

Linear Equations 2

Starter

- (Review of last lesson)**
Solve: (a) $x - 9 = 15$ (b) $7x = 56$
- (Review of previous material)**
Expand these brackets: (a) $3(x - 7)$ (b) $9(7x - 6)$
- (Review of previous material)**
Evaluate: (a) $3 + 5 \times 4$ (b) $9 - 6 \div 2$
- Solve the equation $2x - 7 = 15$.
Hint: Decide whether to deal with the -7 or the 2 first.

Notes

Solving an equation mean finding the value of the unknown, usually x . This requires us to get x on its own.

To transfer numbers from one side to the other do the **opposite operation**.

When giving your final answer, make sure the unknown is on the **LHS** and **positive**.

Always have the '=' sign in a column, one above the other.

When solving equations requiring two or more steps, we decide the order using SADMIB.

Subtraction

Addition

Division

Multiplication

Indices (i.e. powers)

Brackets

There are two methods to use: operation operation and balancing method.

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.

$$3x + 8 = 20$$

-8

$$3x = 12$$

$$20 - 8 = 12$$

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

$$x = 4$$

$\div 3$

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

$$3x + 8 = 20$$

$$3x + 8 - 8 = 20 - 8$$

$$3x = 12$$

Divide both side by 3

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

$$x = 4$$

N.B. The steps in orange do not need to be shown.

Always have the ‘=’ symbols in a column, one above the other.

The final answer should always have the unknown on the LHS i.e. $x = 3$, not $3 = x$

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 $\frac{(2x + 5)}{3}$

Some questions will require you to collect like terms before solving i.e. collect the unknowns and numbers together on each side.

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

Working: (a)

Collect like terms

Addition before multiplication

Subtract 6 from both sides

Divide both sides by 5

$$3x + 7 + 2x - 1 = 26$$

$$5x + 6 = 26$$

$$5x = 20$$

$$x = 4$$

When there are brackets, expand them before collecting like terms.

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

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

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
 $x = 45$

When two fractions are equal to each other, it is usually a good idea to **cross-multiply**. This means the denominator on each side multiplies the numerator of the other side. It is then correct to expand the brackets and collect like terms.

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
 $12(n + 4) = 21(n + 1)$
Subtract 21 from both sides
 $12n + 48 = 21n + 21$
Subtract 12n from both sides
 $27 = 9n$
Divide both sides by 9
 $3 = n$
Rearrange so that n = ...
 $n = 3$

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)

Summary

When solving equations requiring two or more steps, we decide the order using SADMIB.

Subtraction

Addition

Division

Multiplication

Indices (i.e. powers)

Brackets

Key skills: Cross-multiplying
 Expanding brackets.
 Collecting like terms

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