# SIMULTANEOUS EQUATIONS

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| **Keywords:** | Simultaneous / Eliminate / Non-linear / Linear / Substitute | | | | |
| **Definition / Description:** | **Simultaneous:** 2 values satisfying more than one equation at the same time | **Eliminate:** To remove | **Non-Linear:** An expression or equation where there is a power than is not 1 | **Linear:** An expression or equation where the only power than 1 | **Substitute:** To exchange or replace a value |

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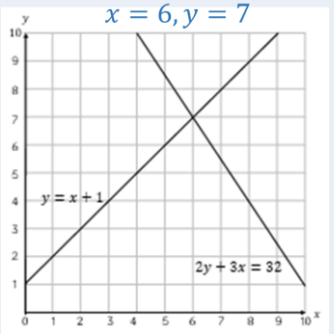
| **Knowledge points:** | Solving using Elimination (2 Linear)<br>1. Label equations<br>2. Look to see if the coefficients of either variable are equal<br>3. Multiply one or both equations to make the coefficients of one variable the same<br>4. Look at sign in front of those variables<br>5. Same Signs Subtract Different Signs Add<br>6. Solve equation to find first variable<br>7. Substitute into original equation to find second variable<br>8. Check both solutions in other equation | Solving using Substitution (1 linear and 1 quadratic)<br>1. Rearrange one equation to make a variable as subject<br>2. Substitute into second equation<br>3. Solve as linear equation<br>4. Substitute into original equation to find other variable<br>5. Check both solutions in the other equation | Simultaneous Equations Graphically<br>1. Plot both graphs<br>2. The solution to the simultaneous equation is found at the intersection of the two graphs | Setting up and solving:<br>David and Jen are attending a football match with their families<br>Jen buys 2 Adult tickets and 2 Kids tickets for £90<br>David buys 1 Adult ticket and 3 Kids tickets for £75<br>Use Simultaneous Equations to work out the price of 1 Adult and 1 Kids Ticket. | Solving using Substitution (1 linear and 1 quadratic)<br>1. Rearrange linear to make variable as subject<br>2. Substitute into quadratic<br>3. Solve quadratic (2 solutions)<br>4. Substitute both solutions in the linear equation to find other variable |
| **Knowledge point examples:** | $7x + 6y = 46$ (1)<br>$2x + 3y = 17$ (2)<br><br>(2) x 2 $4x + 6y = 34$ (3)<br><br>SSS (1)-(3) $3x = 12$<br>$x = 4$<br><br>Sub in (1) $7(4) + 6y = 46$<br>$28 + 6y = 46$<br>$6y = 18$<br>$y = 3$<br><br>Check in (2) $2(4) + 3(3) = 17$ | $3x + 2y = 21$<br>$y = x + 3$<br><br>$3x + 2(x + 3) = 21$<br>$3x + 2x + 6 = 21$<br>$5x + 6 = 21$<br>$5x = 15$<br>$x = 3$<br><br>$y = 3 + 3$<br>$y = 6$<br><br>$3(3) + 2(6) = 21$ |  | $2a + 2k = 90$ (1)<br>$a + 3k = 75$ (2)<br><br>(2) X 2 $2a + 6k = 150$ (3)<br>SSS (3) – (1) $4k = 60$<br>$k = 15$<br><br>$a + 3(15) = 75$<br>$a = 30$<br><br>Adults = £30<br>Kids = £15 | $x^2 - y^2 = 7$<br>$2y = 2 + x$<br><br>$x = 2y - 2$<br><br>$(2y - 2)^2 - y^2 = 7$<br>$4y^2 - 8y + 4 - y^2 = 7$<br>$3y^2 - 8y - 3 = 0$<br>$(3y+1)(y-3) = 0$<br>$y = -\frac{1}{3}$ or 3<br><br>$x = 2(-\frac{1}{3}) - 2$ or $x = 2(3) - 2$<br><br>$= -2\frac{2}{3}$ $= 4$ |
| **Linked Knowledge Maps** | Solving Linear Equations / Non-Linear Graphs quadratic and cubic / Solving Quadratic Equations / Linear Graphs | | | | |