Y10 Maths Knowledge Organiser Foundation Tier: Simultaneous Equations and Linear Inequalities

What must I be able to do?	Key vocabulary	
New content: ☐ Solve simultaneous linear equations using the elimination method ➢ Sparx U760 ☐ Solve simultaneous linear equations using a substitution method ➢ Sparx U757 ☐ Solve simultaneous linear equations using graphs ➢ Sparx U836	**Simultaneous equations**	Two equations which have two unknowns. A single solution is true for both equations.
	Coefficient	A numerical or constant value multiplying a variable in an algebraic expression e.g. 4 in 4x.

Elimination Method

To solve simultaneous equations using an elimination method one of the two variables must have the same coefficient (ignoring plus/minus signs)

e.g. $3x$ and $3x$ or $3x$ and $-3x$.

Step 1: Multiply one or both equations to scale one of the variables to have the same coefficient (ignoring signs).

Step 2: Add or subtract the equations to eliminate the variable.

Step 3: Solve the remaining equation in one unknown.

Step 4: Substitute the value found back into one of the original equations and solve for the second unknown.

e.g. Solve:

$3x + 4y = 27$ (equation 1)

$2x - 5y = -5$ (equation 2)

As neither the x nor the y have the same coefficients, we need to scale up by multiplying. 6 is the LCM of 2 and 3.

Equation 1 × 2 $6x + 8y = 54$ (equation 3)

Equation 2 × 3 $6x - 15y = -15$ (equation 4)

We now have the x with the same coefficient. To eliminate 6x and 6x we need to subtract them.

Equation 3 – equation 4 (being careful of $8y - -15y$)

$23y = 69$

$y = 3$

Substituting $y = 3$ back into equation 1

$3x + 4 \times 3 = 27$

$3x + 12 = 27$

$3x = 15$

$x = 5$

Therefore the solutions are $x = 5$ and $y = 3$.

Substitution Method

To solve simultaneous equation using a substitution method, we first need to rearrange one of the equations so that has one of the variables as the subject
e.g. $y = 3x + 8$ has y as the subject.

Step 1: Make one of the variables the subject.

Step 2: Substitute this into the second equation.

Step 3: Solve the second equation in one unknown.

Step 4: Substitute the value found back into one of the original equations and solve for the second unknown.

e.g. Solve:

$y - 2x = 17$ (equation 1)

$3y + 4x = 66$ (equation 2)

Rearrange equation 1 to have y the subject ($y = \ldots$):

$y = 2x + 17$

Substitute $2x + 17$ into the second equation in the place of y

$3(2x + 17) + 4x = 66$

$6x + 51 + 4x = 66$

$10x + 51 = 66$

$10x = 15$

$x = 1.5$

Substituting $x = 1.5$ back into equation 1

$y - 2 \times 1.5 = 17$

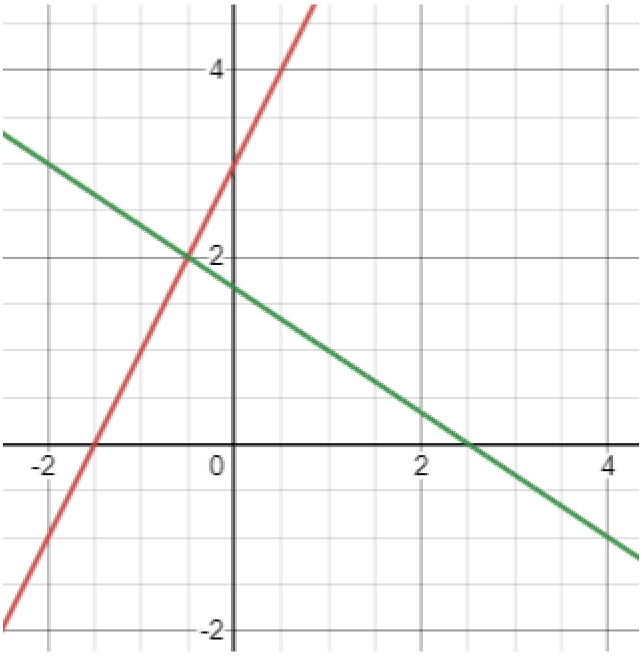
$y - 3 = 17$

$y = 20$

Therefore the solutions are $x = 1.5$ and $y = 20$.

This method will be used more often when one of the equations is a quadratic or a circle, rather than both being linear.

Solving simultaneous linear equations using graphs



The graphs $y = 2x + 3$ and $3y + 2x = 5$ are shown on the grid.

By using the graph, solve the simultaneous equations

$y = 2x + 3$

$3y + 2x = 5$

The solution to simultaneous equations when drawn as graphs is just where the 2 graphs intersect (cross).

In this instance they cross at $(-0.5, 2)$

So the solutions are $x = -0.5$, $y = 2$

GLUE

HERE