

Co-Ordinate Geometry

Quick revision notes [Open it online](#)

Name: _____

Date: _____

At a glance

Coordinates, gradient, length and midpoint, $y = mx + c$, and parallel and perpendicular lines.

1. Coordinates and straight-line graphs
2. Gradient
3. Length and midpoint
4. The equation $y = mx + c$
5. Parallel and perpendicular lines

1. Coordinates and straight-line graphs

☐ I revised this

- (x, y) : across first, then up. Points can be in any of the four quadrants.
- Draw a line from its equation with a table of three x values (three points catch mistakes).
- $x = a$ is a **vertical** line; $y = b$ is a **horizontal** line.
- A line crosses the y -axis where $x = 0$ and the x -axis where $y = 0$.

Worked example

Find where $3x + 2y = 12$ crosses the axes.

1. $x = 0$: $2y = 12 \rightarrow y = 6$.

2. $y = 0$: $3x = 12 \rightarrow x = 4$.

(0, 6) and (4, 0)

2. Gradient

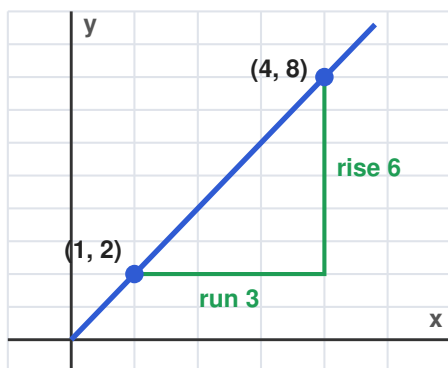
☐ I revised this

- Gradient = change in $y \div$ change in x (rise over run).
- Uphill left to right $\rightarrow$ positive; downhill $\rightarrow$ negative; horizontal $\rightarrow 0$; vertical $\rightarrow$ undefined.
- From a graph: pick two points exactly on grid corners, far apart.

Formulas

$$m = (y_2 - y_1) / (x_2 - x_1)$$

gradient between two points



Rise 6, run 3: gradient $6 \div 3 = 2$.

Worked example

Find the gradient of the line through $(-1, 7)$ and $(3, -5)$.

1. Change in y : $-5 - 7 = -12$.
2. Change in x : $3 - (-1) = 4$.
3. $-12 \div 4$.

-3

3. Length and midpoint

☐ I revised this

- Midpoint: average the x 's and average the y 's.
- Length: draw the right-angled triangle and use Pythagoras on the run and the rise.

Formulas

$M = ((x_1 + x_2)/2, (y_1 + y_2)/2)$	midpoint
$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	length

Worked example

A is $(-2, 1)$ and B is $(4, 9)$. Find the midpoint and the length of AB.

1. Midpoint: $((-2 + 4)/2, (1 + 9)/2) = (1, 5)$.
2. Run 6, rise 8: $\sqrt{(36 + 64)} = \sqrt{100}$.

Midpoint (1, 5); length 10

4. The equation $y = mx + c$

☐ I revised this

- m is the gradient; c is where the line cuts the y -axis.
- Rearrange to $y = \dots$ before reading m : $2y = 6x + 4 \rightarrow y = 3x + 2$, so $m = 3$.
- Through a point with gradient m : substitute the point into $y = mx + c$ to find c (or use $y - y_1 = m(x - x_1)$).
- Through two points: find m first, then c .

How to do it

1. Find m (from two points if needed).
2. Substitute one point into $y = mx + c$.
3. Solve for c .
4. Write $y = mx + c$.

Worked example

Find the equation of the line through $(2, 7)$ and $(5, 13)$.

1. $m = (13 - 7) \div (5 - 2) = 2$.
2. $7 = 2(2) + c \rightarrow c = 3$.

$y = 2x + 3$

5. Parallel and perpendicular lines

☐ I revised this

- Parallel lines have the **same gradient**.
- Perpendicular gradients multiply to -1 : flip the fraction and change the sign ($2/3 \rightarrow -3/2$).
- Perpendicular bisector of AB: passes through the midpoint of AB, with gradient perpendicular to AB.

Formulas

$$m_1 = m_2$$

parallel

$$m_1 \times m_2 = -1$$

perpendicular

Worked example

A(1, 2) and B(5, 4). Find the equation of the perpendicular bisector of AB.

1. Midpoint (3, 3).

2. Gradient of AB = $2/4 = 1/2$, so perpendicular gradient -2 .

3. $3 = -2(3) + c \rightarrow c = 9$.

$$y = -2x + 9$$

Common mistakes

Don't write	Write instead
$\times$ Run over rise: $(x_2 - x_1)/(y_2 - y_1)$	$\checkmark$ Always y on top: change in y $\div$ change in x
$\times$ Reading m from $2y = 6x + 4$ as 6	$\checkmark$ Make y the subject first: $y = 3x + 2$, so $m = 3$
$\times$ Perpendicular to $m = 2$ written as -2	$\checkmark$ Flip it too: $-1/2$
$\times$ $3 - (-2) = 1$	$\checkmark$ $3 - (-2) = 5$. Put negatives in brackets

In the exam

- None of the gradient, midpoint or length formulas are given — learn them.
- Sketch the points roughly first: it shows whether the gradient should be positive or negative.
- Leave a length as a surd if the question asks for an exact answer.

My notes

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