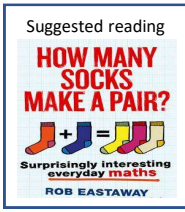


# Year 9 – Reasoning with Algebra

## Forming & Solving Equations



Want to know more? Scan the QR code to visit the curriculum overview for Year 9 Maths, including topic summaries, key words, and books that you may want to read in your own time



### 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

$3(2x + 4) = 30$

Expand the brackets

$6x + 12 = 30$

$-12 \quad -12$

$6x = 18$

$-6 \quad -6$

$x = 3$

### Form and solve inequalities

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

$4x + 5 = 3x + 24$

$-3x \quad -3x$

$x + 5 = 24$

$-5 \quad -5$

$x = 19$

### 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

Formulae – all expressed in symbols

Substitute in values

Equations – include numbers and can be solved

### Rearranging Formulae (one step)

$x = y + z$

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  $y = mx + c$

eg Find the gradient of the line  $2y - 4x = 9$

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

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