Solving Linear Equations: answers

Worked solutions and mark scheme · GCSE Maths · Foundation tier

M = method mark, A = accuracy mark (needs the method), B = independent mark, ft = follow through from an earlier wrong answer.

Level 1 · Warm-up 11 marks

Two-step equations, brackets and unknowns on both sides.

1 Solve $3x + 5 = 20$.

Answer: $x = 5$

$3x = 15$	*Subtract* 5 *from both sides*
$x = 5$	*Divide both sides by* 3

Marks M1 $3x = 15$ A1 $x = 5$

2 Solve $\frac{x}{4} - 3 = 2$.

Answer: $x = 20$

$\frac{x}{4} = 5$	*Add* 3 *to both sides*
$x = 20$	*Multiply both sides by* 4

Marks M1 $\frac{x}{4} = 5$ A1 $x = 20$

3 Solve $5(x - 2) = 35$.

Answer: $x = 9$

$x - 2 = 7$	*Divide both sides by* 5 *(or expand to* $5x - 10 = 35$*)*
$x = 9$	

Marks M1 $5x - 10 = 35$ or $x - 2 = 7$ A1 $x = 9$

4 Solve $7x - 4 = 3x + 16$.

Answer: $x = 5$

$4x - 4 = 16$	*Subtract $3x$ from both sides*
$4x = 20$	*Add 4 to both sides*
$x = 5$	

Marks M1 Collects the x terms: $4x - 4 = 16$ or $7x - 3x = 16 + 4$ M1 $4x = 20$ A1 $x = 5$

5 Solve $2(3x + 1) = 5$.

Answer: $x = \frac{1}{2}$

$6x + 2 = 5$	*Expand the bracket*
$6x = 3$	
$x = \frac{3}{6} = \frac{1}{2}$	*An answer can be a fraction*

Marks M1 $6x + 2 = 5$ A1 $x = \frac{1}{2}$ oe

Level 2 · Build

11 marks

Negative answers, fractions, and equations with two fractions.

6 Solve $4(x + 3) = 2(x - 5)$.

Answer: $x = -11$

$4x + 12 = 2x - 10$	*Expand both brackets*
$2x + 12 = -10$	*Subtract $2x$ from both sides*
$2x = -22$	
$x = -11$	

Marks M1 $4x + 12 = 2x - 10$ M1 $2x = -22$ A1 $x = -11$

7 Solve $\frac{x+5}{3} = x - 3$.

Answer: $x = 7$

$x + 5 = 3(x - 3)$	*Multiply both sides by* 3
$x + 5 = 3x - 9$	
$14 = 2x$	*Subtract* x *and add* 9 *on both sides*
$x = 7$	

Marks M1 $x + 5 = 3(x - 3)$ M1 $x + 5 = 3x - 9$ and collects terms, e.g. $14 = 2x$ A1 $x = 7$

8 Solve $12 - 3x = 2x - 8$.

Answer: $x = 4$

$12 = 5x - 8$	*Add* $3x$ *to both sides, so the* x *term stays positive*
$20 = 5x$	
$x = 4$	

Marks M1 Collects the x terms on one side: e.g. $12 = 5x - 8$ M1 $20 = 5x$ A1 $x = 4$

9 Solve $\frac{2x-1}{5} = 3$.

Answer: $x = 8$

$2x - 1 = 15$	*Multiply both sides by* 5
$2x = 16$	
$x = 8$	

Marks M1 $2x - 1 = 15$ A1 $x = 8$

Level 3 · Exam-style 14 marks
Forming equations from angles, perimeters and ages, and spotting mistakes.

10 The angles of a triangle are $x°$, $(2x + 10)°$ and $(3x - 40)°$. Work out the size of the largest angle.

Answer: $80°$

$x + (2x + 10) + (3x - 40) = 180$ — *Angles in a triangle add up to* $180°$

$6x - 30 = 180$

$6x = 210 \Rightarrow x = 35$

$35°, \quad 2(35) + 10 = 80°, \quad 3(35) - 40 = 65°$ — *Work out all three angles*

Largest angle $= 80°$ — *The question asks for the angle, not* x

Marks M1 $x + 2x + 10 + 3x - 40 = 180$ M1 $6x - 30 = 180$ A1 $x = 35$ A1 $80°$

11 (a) A rectangle has length $(2x + 3)$ cm and width $(x - 1)$ cm. Its perimeter is 34 cm. Form an equation and solve it to find x.

Answer: $x = 5$

$2(2x + 3) + 2(x - 1) = 34$ — *Perimeter: two lengths and two widths*

$4x + 6 + 2x - 2 = 34$

$6x + 4 = 34$

$6x = 30 \Rightarrow x = 5$

Marks M1 $2(2x + 3) + 2(x - 1) = 34$ oe M1 $6x + 4 = 34$ A1 $x = 5$

(b) Work out the area of the rectangle.

Answer: 52 cm^2

length $= 2(5) + 3 = 13, \quad$ width $= 5 - 1 = 4$

area $= 13 \times 4 = 52$ cm^2

Marks M1 Length 13 and width 4 — ft their x A1 52 cm^2

12 Ali is 3 times as old as Ben. In 5 years' time, Ali will be twice as old as Ben. How old is Ben now?

Answer: 5 years old

Ben $= x$, Ali $= 3x$	*Choose a letter for the unknown*
$3x + 5 = 2(x + 5)$	*In 5 years both are 5 years older*
$3x + 5 = 2x + 10$	
$x = 5$	*Check: Ali is 15; in 5 years, $20 = 2 \times 10$*

Marks M1 $3x + 5 = 2(x + 5)$, where Ben is x now M1 $3x + 5 = 2x + 10$ A1 5

13 Leah solves $4x - 7 = 2x + 9$. Her working is: $4x - 2x = 9 - 7$, so $2x = 2$, so $x = 1$. Explain Leah's mistake, and solve the equation correctly.

Answer: Moving -7 to the other side makes it $+7$, not -7. $2x = 16$, so $x = 8$.

$4x - 2x = 9 + 7$	*Adding 7 to both sides gives $+7$ on the right*
$2x = 16$	
$x = 8$	

Marks B1 Explains that the -7 becomes $+7$ on the other side (she should add 7) B1 $x = 8$

Level 4 · Challenge (Foundation) — 9 marks

Grade 4–5 problem solving: forming and solving equations from words.

14 The mean of 4, 7, x and $2x$ is 8. Work out the value of x.

Answer: $x = 7$

$\dfrac{4 + 7 + x + 2x}{4} = 8$	*Mean = total ÷ how many*
$11 + 3x = 32$	*Multiply both sides by 4*
$3x = 21 \Rightarrow x = 7$	

Marks M1 $\dfrac{4 + 7 + x + 2x}{4} = 8$ M1 $11 + 3x = 32$ A1 $x = 7$

15 A taxi charges £3.50 plus £1.20 for every mile. Kim's journey cost £16.10. How many miles did Kim travel?

Answer: 10.5 miles

$3.50 + 1.20m = 16.10$ *Let m be the number of miles*

$1.20m = 12.60$

$m = 12.60 \div 1.20 = 10.5$

Marks M1 $3.50 + 1.20m = 16.10$ M1 $1.20m = 12.60$ A1 10.5

16 Two consecutive odd numbers add up to 76. Form and solve an equation to find the two numbers.

Answer: 37 and 39

$x + (x + 2) = 76$ *Consecutive odd numbers are 2 apart*

$2x + 2 = 76 \Rightarrow 2x = 74$

$x = 37$ *The numbers are 37 and 39*

Marks M1 $x + (x + 2) = 76$ M1 $2x = 74$ A1 37 and 39