Y10 Maths Knowledge Organiser Higher Tier: Equations and 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 ☐ Show graphical inequalities ➢ Sparx U747	**Simultaneous equations**	Two equations which have <u>two unknowns</u>. A <u>single solution</u> is true for both equations.
	Coefficient	A numerical or <u>constant value multiplying</u> a <u>variable</u> 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 = ...):

$y = 2x + 17$

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.

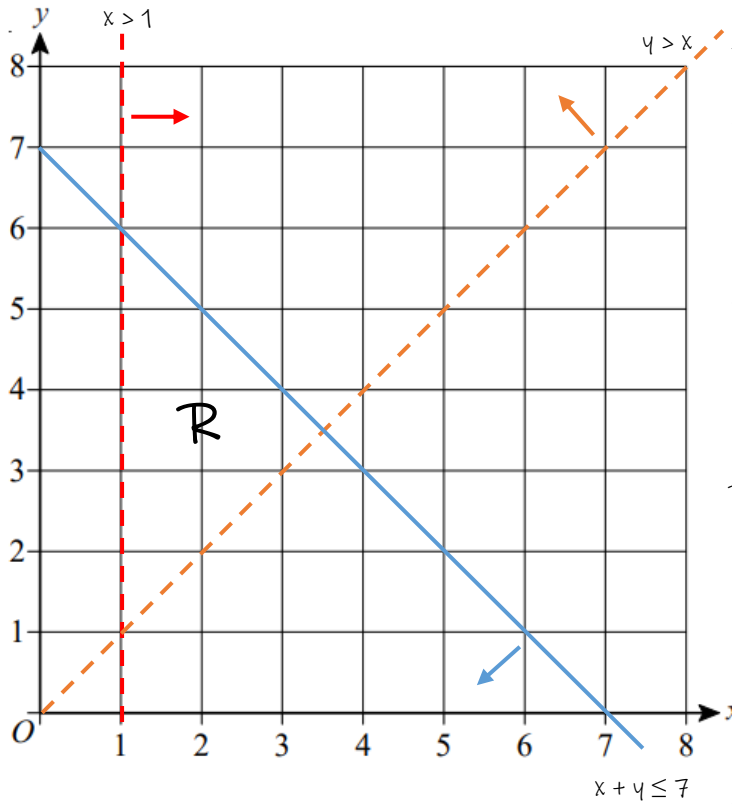
This method will be used more often when one of the equations is a quadratic or a circle, rather than both being linear.

Graphical Inequalities

To plot and shade graphical inequalities, start by considering a normal line (ignore the inequality sign). If the inequality does not include the equals then it is drawn as a dotted line, if it does include the equals it is drawn as a solid line.

e.g. draw straight lines and indicate the region R that satisfies the inequalities $x > 1$, $y > x$, $x + y \leq 7$

First, plot onto a graph the lines $x = 1$, $y = x$ and $x + y = 7$. The first two graphs will be dotted lines as they are just > while the final graph will be a solid line as it is ≤.



Having drawn the 3 lines, we need to decide which side of each line R may lie.

Pick any point on the grid which is not on the line you are checking and substitute it into the equation. If the resulting inequality is true, then the point you picked is on the correct side of the line. If it is false, you want the other side.

e.g. Testing $x > 1$

The coordinate (3,0) is not on the line $x = 1$.

Substituting into $x > 1$. $3 > 1$. True. So we want to be to the right of the line $x > 1$ as indicated by the arrow in the top left.

Repeat for the other 2 lines

Using (3,0) again with $y > x$ $0 > 3$. False. So we need to be the other side of the diagonal line $y > x$ (arrow in top right).

Using (3,0) with $x + y \leq 7$ $3 + 0 \leq 7$. True. So we want to 'below' the diagonal line $x + y \leq 7$ as indicated by the arrow in the bottom right.

Finally, the region which is true for all 3 arrows is the triangle in the middle, labelled R

GLUE

HERE