

# YEAR 10 — 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  $y=8$

$$y = 3x + 5$$

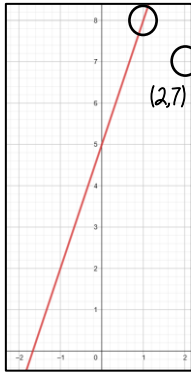
$$8 = 3(1) + 5$$

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

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

$$3x + y = 14$$

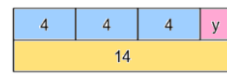
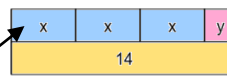
$$3(4) + y = 14$$

$$12 + y = 14$$

$$-12 \quad -12$$

$$y = 2$$

$$x = 4$$



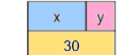
## Substituting in an expression

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

$$x = 2y$$



$$x + y = 30$$



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



$$3y = 30$$

$$3y = 30$$

$$\div 3$$

$$y = 10$$

$$x = 2y$$

$$x = 2(10)$$

$$x = 20$$

Pair of simultaneous equations (two representations)

## Solve graphically

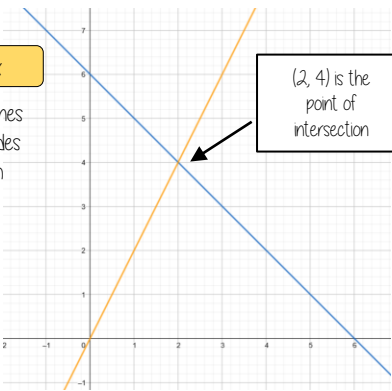
$$x + y = 6$$

$$y = 2x$$

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

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



(2, 4) is the point of intersection

## Solve by subtraction

$$3x + 2y = 18$$

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$$- \quad x + 2y = 10$$

$$2x = 8$$

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

$$x = 4$$

$$x + 2y = 10$$

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

$$-4 \quad -4$$

$$2y = 6$$

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

$$y = 3$$

$$x = 4$$

$$y = 3$$

$$x + x + x + y + y = 18$$

$$x + y + y = 10$$

$$x + x + y + y = 18$$

$$x + y + y = 10$$

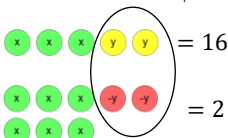
$$x + x = 8$$

$$x = 4$$

$$y = 3$$

## Solve by addition

Addition makes zero pairs



$$x = 2$$

$$y = 5$$

$$3x + 2y = 16$$

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

$$9x = 18$$

$$\div 9 \quad \div 9$$

$$x = 2$$

$$3x + 2y = 16$$

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

$$6 + 2y = 16$$

$$-6 \quad -6$$

$$2y = 10$$

$$y = 5$$

## Solve by adjusting one

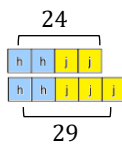
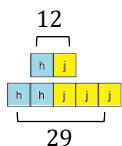
$$h + j = 12 \quad \text{No equivalent values}$$

$$2h + 2j = 29$$

$$2h + 2j = 24$$

$$2h + 2j = 29$$

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



## Solve by adjusting both

$$2x + 3y = 39$$

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

$$2x + 3y = 39$$

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

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

$$4x + 6y = 78$$

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

$$4x + 6y = 78$$

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

Now solve by addition

Addition makes zero pairs