Your notes

Level 2 Further Maths: revision notes

Straight lines, midpoints and perpendicular lines

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Gradient, midpoint and distance

- **Gradient** $m = (y_2 - y_1) \div (x_2 - x_1)$. From A(2, 3) to B(6, 11), $m = 8 \div 4 = 2$.
- **Midpoint** $= ((x_1 + x_2) \div 2, (y_1 + y_2) \div 2)$. The **midpoint** of AB is (4, 7).
- Distance $= \sqrt{((x_2 - x_1)^2 + (y_2 - y_1)^2)}$. AB $= \sqrt{(4^2 + 8^2)} = \sqrt{80} = 4\sqrt{5}$.

Equations of lines

- $y = mx + c$, where m is the **gradient** and c is the **y-intercept**.
- Through a point (x_1, y_1) with **gradient** m: $y - y_1 = m(x - x_1)$. Through (1, 5) with **gradient** 2: $y - 5 = 2(x - 1)$, so $y = 2x + 3$.
- For a line like $2x + 3y = 12$, rearrange to $y = -(2/3)x + 4$ to read off the **gradient** (–2/3) and the **y-intercept** (4).

Parallel and perpendicular lines

- **Parallel** lines have equal **gradients**.
- **Perpendicular** lines have **gradients** that multiply to –1: $m_1 \times m_2 = -1$. The **perpendicular** gradient to 3 is –1/3; to –2/5 it is 5/2.
- The **perpendicular bisector** of AB passes through the **midpoint** of AB at right angles. For A(2, 3) and B(6, 11): **midpoint** (4, 7), gradient –1/2, so $y - 7 = -(1/2)(x - 4)$, giving $y = -(1/2)x + 9$.

Dividing a line in a ratio

- To find P dividing AB in the ratio 1 : 2, go 1/3 of the way from A to B. For A(1, 2) and B(7, 11): P = (1 + 6/3, 2 + 9/3) = (3, 5).

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Key terms

Gradient	The steepness of a line: change in y divided by change in x.
y-intercept	Where a line crosses the y-axis.
Midpoint	The point halfway between two points.
Parallel	Lines with equal gradients that never meet.
Perpendicular	Lines at right angles, whose gradients multiply to –1.
Perpendicular bisector	A line through the midpoint of a segment at right angles to it.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is the gradient of the line through (2, 3) and (6, 11)?
2. What is the midpoint of (2, 3) and (6, 11)?
3. What is the distance between (1, 2) and (4, 6)?
4. What is the gradient of a line perpendicular to one with gradient 3?
5. What is the gradient of a line parallel to $y = 4x - 1$?
6. What is the equation of the line through (1, 5) with gradient 2?
7. Which point divides the line from (1, 2) to (7, 11) in the ratio 1 : 2?
8. Where does $2x + 3y = 12$ cross the y-axis?

Answers

1. 2
2. (4, 7)
3. 5
4. –1/3
5. 4
6. $y = 2x + 3$
7. (3, 5)
8. (0, 4)

What to do next

Practise 10 questions on this topic

Try 3 exam questions, with mark schemes

Read the lesson, one step at a time

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