



Year 7 higher topic 7

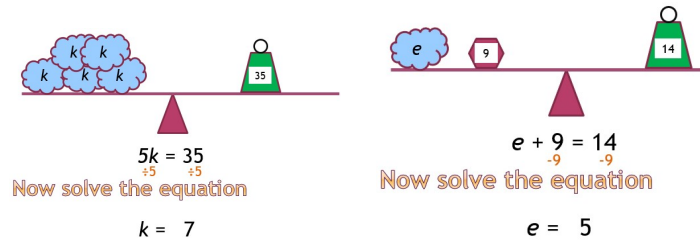
Equations

What careers would use these skills?

Police collision investigator, astronomer, astrologist, NASA scientist, chemist, doctor, physicist, business owner, builder

Solving simple equations

In an equation, the expressions on both sides of the equals sign have the same value, like a balanced set of scales. To stay balanced, do the same operation on both sides.



Writing simple equations

An equation involves an unknown number (a letter) and an '=' sign. You can write (and solve) an equation using the information you are given. For example, **Jack is 3 years older than Joe, so Joe is n years old and Jack is $n + 3$ years old.**

I think of a number (n), multiply it by 3 and add 2. $3n + 2$

My new number is 23. Write an equation and solve it.

$$3n + 2 = 23$$

$$-2 \quad -2$$

$$3n = 21$$

$$\div 3 \quad \div 3$$

$$n = 7$$

Two-step equations

Worked example

Solve $4x + 7 = 27$

$$4x + 7 - 7 = 27 - 7$$

$$4x = 20$$

$$x = 5$$

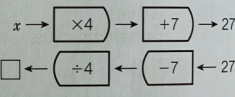
$$\text{Check: } 4 \times 5 + 7 = 27 \quad \checkmark$$

Check by replacing x in the equation with your solution.

Balance the equation by subtracting 7 from each side.

Balance again by dividing both sides by 4.

Visualise the function machines to decide which inverses to use.



Trial and improvement

To use trial and improvement to solve an equation:

Estimate a value (choose a sensible number!)

Try your value in the equation. Is your answer too big or too small?

Use this to help you improve your estimate and try again.

Keep improving your estimate until you get very close to the value.

Equations with brackets

Start by expanding the brackets, then eliminate your smallest variable

$$3(x + 4) = 27$$

$$3x + 12 = 27$$

$$-12 \quad -12$$

Remember in order to eliminate a variable, you have to do the opposite, e.g. to get rid of $8x$, you have to **subtract** $8x$ from both sides.

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

$$10x + 4 = 8x + 12$$

$$-8x \quad -8x$$

$$2x + 4 = 12$$

$$-4 \quad -4$$

$$2x = 8$$

$$\div 2 \quad \div 2$$

$$x = 4$$

Solving equations including x^2 and x^3

Worked example

Solve the equation $x^3 = 54$ using trial and improvement. Give your answer to 1 decimal place.

x	x^3	Comment
3	27	too small
4	64	too big
3.5	42.875	too small
3.7	50.653	too small
3.8	54.872	too big

The value of x lies between 3.7 and 3.8.

3.8^3 (54.872) is closer to 54 than 3.7^3 (50.653)

$x = 3.8$ (to 1 decimal place)

Draw a table for your working.

54 is between the cube numbers 27 (3^3) and 64 (4^3). So 54 is between 3 and 4.

Try the value halfway between 3 and 4. Cube the value. Decide if it is too big or too small.

Try another value.

Find two values to 1 decimal place that x lies between. Decide which gives the answer closer to 54.

Key point
To use trial and improvement to solve an equation:
• Estimate a value. Try it in the equation. Is your answer too big or too small?
• Use this to help you improve your estimate and try again.

Complex equations

You want to find out what ' x ' is so you have to eliminate the smallest unknown ($4x$)

You need to eliminate the smallest value now (2)

$$4x = 8 \text{ so } 'x' \text{ (or } 1x) = 8 \div 4$$

$$8x + 2 = 4x + 10$$

$$-4x \quad -4x$$

$$4x + 2 = 10$$

$$-2 \quad -2$$

$$4x = 8$$

$$\div 4 \quad \div 4$$

$$x = 2$$