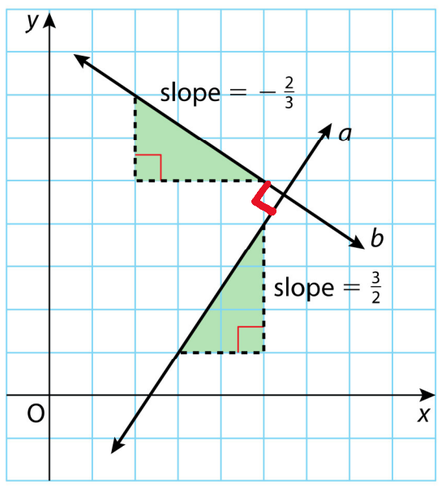
multiply

Notice also that the product of the two slopes is -1, i.e.,

$$-\frac{2}{3} \times \frac{3}{2} = -1 \qquad -\frac{6}{6} = -1$$

If two lines are perpendicular, the product of their slopes is -1, i.e.,

$$m_1 \times m_2 = -1$$



Classwork Pg 57 Q1
Pg 58 Q2,3

Example 1

If A $= (3, -1)$ and B $= (5, 2)$, find the slope of the line AB.

The slope, m, of the line passing through (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$(3, -1)$ $(5, 2)$
$\downarrow$ $\downarrow$
(x_1, y_1) (x_2, y_2)

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{2 + 1}{5 - 3} = \frac{3}{2}$$

The slopes of AB $= \frac{3}{2}$.

Example 2

A$(-1, 0)$, B$(3, 2)$, C$(-1, 4)$ and D$(2, -2)$ are four points in the plane. Show that AB is perpendicular to CD.

The slope, m, of the line passing through (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Let m_1 be the slope of AB and m_2 be the slope of CD.

A$(-1, 0)$ B$(3, 2)$
$\downarrow$ $\downarrow$
(x_1, y_1) (x_2, y_2)

$$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{2 - 0}{3 + 1}$$
$$= \frac{2}{4} = \frac{1}{2}$$

C$(-1, 4)$ D$(2, -2)$
$\downarrow$ $\downarrow$
(x_1, y_1) (x_2, y_2)

$$m_2 = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{-2 - 4}{2 + 1} = \frac{-6}{3}$$
$$= \frac{-6}{3} = -2$$

$$m_1 \times m_2 = \frac{1}{2} \times (-2)$$
$$= -1$$

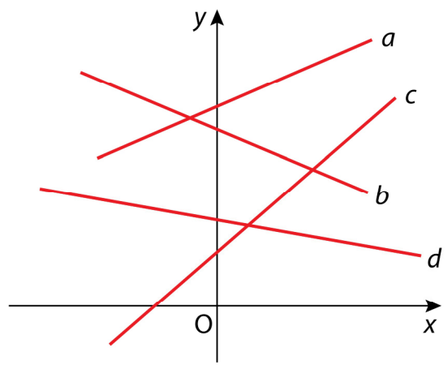
AB is perpendicular to CD as the product of the slopes is -1.

Exercise 3.4

1. The diagram shows four lines a, b, c and d.

(i) Which lines have positive slopes? a and c

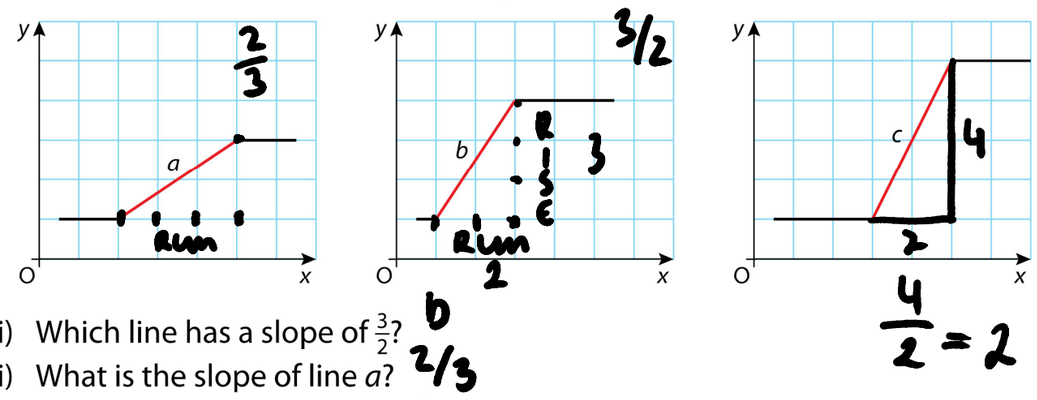
(ii) Which lines have negative slopes? b and d.



Exercise 3.4

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

2. Three lines a, b and c are drawn on the grids below:



(i) Which line has a slope of $\frac{3}{2}$? b

(ii) What is the slope of line a? 2/3

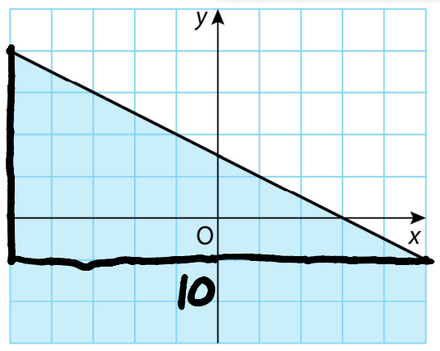
(iii) What is the slope of line c? 2

Exercise 3.4

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

3. Why is the slope of the given line negative?
Use the grid to work out the slope of the line.

$-\frac{5}{10} = -\frac{1}{2}$ 5



Exercise 3.4

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

4. Find the slope of the line AB in each of the following:

(i) A(3, 1) and B(5, 3)
(ii) A(−1, 2) and B(3, −4)
(iii) A(−1, −3) and B(0, 5)
(iv) A(3, 0) and B(−1, −4)
(v) A(−3, 2) and B(−5, 0)
(vi) A(−5, 1) and B(−2, 3).

$\frac{-4-2}{3+1} = \frac{-6}{4} = -\frac{3}{2}$

iii) $\frac{5+3}{0+1} = \frac{8}{1} = 8$

iv) $\frac{-4-0}{-1-3} = \frac{-4}{-4} = 1$

v) $\frac{0-2}{-5+3} = \frac{-2}{-2} = 1$

vi) $\frac{3-1}{-2+5} = \frac{2}{3}$

Exercise 3.4

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

5. Show that the line passing through A(−1, −2) and B(3, 0) has the same slope as the line passing through C(2, 3) and D(−2, 1).
What can you say about the lines AB and CD?

AB $\frac{0+2}{3+1} = \frac{2}{4} = \frac{1}{2}$

CD: $\frac{1-3}{-2-2} = \frac{-2}{-4} = \frac{1}{2}$

Exercise 3.4

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

6. ℓ contains the points (1, 1) and (2, 4).
m contains the points (4, 1) and (3, −2).
Investigate if ℓ is parallel to m.

ℓ: $\frac{4-1}{2-1} = \frac{3}{1} = 3$

m: $\frac{-2-1}{3-4} = \frac{-3}{-1} = 3$

$3 // 3$
$m // \ell$

Exercise 3.4

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

7. A(−2, −4), B(5, −1), C(6, 4) and D(−1, 1) are the vertices of a quadrilateral. Draw a rough sketch of the figure. Now verify that AB||CD and AD||BC.

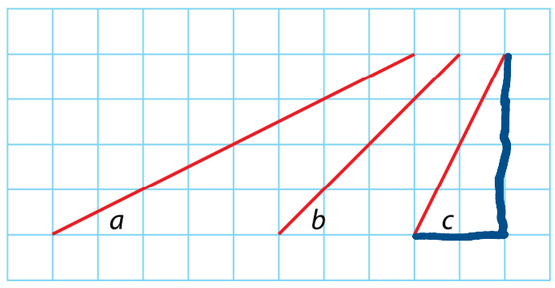
Exercise 3.4

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

8. The given diagram shows three lines *a*, *b*, and *c*. Match the lines with these slopes:

2, $\frac{1}{2}$, 1.

c a b



$a = \frac{4}{8} = \frac{1}{2}$

$b = \frac{4}{4} = 1$

$c = \frac{4}{2} = 2$