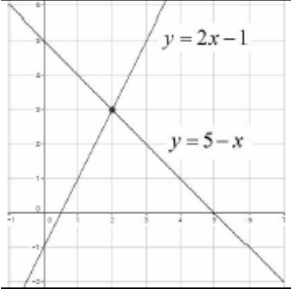


## Topic: Simultaneous Equations

Topic/Skill	Definition/Tips	Example
1. Simultaneous Equations	<p>A set of <b>two or more equations</b>, each involving <b>two or more variables</b> (letters).</p> <p>The <b>solutions</b> to simultaneous equations <b>satisfy both/all of the equations</b>.</p>	$2x + y = 7$ $3x - y = 8$ $x = 3$ $y = 1$
2. Variable	A <b>symbol</b> , usually a <b>letter</b> , which <b>represents a number</b> which is usually unknown.	In the equation $x + 2 = 5$ , $x$ is the variable.
3. Coefficient	<p>A <b>number</b> used to <b>multiply</b> a <b>variable</b>.</p> <p>It is the number that comes before/in front of a letter.</p>	$6z$ 6 is the coefficient $z$ is the variable
4. Solving Simultaneous Equations (by Elimination)	<ol style="list-style-type: none"> <li><b>Balance</b> the <b>coefficients</b> of one of the variables.</li> <li><b>Eliminate</b> this variable by adding or subtracting the equations (<b>Same Sign Subtract, Different Sign Add</b>)</li> <li><b>Solve</b> the linear equation you get using the other variable.</li> <li><b>Substitute</b> the value you found back into one of the previous equations.</li> <li><b>Solve</b> the equation you get.</li> <li><b>Check</b> that the two values you get satisfy both of the original equations.</li> </ol>	$5x + 2y = 9$ $10x + 3y = 16$ <p>Multiply the first equation by 2.</p> $10x + 4y = 18$ $10x + 3y = 16$ <p>Same Sign Subtract (+10x on both)</p> $y = 2$ <p>Substitute <math>y = 2</math> in to equation.</p> $5x + 2 \times 2 = 9$ $5x + 4 = 9$ $5x = 5$ $x = 1$ Solution: $x = 1, y = 2$
5. Solving Simultaneous Equations (by Substitution)	<ol style="list-style-type: none"> <li><b>Rearrange</b> one of the equations into the form <math>y = \dots</math> or <math>x = \dots</math></li> <li><b>Substitute</b> the right-hand side of the rearranged equation into the other equation.</li> <li>Expand and <b>solve</b> this equation.</li> <li><b>Substitute</b> the value into the <math>y = \dots</math> or <math>x = \dots</math> equation.</li> <li><b>Check</b> that the two values you get satisfy both of the original equations.</li> </ol>	$y - 2x = 3$ $3x + 4y = 1$ <p>Rearrange: <math>y - 2x = 3 \rightarrow y = 2x + 3</math></p> <p>Substitute: <math>3x + 4(2x + 3) = 1</math></p> <p>Solve: <math>3x + 8x + 12 = 1</math></p> $11x = -11$ $x = -1$ <p>Substitute: <math>y = 2 \times -1 + 3</math></p> $y = 1$ Solution: $x = -1, y = 1$

<p>6. Solving Simultaneous Equations (Graphically)</p>	<p><b>Draw the graphs</b> of the two equations.</p> <p>The <b>solutions</b> will be <b>where the lines meet</b>.</p> <p>The solution can be written as a <b>coordinate</b>.</p>	 <p><math>y = 5 - x</math> and <math>y = 2x - 1</math>.</p> <p>They meet at the point with coordinates (2,3) so the answer is <math>x = 2</math> and <math>y = 3</math></p>
<p>7. Solving Linear and Quadratic Simultaneous Equations</p>	<p>Method 1: If both equations are in the same form (eg. Both <math>y = \dots</math>):</p> <ol style="list-style-type: none"> <li>1. Set the equations <b>equal to each other</b>.</li> <li>2. <b>Rearrange</b> to make the equation <b>equal to zero</b>.</li> <li>3. <b>Solve</b> the quadratic equation.</li> <li>4. <b>Substitute</b> the values back in to one of the equations.</li> </ol> <p>Method 2: If the equations are not in the same form:</p> <ol style="list-style-type: none"> <li>1. <b>Rearrange</b> the linear equation into the form <math>y = \dots</math> or <math>x = \dots</math></li> <li>2. <b>Substitute</b> in to the quadratic equation.</li> <li>3. <b>Rearrange</b> to make the equation <b>equal to zero</b>.</li> <li>4. <b>Solve</b> the quadratic equation.</li> <li>5. <b>Substitute</b> the values back in to one of the equations.</li> </ol> <p>You should get <b>two pairs of solutions</b> (two values for <math>x</math>, two values for <math>y</math>.)</p> <p>Graphically, you should have <b>two points of intersection</b>.</p>	<p><u>Example 1</u> Solve <math>y = x^2 - 2x - 5</math> and <math>y = x - 1</math></p> $x^2 - 2x - 5 = x - 1$ $x^2 - 3x - 4 = 0$ $(x - 4)(x + 1) = 0$ <p><math>x = 4</math> and <math>x = -1</math></p> <p><math>y = 4 - 1 = 3</math> and <math>y = -1 - 1 = -2</math></p> <p>Answers: (4,3) and (-1,-2)</p> <p><u>Example 2</u> Solve <math>x^2 + y^2 = 5</math> and <math>x + y = 3</math></p> $x = 3 - y$ $(3 - y)^2 + y^2 = 5$ $9 - 6y + y^2 + y^2 = 5$ $2y^2 - 6y + 4 = 0$ $y^2 - 3y + 2 = 0$ $(y - 1)(y - 2) = 0$ <p><math>y = 1</math> and <math>y = 2</math></p> <p><math>x = 3 - 1 = 2</math> and <math>x = 3 - 2 = 1</math></p> <p>Answers: (2,1) and (1,2)</p>