Y11F 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

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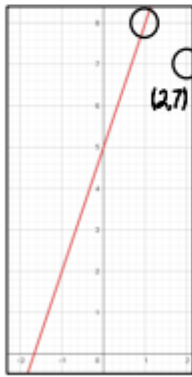$$8 = 3(1) + 5$$

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

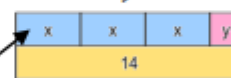(2,7)

Substituting known variables

A line has the equation 3x + y = 14

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

$$x = 4$$

Two different variables, two solutions
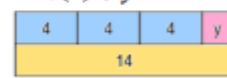
$$3x + y = 14$$
$$3(4) + y = 14$$
$$12 + y = 14$$
$$-12 \qquad -12$$
$$y = 2$$

Substituting in an expression

x = 2y

x + y = 30

Pair of simultaneous equations (two representations)

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

$$x = 2y \qquad x + y = 30$$

$$3y = 30$$

$$x = 2y$$

$$3y = 30$$
$$+3 \qquad +3$$
$$y = 10$$

$$x = 20$$

Solve graphically
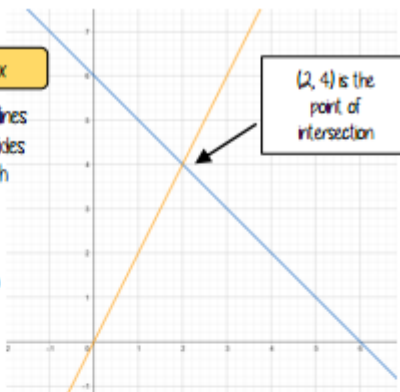
x + y = 6

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

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

(2, 4) is the point of intersection

Solve by subtraction

$$3x + 2y = 18$$
$$x + 2y = 10$$
$$- \qquad\qquad$$
$$2x = 8$$
$$+2 \qquad +2$$
$$x = 4$$

$$x + 2y = 10$$
$$(4) + 2y = 10$$
$$-4 \qquad\qquad -4$$
$$2y = 6$$
$$+2 \qquad +2$$

$$x = 4$$
$$y = 3$$
$$y = 3$$

= 18
= 10

= 18
= 10

= 8
= 4
= 3

Solve by addition

$$3x + 2y = 16$$
$$+ 6x - 2y = 2$$
$$9x = 18$$
$$\div 9 \qquad \div 9$$
$$x = 2$$

$$3x + 2y = 16$$
$$3(2) + 2(y) = 16$$
$$6 + 2y = 16$$
$$-6 \qquad -6$$
$$2y = 10$$
$$y = 5$$

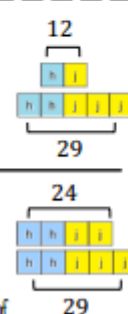Addition makes zero pairs

= 16

= 2

= 18

x = 2

y = 5
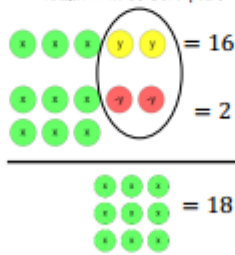
Solve by adjusting one

$$h + j = 12$$
$$2h + 2j = 29$$

No equivalent values

12

29

$$2h + 2j = 24$$
$$2h + 2j = 29$$

24

29

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

Solve by adjusting both

$$2x + 3y = 39$$
$$5x - 2y = -7$$

= 39
= -7

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

$$4x + 6y = 78$$
$$15x - 6y = -21$$

Now solve by addition

= 78
= -21

Addition makes zero pairs