

Need to Know

The Line 1

Notation

Every point has two parts (x, y) called the coordinates.

The x coordinate always comes first and on a diagram tells us to go left (if negative) or right (if positive).

The y coordinate comes second and tells us to go down (if negative) or up (if positive).

Points are named using lower case letters.

Lines are named using capital letters.

With each one of the formulae we must follow the steps

- Step 1 Write down the points from the question.
- Step 2 Label the points (x_1, y_1) and (x_2, y_2) .
- Step 3 Write down the formula.
- Step 4 Put the figures into the formula and work it out.

Note As usual you must take a lot of care with signs.

Distance

Distance between two points (x_1, y_1) and (x_2, y_2) is given by

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

Note $|ab|$ means the distance from a to b .

Midpoint

The midpoint between two given points is

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

If $a(3,7)$ is the midpoint of $[pq]$ where $p(6,5)$ find q .

We can do this using central symmetry.

The Line 2

Slope between two points

Slope of a line between two given points is given by

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

Note Always leave slope as a whole number or a fraction.

To find the slope of a given line

Slope of the line $ax + by + c = 0$ is $m = -\frac{a}{b}$

Note To find the slope of a line it comes down to

Slope = minus $\frac{\text{number in front of } x}{\text{number in front of the } y}$

Note If there is no number in front of the x then the number in front is 1.

Parallel and Perpendicular Lines

If two lines are parallel $M \parallel L$ then the slopes are equal then $m_1 = m_2$.

If two lines are perpendicular $L \perp M$ then $m_1 m_2 = -1$.

Note If we are given a slope and asked to find a parallel slope then the answer is the exact same as first slope.

Note If we are given a slope and asked to find a perpendicular slope then the answer is got by inverting and changing sign of original slope.

To show a point is on a line

Put the given values of x and y into the line and it should satisfy the line i.e. should work out.

To draw a line

Find where it cuts (intercept) the x axis. On x - axis $y = 0$

Find where it cuts (intercept) the y axis. On y - axis $x = 0$

The method here comes down to two parts

To find where a line cuts the x - axis put $y = 0$ into the equation and get a value for x .

To find where a line cuts the y - axis put $x = 0$ into the equation and get a value for y .

Note Remember we need only 2 points to draw a line.

Special Lines

Lines that are horizontal have equation $y =$

Lines that are vertical have equation $x =$

The Line 3

Equation of a line

The equation of a line is given by

$$y - y_1 = m(x - x_1)$$

To be able to use this formula we must be given two pieces of information

- (a) one point on the line
- (b) slope of the line

To find the equation of a line given two points on the line

Step 1 Find slope between two given points.

Step 2 Using one point and slope find equation of line.

To find the equation of a line parallel or perpendicular to another line.

Step 1 Find the slope of the given line.

Step 2 Find the slope of the required line.

Step 3 Use the equation of the line formula.

To find where two lines meet

Use simultaneous equations as from algebra.

The Line 4

Area of a triangle

There are two different types of questions they can ask here but both will use the formula

$$\text{Area} = \frac{1}{2} \text{base} \times \text{perpendicular height}$$

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To move a point under a given Translation

Always attempt to make a rule out of the given translation

Central symmetry

Definition – move through a point and go the same distance again the other side.

Axial Symmetry

Definition – move through a line at right angles and go the same distance again the other side.

Axial symmetry in the x -axis = change the sign of y

Axial symmetry in the y -axis = change the sign of x

Central symmetry in the origin = change the sign of x and y .

Find equation of a point p under axial symmetry in a line L .

Step 1 Find the equation of line M perpendicular to L through p .

Step 2 Find point q of intersection of L and M .

Step 3 Find the image of point p under central symmetry in q .