

DEVELOPING ALGEBRA...

Simultaneous Equations

What do I need to be able to do?

By the end of this unit you should be able to:

- 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

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

Equation: an equation says that two things are equal – it will have an equals sign =

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 $y=8$

$$y = 3x + 5$$

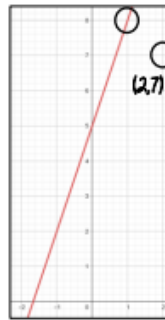
$$8 = 3(1) + 5$$

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

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

$$x = 4$$

$$3x + y = 14$$

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

Two different variables, two solutions

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

$$12 + y = 14$$

$$-12 \quad -12$$

$$y = 2$$

Substituting in an expression

$$x = 2y$$

$$x + y = 30$$

$$2y + y = 30$$

$$3y = 30$$

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

$$x + y = 30$$

$$2y + y = 30$$

$$3y = 30$$

$$+3 \quad +3$$

$$y = 10$$

$$x = 2y$$

$$x = 20$$

Pair of simultaneous equations (two representations)

Solve graphically

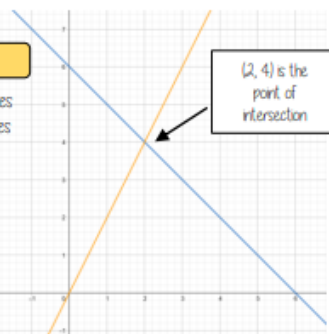
$$x + y = 6$$

$$y = 2x$$

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

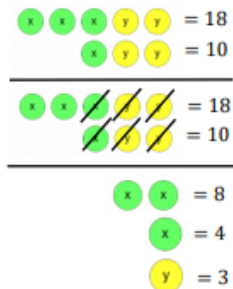
$$\begin{array}{r} 18 \\ 3x + 2y = 18 \\ -10 \\ x + 2y = 10 \\ \hline 8 \\ 2x = 8 \end{array}$$

$$x = 4$$

$$y = 3$$

$$\begin{array}{r} 3x + 2y = 18 \\ -x + 2y = 10 \\ \hline 2x = 8 \\ +2 \quad +2 \\ x = 4 \end{array}$$

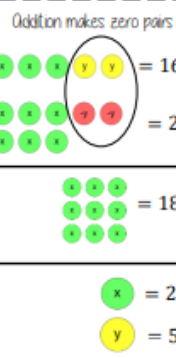
$$\begin{array}{r} x + 2y = 10 \\ (4) + 2y = 10 \\ -4 \quad -4 \\ 2y = 6 \\ +2 \quad +2 \\ y = 3 \end{array}$$



Solve by addition

$$\begin{array}{r} 3x + 2y = 16 \\ +6x - 2y = 2 \\ \hline 9x = 18 \\ +9 \quad +9 \\ x = 2 \end{array}$$

$$\begin{array}{r} 3x + 2y = 16 \\ 3(2) + 2(y) = 16 \\ 6 + 2y = 16 \\ -6 \quad -6 \\ 2y = 10 \\ y = 5 \end{array}$$



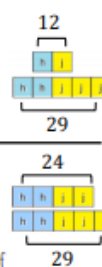
Solve by adjusting one

$$\begin{array}{r} h + j = 12 \\ 2h + 2j = 29 \end{array}$$

No equivalent values

$$\begin{array}{r} 2h + 2j = 24 \\ 2h + 2j = 29 \end{array}$$

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



Solve by adjusting both

$$\begin{array}{r} 2x + 3y = 39 \\ 5x - 2y = -7 \end{array}$$

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

$$\begin{array}{r} 4x + 6y = 78 \\ 15x - 6y = -21 \\ \hline 19x = 57 \\ x = 3 \end{array}$$

