

Linear Equations with Fractions

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Higher tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (4 marks)

(a) Solve $\frac{2x-1}{3} = 7$

Multiply both sides by 3 to clear the fraction:

$$2x - 1 = 21$$

Add 1 to both sides:

$$2x = 22$$

Divide both sides by 2:

$$x = 11$$

Answer: $x = 11$

Marks: 1 mark for $2x - 1 = 21$. 1 mark for the correct answer.

(b) Solve $5 - \frac{x}{4} = 2$

Add $\frac{x}{4}$ to both sides:

$$5 = 2 + \frac{x}{4}$$

Subtract 2 from both sides:

$$\frac{x}{4} = 3$$

Multiply both sides by 4:

$$x = 12$$

Answer: $x = 12$

Tip: Add $\frac{x}{4}$ to both sides, not x . Check your answer: $5 - \frac{12}{4} = 5 - 3 = 2$ ✓

Marks: 1 mark for $\frac{x}{4} = 3$ or $20 - x = 8$. 1 mark for the correct answer.

2 (3 marks)

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

Multiply both sides by 3:

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

Expand the bracket:

$$2x + 5 = 3x - 3$$

Subtract $2x$ from both sides and add 3 to both sides:

$$5 + 3 = 3x - 2x$$

$$x = 8$$

Answer: $x = 8$

Tip: Multiply the **whole** of the right-hand side by 3: $3(x - 1) = 3x - 3$, not $3x - 1$.

Marks: 1 mark for multiplying both sides by 3. 1 mark for collecting the terms. 1 mark for the correct answer.

3 (3 marks)

Solve $\frac{x+1}{4} + \frac{2x-3}{5} = 2$

The lowest common multiple of 4 and 5 is 20.

Multiply every term by 20:

$$5(x + 1) + 4(2x - 3) = 40$$

Expand the brackets:

$$5x + 5 + 8x - 12 = 40$$

Simplify: $13x - 7 = 40$

Add 7 to both sides: $13x = 47$

Divide both sides by 13: $x = \frac{47}{13}$

Answer: $x = \frac{47}{13}$

Marks: 1 mark for multiplying by 20. 1 mark for $13x = 47$. 1 mark for the correct answer (or an equivalent, e.g. $3\frac{8}{13}$).

4 (3 marks)

Solve $\frac{4 - x}{2} = \frac{3x + 1}{5}$

Multiply both sides by 10 (or cross-multiply):

$$5(4 - x) = 2(3x + 1)$$

Expand the brackets:

$$20 - 5x = 6x + 2$$

Add $5x$ to both sides and subtract 2 from both sides:

$$18 = 11x$$

Divide both sides by 11: $x = \frac{18}{11}$

Answer: $x = \frac{18}{11}$

Marks: 1 mark for $5(4 - x) = 2(3x + 1)$. 1 mark for $11x = 18$. 1 mark for the correct answer (or an equivalent).

5 (3 marks)

Solve $\frac{3x}{4} - \frac{x-2}{6} = 3$

The lowest common multiple of 4 and 6 is 12.

Multiply every term by 12:

$$\frac{3x}{4} \times 12 = 9x$$

$$\frac{x-2}{6} \times 12 = 2(x-2)$$

$$3 \times 12 = 36$$

$$\text{So } 9x - 2(x-2) = 36$$

$$\text{Expand: } 9x - 2x + 4 = 36$$

$$\text{Simplify: } 7x + 4 = 36$$

$$\text{Subtract 4: } 7x = 32$$

$$\text{Divide by 7: } x = \frac{32}{7}$$

Answer: $x = \frac{32}{7}$

Tip: Watch the sign: $-2(x-2) = -2x + 4$, because $-2 \times (-2) = +4$.

Marks: 1 mark for multiplying by 12. 1 mark for $7x = 32$. 1 mark for the correct answer (or an equivalent).

6 (4 marks)

Solve $\frac{3x+1}{4} - \frac{x+2}{3} = \frac{1-x}{6}$

You must show all your working.

The lowest common multiple of 4, 3 and 6 is 12.

Multiply every term by 12:

$$3(3x+1) - 4(x+2) = 2(1-x)$$

Expand the brackets:

$$9x + 3 - 4x - 8 = 2 - 2x$$

Simplify the left side: $5x - 5 = 2 - 2x$

Add $2x$ to both sides: $7x - 5 = 2$

Add 5 to both sides: $7x = 7$

Divide by 7: $x = 1$

Answer: $x = 1$

Marks: 1 mark for multiplying every term by 12 (or another common multiple). 1 mark for expanding the brackets correctly. 1 mark for $7x = 7$. 1 mark for the correct answer.

7 (4 marks)

A triangle has sides of length $\frac{x}{2}$ cm, $\frac{2x}{3}$ cm and $(x - 2)$ cm.

The perimeter of the triangle is 24 cm.

Work out the length of the longest side.

Perimeter = the sum of the three sides:

$$\frac{x}{2} + \frac{2x}{3} + x - 2 = 24$$

Multiply every term by 6:

$$3x + 4x + 6x - 12 = 144$$

$$13x - 12 = 144$$

$$13x = 156$$

$$x = 12$$

Now find each side:

$$\frac{12}{2} = 6 \text{ cm}, \quad \frac{2 \times 12}{3} = 8 \text{ cm}, \quad 12 - 2 = 10 \text{ cm}$$

Check: $6 + 8 + 10 = 24$ ✓

The longest side is 10 cm.

Answer: 10 cm

Tip: $x = 12$ is not the final answer. Use it to work out all three sides, then pick the longest.

Marks: 1 mark for forming the equation. 1 mark for clearing the fractions. 1 mark for $x = 12$. 1 mark for the correct answer.
