JUNIOR CYCLE MATHS · FREE REVISION SHEET

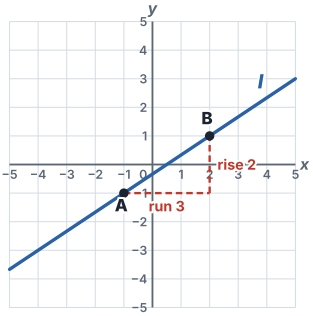
Coordinate geometry of the line

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Learning outcomes (2018 specification): GT.5a, GT.5b, GT.5c. Play the game: **leim.ie/line-lab.html**

1. Slope

The **slope** m is **rise ÷ run**: how far the line goes up for each step across. A(−1, −1) to B(2, 1): run 3, rise 2, slope **2/3**.



$m = (y_2 - y_1) \div (x_2 - x_1)$

Rises left to right: **positive**. Falls: **negative**. Flat: **zero**.

In a real graph the slope is the **rate** (€ per km, litres per minute) and the point on the y-axis is the **starting value** (a fixed charge).

2. Midpoint and distance

Midpoint	Distance
$((x_1 + x_2) \div 2, (y_1 + y_2) \div 2)$ add, then halve	$\sqrt{((x_2 - x_1)^2 + (y_2 - y_1)^2)}$ it's Pythagoras

(1, 2) to (4, 6): across 3, up 4, distance $\sqrt{(9 + 16)} = \mathbf{5}$. Midpoint (2.5, 4).

3. The equation of a line

y = mx + c: m is the slope, the line meets the y-axis at **(0, c)**. Get y on its own first: y = 6 − 3x has slope **−3**.

$y - y_1 = m(x - x_1)$: one point and the slope. Through (2, 5), slope 3: y − 5 = 3(x − 2) → **y = 3x − 1**.

Two points: find the slope first, then use either point.

On the line? Put in x; if you get the point's y, yes. **Axes:** x = 0 on the y-axis, y = 0 on the x-axis.

4. Parallel, perpendicular, meeting

Parallel lines have the **same slope**. **Where lines meet:** read the crossing point, then check it in both equations.

Higher Level: perpendicular slopes multiply to −1 (flip and change the sign: 2/3 → −3/2). **ax + by + c = 0**: get y on its own; slope = −a ÷ b.

Classic mistakes: run ÷ rise · losing a minus (5 − (−2) = 7) · subtracting for the midpoint · 3 + 4 instead of $\sqrt{(3^2 + 4^2)}$ · reading c as the slope · not getting y on its own first.

Exam tip: write the formula, label (x_1, y_1) and (x_2, y_2), use brackets for negatives, and check your equation with the points you were given.

PRACTICE · 34 QUESTIONS

Have a go

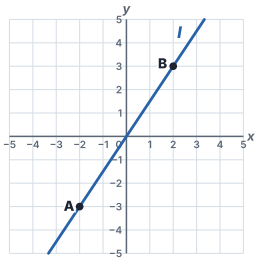
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A. Midpoint and distance

1. Find the midpoint of (2, 5) and (6, 1). _____
2. Find the midpoint of (−3, 4) and (5, −2). _____
3. Find the midpoint of (−1, −6) and (4, 0). _____
4. M(2, 1) is the midpoint of [AB] and A is (−1, 3). Find B. _____
5. Find the distance between (1, 2) and (4, 6). _____
6. Find the distance between (−2, 3) and (4, −5). _____
7. Find the distance between (0, 0) and (3, 5), to 1 decimal place. _____
8. P is (−4, 1) and Q is (2, 4). Find |PQ| to 1 decimal place. _____

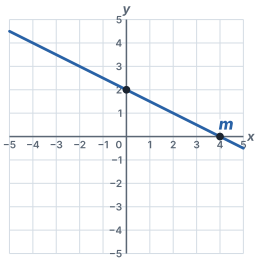
B. Slope

9. Find the slope of the line through (1, 2) and (3, 8). _____
10. Find the slope of the line through (−2, 5) and (2, −3). _____
11. Find the slope of the line through (0, −1) and (6, 3). _____
12. Find the slope of the line through (−4, −2) and (5, −2). _____
13. Use the diagram. Find the slope of the line l. _____
14. The line through (2, k) and (5, 10) has slope 2. Find k. _____
15. A taxi's fares are shown by a straight-line graph through (0, 5) and (10, 25), x in km and y in euro. Find the slope and say what it means. _____
16. What does the point (0, 5) on the taxi graph tell you? _____



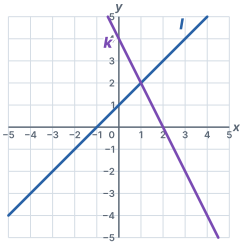
C. The equation of a line

17. Write down the slope of y = 4x − 7 and the point where it meets the y-axis. _____
18. What is the slope of the line y = 6 − 3x? _____
19. Find the equation of the line through (2, 5) with slope 3. _____
20. Find the equation of the line through (−1, 4) with slope −2. _____
21. Find the equation of the line through (1, 1) and (3, 7). _____
22. Is the point (3, 5) on the line y = 2x − 1? Show how you know. _____
23. Use the diagram. Find the equation of the line m. _____
24. Where does the line y = 3x − 6 cross the x-axis? _____



D. Parallel, perpendicular and meeting

25. What is the slope of any line parallel to y = 5x + 2? _____
26. Find the equation of the line through (0, −3) parallel to y = 2x + 7. _____
27. Find the equation of the line through (2, 1) parallel to y = −x + 4. _____
28. Use the diagram. Where do the lines l and k meet? _____
29. Higher Level: what is the slope of a line perpendicular to y = ⅔x − 1? _____
30. Higher Level: find the slope of the line 2x + 5y − 10 = 0. _____



Questions 31–34 are on the next page.

EXAM-STYLE · THEN CHECK

Exam corner + answers

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E. Exam-style questions (show your work)

31. **The segment [AB].** A is (−2, 7) and B is (4, −5). (a) Find the midpoint of [AB]. (b) Find the slope of AB. (c) Find |AB| to 1 decimal place. (d) Find the equation of AB. (e) Is (5, −7) on the line AB?

32. **Filling a tank.** A straight-line graph of the water in a tank goes through (0, 30) and (8, 190), with x in minutes and y in litres. (a) Find the slope and say what it means. (b) What does (0, 30) tell you? (c) Write the equation of the line. (d) When will the tank hold 250 litres?

33. **Two lines.** l: y = 2x − 1 and k: y = −x + 5. (a) Write down the slope of each line. (b) Show that (2, 3) is on both lines. (c) Where does k cross the x-axis? (d) Find the equation of the line through (0, 4) parallel to l.

34. **Higher Level.** The line p is 3x − y + 2 = 0. (a) Write p in the form y = mx + c. (b) Find the slope of a line perpendicular to p. (c) Find the equation of the line through (3, 0) perpendicular to p. (d) Is (6, −1) on the line in (c)?

Answers

A	1. (4, 3) · 2. (1, 1) · 3. (1.5, −3) · 4. (5, −1) · 5. 5 · 6. 10 · 7. 5.8 · 8. 6.7
B	9. 3 · 10. −2 · 11. 2/3 · 12. 0 · 13. 3/2 · 14. 4 · 15. 2: €2 per km · 16. a €5 fixed charge
C	17. 4; (0, −7) · 18. −3 · 19. y = 3x − 1 · 20. y = −2x + 2 · 21. y = 3x − 2 · 22. yes: 2 × 3 − 1 = 5 · 23. y = −½x + 2 · 24. (2, 0)
D	25. 5 · 26. y = 2x − 3 · 27. y = −x + 3 · 28. (1, 2) · 29. −3/2 · 30. −2/5
E	31. (a) **(1, 1)** (b) **−2** (c) √180 = **13.4** (d) **y = −2x + 3** (e) **yes**: −2 × 5 + 3 = −7 · 32. (a) **20**: 20 litres per minute (b) **30 litres** at the start (c) **y = 20x + 30** (d) 20x + 30 = 250, **11 minutes** · 33. (a) **2** and **−1** (b) 2 × 2 − 1 = 3 ✓, −2 + 5 = 3 ✓ (c) **(5, 0)** (d) **y = 2x + 4** · 34. (a) **y = 3x + 2** (b) **−1/3** (c) **y = −⅓x + 1** (d) **yes**: −⅓ × 6 + 1 = −1

Got one wrong? Check: rise on top, run underneath? Brackets round the negatives? Did you get y on its own first? Then play **Line Lab** at leim.ie/line-lab.html: the "Go back over these" list at the end shows the rule for each mistake.

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