

Linear Equations 2

Starter

1. (Review of last lesson)

Solve: (a) $x - 9 = 15$

(b) $7x = 56$

Working: (a) $x - 9 = 15$

(b) $7x = 56$

$$x = 15 + 9$$

$$x = \frac{56}{7}$$

$$x = 24$$

$$x = 8$$

N.B. The middle step could be missed out in each of these questions.

2. (Review of previous material)

Expand these brackets: (a) $3(x - 7)$

(b) $9(7x - 6)$

Working: (a) $3(x - 7) = 3x - 21$

(b) $9(7x - 6) = 63x - 54$

3. (Review of previous material)

Evaluate: (a) $3 + 5 \times 4$

(b) $9 - 6 \div 2$

Working: (a) $3 + 5 \times 4 = 3 + 20$
 $= 23$

multiplication before addition

(b) $9 - 6 \div 2 = 9 - 3$
 $= 6$

division before subtraction

4. Solve the equation $2x - 7 = 15$.

Hint: Decide whether to deal with the -7 or the 2 first.

Working: $2x - 7 = 15$

$$2x = 15 + 7 \quad \text{when rearranging, addition before division}$$

$$2x = 22$$

$$x = \frac{22}{2}$$

$$x = 11$$

N.B. You can miss out the lines in orange if you feel confident.

E.g. 1 Solve $3x + 8 = 20$

Working: **Opposite operation method** (“do the same to both sides”)

Do we deal with the $\times 3$ or the $+8$ first?

*Using **SADMIB**, we deal with $+8$ first.*

We do the opposite operation to $+8$ to both sides.

$$3x + 8 = 20 \quad \textcircled{-8}$$

$$3x = 12 \quad 20 - 8 = 12$$

We do the opposite operation to $\times 3$ to both sides.

$$x = 4 \quad \textcircled{\div 3}$$

N.B. Annotate in a circle each step that you take with the opposite operation.
Always have the ‘=’ symbols in a column, one above the other.

Balancing method

*Using **SADMIB**, we deal with $+8$ first.*

Subtract 8 from both sides $3x + 8 = 20$
 $3x + 8 - 8 = 20 - 8$

$$3x = 12$$

$$\frac{3}{3}x = \frac{12}{3}$$

Divide both side by 3

$$x = 4$$

E.g. 2 Solve: (a) $4d - 7 = 17$ (b) $\frac{2x + 5}{3} = 15$

Hint: For (b), consider $\frac{2x + 5}{3}$ the same as $\frac{(2x + 5)}{3}$

Working: (a) *Solving: subtraction before multiplication* $4d - 7 = 17$
Add 7 to both sides $4d = 24$
Divide both sides by 4 $d = 6$

(b) *Use brackets* $\frac{(2x + 5)}{3} = 15$
Solving: division before brackets
Multiply both sides by 3 $2x + 5 = 45$
Subtract 5 from both sides $2x = 40$
Divide both sides by 2 $x = 20$

E.g. 3 Solve: (a) $3x + 7 + 2x - 1 = 26$ (b) $7p - 8 - 4p + 3p = 34$

Working:

(a) $3x + 7 + 2x - 1 = 26$
 $5x + 6 = 26$
Collect like terms
Addition before multiplication
Subtract 6 from both sides $5x = 20$
Divide both sides by 5 $x = 4$

(b) $7p - 8 - 4p + 3p = 34$
 $6p - 8 = 34$
Collect like terms
Subtraction before multiplication
Add 8 to both sides $6p = 42$
Divide both sides by 6 $p = 7$

E.g. 4 Solve: (a) $8(x - 3) + 2(x + 2) = 30$ (b) $3(x + 2) - 5(x - 1) = 7$

Working:

(a) $8(x - 3) + 2(x + 2) = 30$
 $8x - 24 + 2x + 4 = 30$
 $10x - 20 = 30$
Expand the brackets
Collect like terms
Subtraction before multiplication
Add 20 to both sides $10x = 50$
Divide both sides by 10 $x = 5$

(b) $3(x + 2) - 5(x - 1) = 7$
 $3x + 6 - 5x + 5 = 7$
 $-2x + 11 = 7$
Expand the brackets
Collect like terms
Addition before multiplication
Subtract 11 from both sides $-2x = -4$
Divide both sides by -2 $x = 2$

E.g. 5 Solve: (a) $2 = \frac{x}{5} - 7$ (b) $\frac{x - 4}{3} + 6 = 8$

Working:

(a) *Subtraction before division* $2 = \frac{x}{5} - 7$
Add 7 to both sides $9 = \frac{x}{5}$
Multiply both sides by 5 $x = 45$

(b) *The $x - 4$ can be considered to be in brackets*
Subtraction before division $\frac{(x - 4)}{3} + 6 = 8$
Subtract 6 from both sides $\frac{(x - 4)}{3} = 2$
Multiply both sides by 3 $x - 4 = 6$
Add 4 to both sides $x = 10$

E.g. 6 Solve: (a) $\frac{12}{n+1} = \frac{21}{n+4}$

(b) $\frac{5}{n+3} = \frac{4}{n+5}$

Working: (a)

Cross-multiply
Expand the brackets
Subtract 21 from both sides
Subtract 12n from both sides
Divide both sides by 9
Rearrange so that n = ...

$$\begin{array}{r} 12 \quad \quad 21 \\ \hline n+1 \quad n+4 \\ 12(n+4) = 21(n+1) \\ 12n + 48 = 21n + 21 \\ 12n + 27 = 21n \\ 27 = 9n \\ 3 = n \\ n = 3 \end{array}$$

(b)

Cross-multiply
Expand the brackets
Subtract 4n from both sides
Subtract 25 from both sides

$$\begin{array}{r} 5 \quad \quad 4 \\ \hline n+3 \quad n+5 \\ 5(n+5) = 4(n+3) \\ 5n + 25 = 4n + 12 \\ n + 25 = 12 \\ n = -13 \end{array}$$

Video: [Linear equations - unknown on both sides](#)

[Solutions to Starter and E.g.s](#)

Exercise

p17 Ex 12.4 Qu 1-2 (at least two steps, including brackets and fractions)

p17 Ex 12.4 Qu 3 (unknown on both sides)

p17 Ex 12.4 Qu 4-10 (practical questions)

[Textbook answers \(only available during a lockdown\)](#)