

Simultaneous equations (H)

What do I need to be able to do?

- Determine whether (x, y) is a solution
- Solve by substituting a known variable
- Solve by substituting an expression
- Solve graphically
- Solve by subtracting/ adding equations
- Solve by adjusting equations
- Form and solve linear simultaneous equations

Keywords & definitions:

Solution: a value we can put in place of a variable that makes the equation true

Variable: a symbol for a number we don't know yet.

Substitute: replace a variable with a numerical value

LCM: lowest common multiple (the first time the times table of two or more numbers match)

Eliminate: to remove

Expression: a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)

Coordinate: a set of values that show an exact position.

Intersection: the point two lines cross or meet.

Is (x, y) a solution? x and y represent values that can be substituted into an equation

Does the coordinate $(1, 8)$ lie on the line $y = 3x + 5$?

This coordinate represents $x = 1$ and $y = 8$

$$y = 3x + 5$$

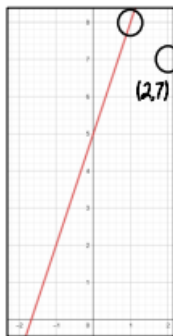
$$8 = 3(1) + 5$$

As the substitution makes the equation correct the coordinate $(1, 8)$ **IS** on the line $y = 3x + 5$

Is $(2, 7)$ on the same line?

$$7 \neq 3(2) + 5$$

No 7 does NOT equal 6 + 5



Substituting known variables

A line has the equation $3x + y = 14$

Two different variables, two solutions

Stephanie knows the point $x = 4$ lies on that line. Find the value for y

$$x = 4$$

$$3x + y = 14$$

$$3(4) + y = 14$$

$$12 + y = 14$$

$$y = 2$$

$$3(4) + y = 14$$

$$12 + y = 14$$

$$y = 2$$

$$12 + y = 14$$

$$y = 2$$

Substituting in an expression

$$x = 2y$$

$$x + y = 30$$

$$x = 2y$$

$$x + y = 30$$

$$x = 2y$$

$$x + y = 30$$

Substitute $2y$ in place of the x variable as they represent the same value

$$x = 2y$$

$$x + y = 30$$

$$3y = 30$$

$$y = 10$$

$$3y = 30$$

$$y = 10$$

$$x = 2y$$

$$x = 20$$

Pair of simultaneous equations (two representations)

Solve graphically

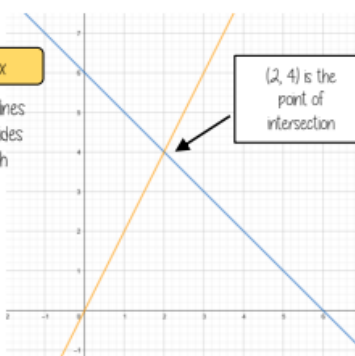
$$x + y = 6$$

$$y = 2x$$

Linear equations are straight lines. The point of intersection provides the x and y solution for both equations

The solution that satisfies both equations is

$$x = 2 \text{ and } y = 4$$



Solve by subtraction

$$3x + 2y = 18$$

$$x + 2y = 10$$

$$2x = 8$$

$$x = 4$$

$$x + 2y = 10$$

$$(4) + 2y = 10$$

$$2y = 6$$

$$y = 3$$

$$x = 4$$

$$y = 3$$

$$3x + 2y = 18$$

$$x + 2y = 10$$

$$2x = 8$$

$$x = 4$$

$$x + 2y = 10$$

$$(4) + 2y = 10$$

$$2y = 6$$

$$y = 3$$

$$x = 4$$

$$y = 3$$

$$3x + 2y = 18$$

$$x + 2y = 10$$

$$2x = 8$$

$$x = 4$$

$$x + 2y = 10$$

$$(4) + 2y = 10$$

$$2y = 6$$

$$y = 3$$

$$x = 4$$

$$y = 3$$

Solve by addition

Addition makes zero pairs

$$3x + 2y = 16$$

$$+ 6x - 2y = 2$$

$$9x = 18$$

$$\div 9 \quad x = 2$$

$$3x + 2y = 16$$

$$3(2) + 2(y) = 16$$

$$6 + 2y = 16$$

$$-6 \quad 2y = 10$$

$$y = 5$$

$$3x + 2y = 16$$

$$6x - 2y = 2$$

$$9x = 18$$

$$x = 2$$

$$3x + 2y = 16$$

$$3(2) + 2(y) = 16$$

$$6 + 2y = 16$$

$$-6 \quad 2y = 10$$

$$y = 5$$

Solve by adjusting one

$$h + j = 12$$

$$2h + 2j = 29$$

$$2h + 2j = 24$$

$$2h + 2j = 29$$

By proportionally adjusting one of the equations — now solve the simultaneous equations choosing an addition or subtraction method

$$h + j = 12$$

$$2h + 2j = 29$$

$$2h + 2j = 24$$

$$2h + 2j = 29$$

Solve by adjusting both

$$2x + 3y = 39$$

$$5x - 2y = -7$$

Use LCM to make equivalent x OR y values. Because of the negative values using zero pairs and y values is chosen choice

$$4x + 6y = 78$$

$$15x - 6y = -21$$

$$4x + 6y = 78$$

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$$15x - 6y = -21$$

$$4x + 6y = 78$$

$$15x - 6y = -21$$

Retrieval Quiz

Answers

Non-Calculator Methods (H)

What do I need to be able to do?

- Use mental./written methods for the four operations with integers, decimals and fractions.
- Round to decimal places and significant figures
- Estimate solutions
- Understand limits of accuracy

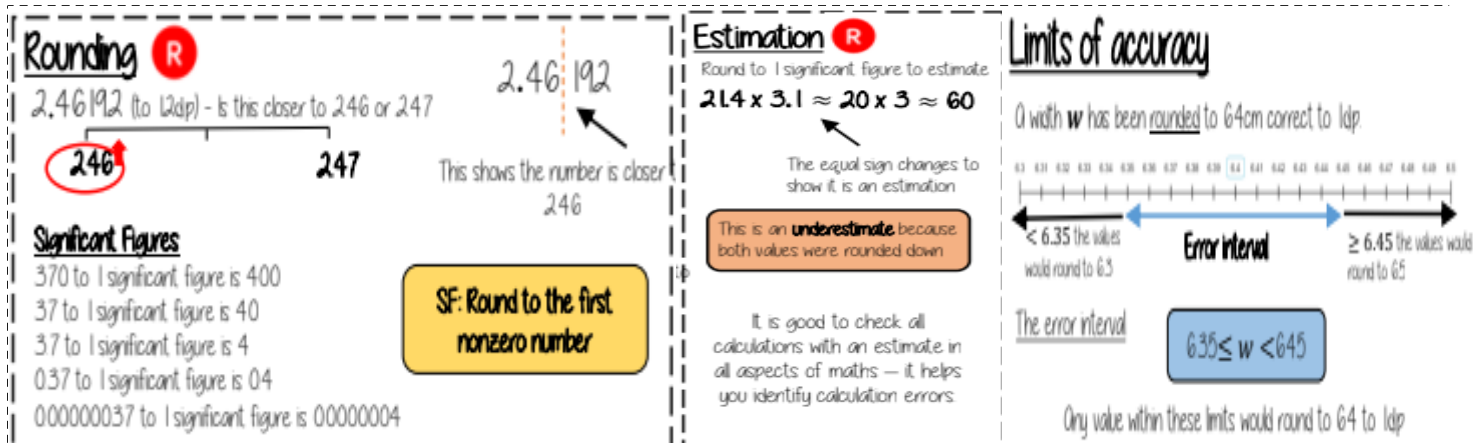
Keywords & definitions:

Reciprocal: the value that, when multiplied by the original number, equals 1

Rational: An integer or a decimal that recurs or terminates e.g. 7, 4.5 or 0.333..

Irrational: An infinitely long decimal with no repeating pattern e.g. π

Surd: A type of irrational number involving a root



calculations with bounds

We can work out the overall bounds of a calculation involving measured quantities by considering which values of the numbers involved will lead to the largest and smallest overall result. It can be helpful to list the error interval for each rounded measurement before calculating the overall bounds.

$a = 3.4$, correct to 1 decimal place.

$b = 4.6$ correct to 1 decimal place.

Work out the maximum possible value of $a \div b$

Error intervals:

$$3.35 \leq a < 3.45$$

$$4.55 \leq b < 4.65$$

$a \div b$ is largest when a is largest and b is smallest...

$$\frac{3.45}{4.55} = 0.75824$$

Surds are roots that cannot be simplified to an integer or other rational number, so $\sqrt{7}$ is a surd but $\sqrt{16}$ is not a surd because it simplifies to 4.

multiplying surds

When multiplying square roots, it is true that: $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

For example: $\sqrt{7} \times \sqrt{3} = \sqrt{21}$

This also means that $\sqrt{a} \times \sqrt{a} = \sqrt{a^2} = a$ For example: $\sqrt{7} \times \sqrt{7} = \sqrt{49} = 7$

When multiplying an integer by a root, we write the integer in front of the root.

For example: $4\sqrt{10}$ means $4 \times \sqrt{10}$

Multiply integers and roots separately.

For example: $3\sqrt{5} \times 2\sqrt{7} = 3 \times 2 \times \sqrt{5 \times 7} = 6\sqrt{35}$

simplifying surds

To simplify a surd means to make the number under the square root sign smaller.

To do this, split a root into its factors, e.g. $\sqrt{50} = \sqrt{25 \times 2} = \sqrt{25} \times \sqrt{2}$

Look for the largest factor of the number that is a square number, which can then be written as an integer. For example: $\sqrt{50} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$ This is now simplified.

A surd is **fully** simplified if the number has no square factors (other than 1).

For example: $\sqrt{12}$ is not fully simplified as 12 has a factor of 4 which is a square number.

Retrieval Quiz

Non-Calculator Methods Quiz

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