JUNIOR CYCLE MATHS · FREE REVISION SHEET

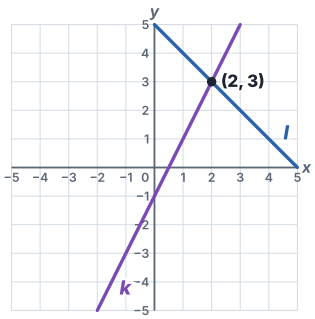
Simultaneous equations

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Learning outcomes (2018 specification): AF.4, U.6. Play the game: **leim.ie/two-line-crossing.html**

1. What is the solution?

Each equation on its own has lots of answers. The **solution** is the one pair (x, y) that fits **both**. On a graph it's where the lines **cross**: x + y = 5 (l) and y = 2x − 1 (k) cross at **(2, 3)**.



2. Elimination

Make the x's or y's the same size, then **signs different → add, signs the same → subtract**.

① 2x + 3y = 12 ② 5x − 2y = 11
① × 2: 4x + 6y = 24 ② × 3: 15x − 6y = 33
Add: 19x = 57, x = 3. In ①: 6 + 3y = 12, y = 2
Check ②: 15 − 4 = 11 ✓

Multiply **every** term, including the number on the right.

3. Substitution

When one equation says **y = …**, put it into the other. **Keep the bracket.**

① y = 2x − 3 ② 3x + 2y = 15
3x + 2(2x − 3) = 15 → 7x − 6 = 15 → x = 3
y = 2(3) − 3 = 3. Check ②: 9 + 6 = 15 ✓

4. Word problems

Say what x and y stand for, make **one equation from each fact**, solve, then answer in words. 120 tickets, adults €8, children €5, €801: x + y = 120 and 8x + 5y = 801 → 67 adults, 53 children.

5. Higher Level

Fractions in an equation: multiply every term by the common denominator (x/2 + y/3 = 4 → 3x + 2y = 24). Answers can be fractions (x = 3/2).

Classic mistakes: adding when the signs are the same · not multiplying the number on the right · dropping the bracket in substitution · finding x but not y · a pair that fits only one equation.

Exam tip: label the equations ① and ②, write each step ("① × 2", "① + ②"), find both letters, and write the check in the other equation.

PRACTICE · 32 QUESTIONS

Have a go

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A. Check and substitute

1. Is x = 3, y = 1 a solution of x + y = 4 and 2x − y = 5? _____
2. Is x = 2, y = 5 a solution of 3x + y = 11 and x − y = −2? _____
3. 2x + 3y = 19 and x = 5. Find y. _____
4. x − 4y = 2 and y = −1. Find x. _____
5. Which of (1, 6), (2, 4) and (3, 2) fits both 2x + y = 8 and x + y = 5? _____
6. Two numbers add up to 10 and their difference is 4. Find them. _____

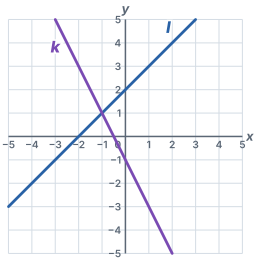
B. Elimination: solve each pair

7. x + y = 7 and x − y = 3
8. 2x + y = 11 and 3x − y = 9
9. 3x + 2y = 16 and x + 2y = 8
10. 5x + y = 17 and 2x + y = 8
11. 4x − 3y = 10 and 2x + 3y = 14
12. 2x + 3y = 12 and 5x − 2y = 11
13. 3x + 4y = 10 and x + 2y = 4
14. 2x + 5y = 1 and 3x − 2y = 11
15. 4x + 3y = 5 and 3x + 2y = 4
16. x − 3y = −11 and 2x + y = 6

C. Substitution and graphs

17. y = 3x + 1 and 2x + y = 11 _____
18. y = −2x + 7 and 3x + y = 12 _____
19. y = x − 4 and 5x − 2y = −1 _____
20. Use the graph. Write down the solution of the equations of l and k. _____
21. Check your answer to question 20 in both equations: l is y = x + 2, k is 2x + y = −1.

    _____
22. Solve y = x + 1 and y = 3x − 5 (they are equal, so x + 1 = 3x − 5). _____



D. Word problems and Higher Level

23. A school show sold 120 tickets: adults €8, children €5. The takings were €801. Write two equations, then find how many of each ticket were sold. _____
24. 2 coffees and 1 scone cost €7. 1 coffee and 3 scones cost €11. Find the price of each. _____
25. Two numbers add up to 30. One is 8 more than the other. Find them. _____
26. A farmer has 40 hens and sheep. Between them they have 110 legs. How many of each? (Hint: 2x + 4y = 110.)

    _____
27. Higher Level: solve x/2 + y/3 = 4 and x − y = 3. _____
28. Higher Level: solve 2x + 4y = 7 and 2x − 2y = 1. _____

Questions 29–32 are on the next page.

EXAM-STYLE · THEN CHECK

Exam corner + answers

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E. Exam-style questions (show your work)

29. **Solve and check.** Solve 3x − 2y = 4 and 5x + 3y = 13. Check your answer in both equations.

30. **Graph and algebra.** On a grid, draw the lines y = x + 1 and y = −x + 5 for x from 0 to 5. (a) Write down where they cross. (b) Solve the equations with algebra to check.

31. **Match tickets.** 200 people went to a match. Adult tickets cost €12 and child tickets cost €7. The takings were €1,890. (a) Write two equations. (b) How many children went?

32. **Substitution.** (a) Solve y = 2x − 1 and 4x − 3y = 1. (b) Higher Level: solve 3x/2 − y = 2 and x + y/2 = 6.

Answers

A	1. yes: 3 + 1 = 4 ✓, 6 − 1 = 5 ✓ · 2. no: 6 + 5 = 11 ✓ but 2 − 5 = −3 × · 3. 3 · 4. −2 · 5. (3, 2) · 6. 7 and 3
B	7. x = 5, y = 2 · 8. x = 4, y = 3 · 9. x = 4, y = 2 · 10. x = 3, y = 2 · 11. x = 4, y = 2 · 12. x = 3, y = 2 · 13. x = 2, y = 1 · 14. x = 3, y = −1 · 15. x = 2, y = −1 · 16. x = 1, y = 4
C	17. x = 2, y = 7 · 18. x = 5, y = −3 · 19. x = −3, y = −7 · 20. x = −1, y = 1 · 21. −1 + 2 = 1 ✓ and −2 + 1 = −1 ✓ · 22. x = 3, y = 4
D	23. x + y = 120, 8x + 5y = 801: 67 adult, 53 child · 24. coffee €2, scone €3 · 25. 19 and 11 · 26. 25 hens, 15 sheep · 27. x = 6, y = 3 · 28. x = 3/2, y = 1
E	29. × 3 and × 2: 9x − 6y = 12, 10x + 6y = 26; add: 19x = 38, **x = 2**, **y = 1**. Check: 6 − 2 = 4 ✓, 10 + 3 = 13 ✓ · 30. (a) **(2, 3)** (b) x + 1 = −x + 5 → 2x = 4 → x = 2, y = 3 ✓ · 31. (a) x + y = 200, 12x + 7y = 1890 (b) 5x = 490, x = 98 adults, so **102 children** · 32. (a) 4x − 3(2x − 1) = 1 → −2x + 3 = 1 → **x = 1**, **y = 1**. Check: 4 − 3 = 1 ✓ (b) × 2: 3x − 2y = 4 and 2x + y = 12; y = 12 − 2x → 7x = 28: **x = 4, y = 4**

Got one wrong? Check: did you add when the signs were different and subtract when they were the same? Did you multiply every term? Does your answer fit BOTH equations? Then play **Two-Line Crossing** at leim.ie/two-line-crossing.html: the "Go back over these" list at the end shows the rule for each mistake.

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