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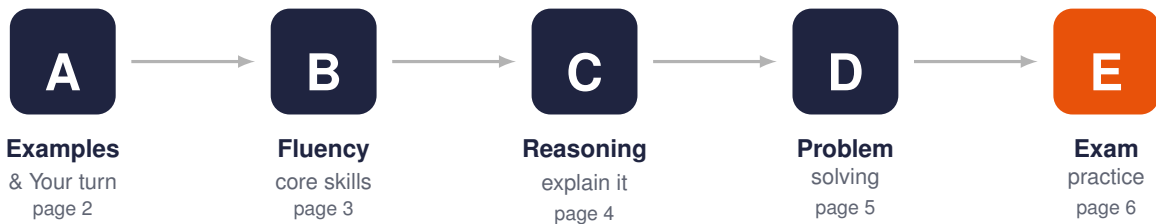
GCSE MATHEMATICS • ALGEBRA

Linear Graphs

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Full worked solutions for the free Linear Graphs worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Linear Graphs worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

Question sheet

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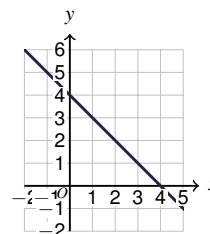
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A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

- A1** Table: $x = -1, 0, 1, 2, 3, 4$ gives $y = 5, 4, 3, 2, 1, 0$
Plot the points and join them with a ruler.



A2 $\frac{-3-5}{2-(-2)} = \frac{-8}{4} = -2$

A3 Gradient = $\frac{-1-7}{3-(-1)} = -2$, so $y = -2x + c$. Substitute $(-1, 7)$: $7 = 2 + c$, so $c = 5$ $y = -2x + 5$

HIGHER

A4 $3y = 6x + 9$ $y = 2x + 3$ gradient 2 , y-intercept 3

A5 Perpendicular gradient = $-1 \div \left(-\frac{1}{2}\right) = 2$. Substitute $(1, 5)$: $5 = 2 + c$, so $c = 3$ $y = 2x + 3$

A6 Midpoint $(1, -1)$. Gradient of $AB = \frac{-4}{6} = -\frac{2}{3}$, so the bisector has gradient $\frac{3}{2}$

$-1 = \frac{3}{2} + c$, so $c = -\frac{5}{2}$ $y = \frac{3}{2}x - \frac{5}{2}$

A7 $\frac{7-2}{3-1} = \frac{5}{2}$ $\frac{11-2}{5-1} = \frac{9}{4}$ The gradients are different, so **no**, they are not on a straight line.



B**Fluency solutions**

One mark for each correct part. The notes in *italics* explain why each sequence was chosen.

FOUNDATION

B1 (a) 2 (b) -7 (c) $3x = 15$: 5 (d) $3 \times 4 - 4 = 8$, not 7, so **no**

B2 (a) **4 and 1** (b) **-4 and 1** (c) **4 and 0** (d) **0 and 4**

The gradient is the number multiplying x , wherever it is written.

B3 (a) 3 (b) -3 (c) $\frac{2}{4} = \frac{1}{2}$ (d) 0 *(d) is horizontal: y does not change.*

B4 (a) $y = 2x + 3$ (b) $3 = 2 + c$: $y = 2x + 1$ (c) $1 = -6 + c$: $y = -3x + 7$ (d) $0 = 2 + c$: $y = \frac{1}{2}x - 2$

B5 (a) $y = 5x + 7$ (b) $1 = -3 + c$: $y = -x + 4$ (c) $y = \frac{1}{2}x + 3$ has gradient $\frac{1}{2}$; $5 = 1 + c$: $y = \frac{1}{2}x + 4$

B6 A: $y = x + 1$ B: $y = -2x + 4$ C: $y = 3$ D: $x = -3$

HIGHER

B7 (a) $y = 3x + 4$: **3 and 4** (b) **3 and 5** (c) $y = -\frac{2}{5}x + 2$: $-\frac{2}{5}$ and 2 (d) $y = \frac{3}{4}x - 3$: $\frac{3}{4}$ and -3

B8 (a) $-\frac{1}{3}$ (b) 2 (c) $-\frac{3}{2}$ (d) gradient $-\frac{2}{3}$, so $\frac{3}{2}$ *Flip the fraction and change the sign.*

B9 (a) $y = -\frac{1}{2}x + 4$ (b) $5 = -1 + c$: $y = -\frac{1}{2}x + 6$ (c) $0 = 1 + c$: $y = \frac{1}{3}x - 1$ (d) $1 = 2 + c$: $y = 2x - 1$

B10 (a) **parallel**: both have gradient 2 (b) **perpendicular**: $2 \times \left(-\frac{1}{2}\right) = -1$

(c) **neither**: $3 \times \frac{1}{3} = 1$, not -1 (d) **perpendicular**: $-\frac{2}{3} \times \frac{3}{2} = -1$



C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

- C1** 7 is the y -intercept. The gradient is the number multiplying x : -2
- C2** Jo divided the change in x by the change in y . It should be change in y over change in x : $\frac{10-4}{3-1} = 3$
- C3** (a) $3 \times 4 - 2 = 10$, not 9, so **no** (b) $13 = 3k - 2$, $3k = 15$: $k = 5$
- C4** Both lines have gradient 2, so they are parallel. They have different y -intercepts, so they are not the same line, and parallel lines never meet.

HIGHER

- C5** Perpendicular gradients multiply to -1 . $4 \times (-4) = -16$. The correct gradient is $-\frac{1}{4}$, since $4 \times \left(-\frac{1}{4}\right) = -1$
- C6** Gradient $AB = \frac{3-1}{4-1} = \frac{2}{3}$ Gradient $BC = \frac{6-3}{2-4} = -\frac{3}{2}$ $\frac{2}{3} \times \left(-\frac{3}{2}\right) = -1$, so AB is perpendicular to BC : a right angle at B
- C7** $AB: \frac{2}{4} = \frac{1}{2}$ $DC: \frac{6-4}{5-1} = \frac{1}{2}$ so $AB \parallel DC$ $AD: \frac{4}{1} = 4$ $BC: \frac{6-2}{5-4} = 4$ so $AD \parallel BC$
Both pairs of opposite sides are parallel, so $ABCD$ is a parallelogram.
- C8** (a) $2x + 1 = kx - 3$ $4 = kx - 2x = x(k - 2)$ so $x = \frac{4}{k - 2}$ **as required**
- (b) The lines meet the y -axis at $(0, 1)$ and $(0, -3)$, so the base on the y -axis is 4. The height is the distance of P from the y -axis.
- Area = $\frac{1}{2} \times 4 \times \left| \frac{4}{k-2} \right| = 8$, so $\left| \frac{4}{k-2} \right| = 4$ and $k - 2 = \pm 1$ $k = 3$ or $k = 1$



D**Problem solving solutions**

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 (a) $\frac{23-3}{10-0} = \boxed{2}$ (b) The fare goes up by £2 for each mile. The y-intercept, £3, is a fixed charge before any miles are travelled.

D2 (a) $\boxed{-25}$: the volume goes down by 25 litres each minute
 (b) $400 - 25t = 0$, $t = \boxed{16}$ minutes (c) At $V = \boxed{400}$, when $t = 0$

D3 Gradient $= \frac{8}{4} = 2$, so $y = 2x + c$. $1 = -2 + c$, so $y = 2x + 3$ $0 = 2x + 3$: $\boxed{(-1.5, 0)}$

D4 AC: gradient 1 through $(1, 1)$: $\boxed{y = x}$ BD: gradient -1 through $(5, 1)$: $1 = -5 + c$: $\boxed{y = -x + 6}$

HIGHER

D5 Gradient $-\frac{3}{2}$ $-1 = -6 + c$, so $\boxed{y = -\frac{3}{2}x + 5}$ Axes: $\boxed{(0, 5)}$ and $\boxed{(\frac{10}{3}, 0)}$

D6 Gradient of $OP = \frac{4}{3}$. The tangent is perpendicular to the radius, so its gradient is $-\frac{3}{4}$

$$4 = -\frac{9}{4} + c, \text{ so } c = \frac{25}{4} \quad \boxed{y = -\frac{3}{4}x + \frac{25}{4}}$$

D7 Gradients: $2x + ky = 5$ gives $-\frac{2}{k}$; $3x - 4y = 1$ gives $\frac{3}{4}$

$$\text{(a)} \quad -\frac{2}{k} \times \frac{3}{4} = -1, \text{ so } \frac{6}{4k} = 1 \quad \boxed{k = \frac{3}{2}} \quad \text{(b)} \quad -\frac{2}{k} = \frac{3}{4} \quad \boxed{k = -\frac{8}{3}}$$

D8 (a) Gradient $-\frac{1}{3}$ through $(7, 0)$: $0 = -\frac{7}{3} + c$ $\boxed{y = -\frac{1}{3}x + \frac{7}{3}}$

$$\text{(b)} \quad 3x - 2 = -\frac{1}{3}x + \frac{7}{3} \quad 9x - 6 = -x + 7 \quad x = 1.3, y = 1.9 \quad \boxed{(1.3, 1.9)}$$

$$\text{(c)} \quad \text{It is the midpoint of } AA': A' = (2.6 - 7, 3.8) = \boxed{(-4.4, 3.8)}$$



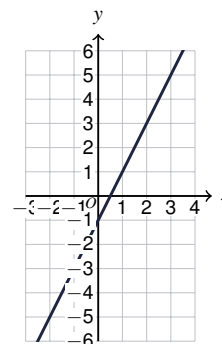
E**Exam practice solutions**

Marks are shown on the right of each line.

FOUNDATION*Foundation and Higher crossover*

E1 (a) y : -5 , -3 , -1 , 1 , 3 , 5

(b) A straight line through all six points



B2 B2

E2 Gradient -3

B1

y-intercept 5

B1

E3 y-intercept 2

B1

Gradient $\frac{8-2}{3-0} = 2$

M1

$y = 2x + 2$

A1

E4 $y = 3x + 1$ and $2y = 6x - 5$

B1

 $2y = 6x - 5$ gives $y = 3x - 2.5$: both have gradient 3

C1

E5 Gradient $= \frac{13-5}{6-2} = 2$

M1

$5 = 4 + c$

M1

$y = 2x + 1$

A1

E6 (a) $y = 0$: $x = 4$ $x = 0$: $y = 6$

M1

$(4, 0)$ and $(0, 6)$

A1

(b) $y = -\frac{3}{2}x + 6$: $-\frac{3}{2}$

B1



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HIGHER

E7 Perpendicular gradient $-\frac{1}{2}$ M1

$$1 = -2 + c$$

M1

$$y = -\frac{1}{2}x + 3$$

A1

E8 Midpoint (2, 5) B1

Gradient $AB = \frac{4}{6} = \frac{2}{3}$, so the bisector has gradient $-\frac{3}{2}$ M1

$$5 = -3 + c$$

M1

$$y = -\frac{3}{2}x + 8$$

A1

E9 $\frac{10-4}{3-1} = 3$ M1

$\frac{19-4}{6-1} = 3$ M1

The same gradient from (1, 4) to each point, so they lie on one straight line C1

E10 L_1 : gradient $\frac{-2-6}{4-0} = -2$, so $y = -2x + 6$ M1

L_2 : gradient $\frac{1}{2}$, and $2 = 1 + c$, so $y = \frac{1}{2}x + 1$ M1

They meet the y-axis at (0, 6) and (0, 1): a base of 5 M1

The third vertex is (2, 2): a height of 2 M1

Area = $\frac{1}{2} \times 5 \times 2 = 5$ units² A1

