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GCSE MATHEMATICS • ALGEBRA

Linear Equations

Worked Solutions

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

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



Tap a section to jump straight to it

Full worked solutions for every question on the Linear Equations 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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A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 $\frac{x}{5} = 7$ $x = 35$

A2 $7 = 5y - 13$ $20 = 5y$ $y = 4$

A3 $5y + 10 - 3 = 2y + 22$ $5y + 7 = 2y + 22$ $3y = 15$ $y = 5$

HIGHER

A4 $5x + 2 = 3(2x - 1)$ $5x + 2 = 6x - 3$ $x = 5$

A5 $\times 12$: $3(x + 2) - 2(x - 3) = 24$ $3x + 6 - 2x + 6 = 24$ $x + 12 = 24$ $x = 12$

A6 $4(x + 2) = 3(x - 1)$ $4x + 8 = 3x - 3$ $x = -11$

A7 $x^2 - 6x + 9 = x^2 + 2x + 1 - 32$ $-6x + 9 = 2x - 31$ $40 = 8x$ $x = 5$

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

B1 (a) $x = 5$ (b) $x = \frac{12}{7}$ (c) $x = 84$ (d) $-x = 5$: $x = -5$

B2 (a) $x = 5$ (b) $3x = 25$: $x = \frac{25}{3}$ (c) $-3x = 15$: $x = -5$ (d) $x + 5 = 60$: $x = 55$

In (d) the whole of $x + 5$ is divided by 3, so multiply by 3 first.

B3 (a) $2x = 8$: $x = 4$ (b) $2x = -12$: $x = -6$ (c) $12 = 3x$: $x = 4$ (d) $15 = 5x$: $x = 3$



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B4 (a) $4x - 12 = 20$: $x = 8$ (b) $4x - 12 = 2x + 8$: $x = 10$ (c) $4x - 12 = 2x + 16$: $x = 14$
 (d) $4x - 12 - 2x + 10 = 10$, $2x - 2 = 10$: $x = 6$

B5 (a) $\frac{x}{4} = 5$: $x = 20$ (b) $x + 3 = 32$: $x = 29$ (c) $3x = 36$: $x = 12$

B6 (a) $3x + 30 = 180$: $x = 50$ (b) $4x + 20 = 180$: $x = 40$ (c) $4x - 3 = 29$: $x = 8$ (d) $12x - 8 = 40$: $x = 4$

HIGHER

B7 (a) $2x + 5 = 3x$: $x = 5$ (b) $2x + 5 = 3x - 3$: $x = 8$ (c) $4x + 10 = 3x + 12$: $x = 2$ (d) $4x + 10 - 3x = 6$:
 $x = -4$

B8 (a) $3x + 2x = 60$: $x = 12$ (b) $3x - 2x = 60$: $x = 60$ (c) $3(x + 1) + 2(x + 1) = 60$: $x = 11$
 (d) $3(x + 1) - 2(x - 1) = 18$, $x + 5 = 18$: $x = 13$ In (d), $-2 \times -1 = +2$

B9 (a) $x = 5$ (b) $x + 1 = 5$: $x = 4$ (c) $20(x - 2) = 5(x + 1)$, $15x = 45$: $x = 3$ (d) $x + 6 = 3x - 3$: $x = 4.5$

B10 (a) $3x = 12$: $x = 4$ (b) $4x + 4 = 20$: $x = 4$ (c) $6x + 5 = 4x + 11$: $x = 3$ (d) $-16x - 8 = 8$: $x = -1$
 In each one the x^2 terms cancel, leaving a linear equation.

C

Reasoning solutions

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

FOUNDATION

C1 Ella added 5 instead of subtracting it. $3x = 15$ $x = 5$

C2 Ben multiplied only the x by 3, not the -2 . The right side must be $3(x - 2) = 3x - 6$
 $x + 4 = 3x - 6$ $10 = 2x$ $x = 5$

C3 (a) $2x = 0$ has the solution $x = 0$, since $2 \times 0 = 0$. "No solution" is not the same as a solution of 0
 (b) $2x = 0$ $x = 0$

C4 $6x - 6 = 2x + 4$ $4x = 10$ $x = 2.5$, as required



HIGHER

C5 Mia did not multiply the 2 by 6. Every term must be multiplied. $2x + 12 = 3x$ $x = 12$

C6 Leo wrote -2 instead of $+2$: $-2(x - 1) = -2x + 2$

$3x + 15 - 2x + 2 = 24$ $x + 17 = 24$ $x = 7$

C7 (a) $4k + 3 = 19$ $k = 4$

(b) $kx - 2x = 8$, so $(k - 2)x = 8$. If $k = 2$ the left side is 0 for every x , but the right side is 8, which is impossible

$k = 2$

C8 (a) $6x - 2 - 4x = 2x + 6$ $2x - 2 = 2x + 6$ The x terms cancel, leaving -2 on one side and 6 on the other, which can never be equal, so there is no solution

(b) $3x + 12 - x = 2x + 12$ $2x + 12 = 2x + 12$, which is true for every x

(c) In both, the x terms cancel. If the numbers left are different, there is no solution; if they are equal, every value of x works.

D

Problem solving solutions

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

FOUNDATION

D1 $x + (x + 6) + 2(x + 6) = 84$ $4x + 18 = 84$ $x = 16.5$ Cara = $2(16.5 + 6) = \text{£}45$

D2 $9.5h + 20 = 153$ $9.5h = 133$ $h = 14$ hours

D3 $(x + 30) + 2x + (3x - 20) + (x + 70) = 360$ $7x + 80 = 360$ $x = 40$

Angles: 70° , 80° , 100° , 110° Largest: 110°

D4 $4(x + 3) = 3(2x - 1)$ $4x + 12 = 6x - 3$ $x = 7.5$ Perimeter = $4 \times 10.5 = 42 \text{ cm}$



HIGHER

D5 $\frac{7x+25}{5} = 12$ $7x+25 = 60$ $x = 5$

Numbers: 10, 10, 14, 12, 14. In order: 10, 10, 12, 14, 14 Median = 12

D6 (a) $n + (n+2) + (n+4) = n+22$ $3n+6 = n+22$ $n = 8$ 8, 10, 12

(b) $n + (n+2) + (n+4) = 3n+6 = 3(n+2)$. $n+2$ is even, so $3(n+2)$ is 3 times an even number, which is a multiple of 6

D7 (a) $3 + 1.6d = 1.5 + 1.9d$ $1.5 = 0.3d$ $d = 5$ km

(b) A: $3 + 12.80 = £15.80$ B: $1.50 + 15.20 = £16.70$ Taxi A, by 90p

D8 Width w , length $w+4$ $w(w+4) = (w+1)(w+2)$

$w^2 + 4w = w^2 + 3w + 2$ $w = 2$

Original rectangle: length 6 cm, width 2 cm. Check: $6 \times 2 = 12$ and $3 \times 4 = 12$

E

Exam practice solutions

Marks are shown on the right of each line.

FOUNDATION

Foundation and Higher crossover

E1 (a) $x = 5$

B1

(b) $\frac{x}{3} = 6$ $x = 18$

B1

E2 $4x = -16$

M1

$x = -4$

A1

E3 $8y - 12 = 3y + 8$

M1

$5y = 20$

M1

$y = 4$

A1

E4 $x + 2x + 10 + 3x - 40 = 180$

M1

$6x - 30 = 180$, so $x = 35$

A1

Angles: 35° , 80° , 65°

M1

Largest: 80°

A1



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E5 $2(3x+2)+2(x-1)=42$ M1
 $8x+2=42$, so $x=5$ A1
Length 17 cm, width 4 cm M1
Area = 68 cm² A1

E6 $2x+1=5(x-4)$ M1
 $2x+1=5x-20$ M1
 $x=7$ A1

HIGHER

E7 $\times 15: 5(x+7)=3(2x-1)+30$ M1
 $5x+35=6x+27$ M1
 $x=8$ A1

E8 $5(x-1)=3(x+1)$ M1
 $5x-5=3x+3$ M1
 $x=4$ A1

E9 $(x^2+6x+9)-(x^2-4x+4)=45$ M1
 $10x+5=45$ M1
 $x=4$ A1

E10 (a) Time = distance $\div$ speed: $\frac{d}{15}$ and $\frac{d}{5}$ M1
2 hours 40 minutes = $\frac{8}{3}$ hours, so $\frac{d}{15} + \frac{d}{5} = \frac{8}{3}$ as required A1
(b) $\times 15: d+3d=40$ M1
 $d=10$ A1
(c) $20 \div \frac{8}{3} = 20 \times \frac{3}{8} = \text{7.5}$ km/h B1

