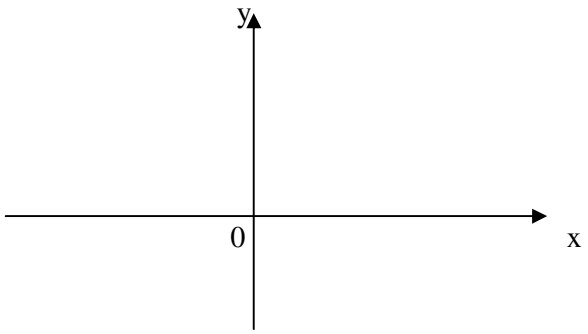
Coordinate geometry is the study of the geometric properties of points, straight lines and curves using algebraic methods. We get familiar with the idea of a point P in a plane being defined by stating the perpendicular distances from P to two axes. The point P has coordinates (x, y).



Distance between two points

The length of the line joining the point $A[x_1, y_1]$ to $B[x_2, y_2]$ is given by

$$\sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$$

Mid-point of a line joining two points

The mid-point of the line joining $A[x_1, y_1]$ to $B[x_2, y_2]$ has coordinates $\left(\frac{x1 + x2}{2}, \frac{y1 + y2}{2}\right)$

Gradient of a line joining two points

Gradient of a line joining two points $A[x_1, y_1]$ and $B[x_2, y_2]$ is a measure of the steepness of the line **AB** and it is the ratio of the change in the y-coordinate to the change in the x-coordinate in going from A to B: $\frac{y2 - y1}{x2 - x1}$.

If the gradient is positive, the line is sloping upwards, i.e. as we proceed along the line in the direction of increasing x, y also increases.

If the gradient is negative, it is sloping downwards, i.e. as we proceed along the line in the direction of increasing x, y decreases.

Parallel and perpendicular lines

The gradient of a line is a measure of its 'steepness'.

- Two parallel lines are equally steep so they will have equal gradients.

- If two lines are perpendicular, the product of their gradients is –1. This condition means that if one line has a gradient m, a perpendicular line will have a gradient $-\frac{1}{m}$.

Thus the following pairs of gradients all apply to pairs of perpendicular lines:

2 and $-\frac{1}{2}$, $\frac{2}{3}$ and $-\frac{3}{2}$.

The equation y = mx + c

This equation is called the general Cartesian equation of a straight line. All straight lines have equations which can be written in the form y = mx + c where m is the gradient and (0, c) is the point at which the line cuts the y-axis.

When we are familiar with the value of the gradient and the points where the line intersects the y-axis we can sketch the line.

DIRECT AND INVERSE PROPORTION

A *ratio* compares the size of two or more quantities 3:4, 1 : 4 : 2. In the ratio 3:4, the **numbers of parts** are 3 and 4.

The ratios 3 : 4 and 6 : 8 are *equivalent ratios.* To write an equivalent ratio multiply or divide each number of parts by the same number.

A ratio in its simplest terms, or lowest terms, is written with the smallest whole numbers possible.

Two or more ratios can be compared by writing each one as a **unitary ratio** in the form **n : 1** or **1 : n**. If the ratios are equivalent, we say they are in **proportion**.

If two variables x and y are proportional to each other, then they are in **direct** proportion. The relationship between the variables can be given as: **y = kx** where k is a constant.

When two variables are directly proportional, an increase in one matches an increase in the other.

Two variables x and y are in **inverse** proportion when one of the variables is in direct proportion to the reciprocal of the other. The relationship between the variables can be given as: **y =** $\frac{k}{x}$ or xy = k, where k is a constant.

When two variables are inversely proportional, an increase in one matches a decrease in the other.