

# YEAR 9 — REASONING WITH ALGEBRA...

## Forming and Solving Equations

@whisto\_maths

### What do I need to be able to do?

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

- Solve inequalities with negative numbers
- Solve equations with unknowns on both sides
- Solve inequalities with unknowns on both sides
- Substitute into formulae and equations
- Rearrange formulae

### Keywords

**Inequality:** an inequality compares two values showing if one is greater than, less than or equal to another

**Variable:** a quantity that may change within the context of the problem

**Rearrange:** Change the order

**Inverse operation:** the operation that reverses the action

**Substitute:** replace a variable with a numerical value

**Solve:** find a numerical value that satisfies an equation

### Solve equations with brackets

R

$$3(2x + 4) = 30$$

$$6x + 12 = 30$$

$$6x = 18$$

$$x = 3$$

$$3(2x + 4) = 30$$

Expand the brackets

$$6x + 12 = 30$$

$$-12 \quad -12$$

$$6x = 18$$

$$-6 \quad -6$$

$$x = 3$$

### Form and solve inequalities

R



Two more than treble my number is greater than 11

Find the possible range of values

$$3x + 2 > 11$$

Solve

$$x \leftarrow -3 \leftarrow -2 \leftarrow 11$$

$$x > 3$$

### Inequalities with negatives

Method 1 Make x positive first

$$2 - 3x > 17$$

$$+3x \quad +3x$$

$$2 > 17 + 3x$$

$$-17 \quad -17$$

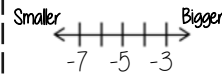
$$-15 > 3x$$

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

$$-5 > x$$

x is true for any value smaller than -5

✓ CHECK IT!  
 $2 - 3(-6) = 20$   
 TRUE/ CORRECT



### Equations with unknown on both sides

$$4x + 5 = 3x + 24$$

$$-3x \quad -3x$$

$$x + 5 = 24$$

$$-5 \quad -5$$

$$x = 19$$

$$x \quad x \quad x \quad x \quad 5$$

$$x \quad x \quad x \quad 24$$

### Inequalities with unknown on both sides

Solving inequalities has the same method as equations

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

$$5x + 20 < 3x + 6$$

$$2x + 20 < 6$$

$$2x < -14$$

$$x < -7$$

Check it!

$$5(-8 + 4) < 3(-8 + 2)$$

$$5(-4) < 3(-6)$$

$$-20 < -18$$

✓ -20 IS smaller than -18

Method 2 Keep the negative x

$$2 - 3x > 17$$

$$-2 \quad -2$$

$$-3x > 15$$

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

$$x > -5$$

x is true for any value bigger than -5

This cannot be true...

$$x < -5$$

When you multiply or divide x by a negative you need to reverse the inequality

### Formulae and Equations

Substitute in values

Formulae — all expressed in symbols

Equations — include numbers and can be solved

### Rearranging Formulae (one step)

$$x = y + z$$

$$x = y + z$$

Rearrange to make y the subject.

$$y = x - z$$

$$y \rightarrow +z \rightarrow x$$

$$y \leftarrow -z \leftarrow x$$

Using inverse operations or fact families will guide you through rearranging formulae

Rearranging can also be checked by substitution.

Language of rearranging...

Make XXX the subject

Change the subject

Rearrange

### Rearranging Formulae (two step)

In an equation (find x)

$$4x - 3 = 9$$

$$+3 \quad +3$$

$$4x = 12$$

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

$$x = 3$$

In a formula (make x the subject)

$$xy - s = a$$

$$+s \quad +s$$

$$xy = a + s$$

$$\div y \quad \div y$$

$$x = \frac{a + s}{y}$$

The steps are the same for solving and rearranging

Rearranging is often needed when using  $y = mx + c$

e.g Find the gradient of the line  $2y - 4x = 9$

Make y the subject first  $y = \frac{4x + 9}{2}$

Gradient =  $\frac{4}{2} = 2$