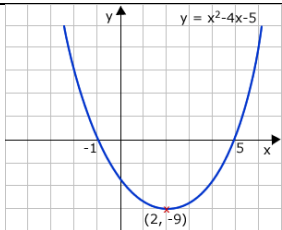
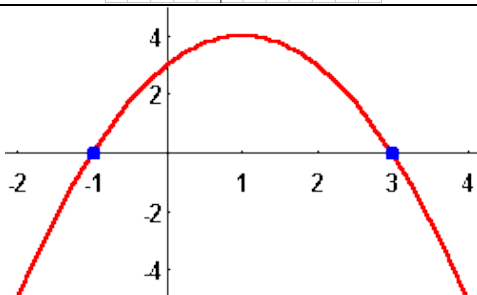



Topic: Further Quadratics

Topic/Skill	Definition/Tips	Example
1. Quadratic	<p>A quadratic expression is of the form</p> $ax^2 + bx + c$ <p>where a, b and c are numbers, $a \neq 0$</p>	<p>Examples of quadratic expressions:</p> x^2 $8x^2 - 3x + 7$ <p>Examples of non-quadratic expressions:</p> $2x^3 - 5x^2$ $9x - 1$
2. Factorising Quadratics	<p>When a quadratic expression is in the form $x^2 + bx + c$ find the two numbers that add to give b and multiply to give c.</p>	$x^2 + 7x + 10 = (x + 5)(x + 2)$ <p>(because 5 and 2 add to give 7 and multiply to give 10)</p> $x^2 + 2x - 8 = (x + 4)(x - 2)$ <p>(because +4 and -2 add to give +2 and multiply to give -8)</p>
3. Difference of Two Squares	<p>An expression of the form $a^2 - b^2$ can be factorised to give $(a + b)(a - b)$</p>	$x^2 - 25 = (x + 5)(x - 5)$ $16x^2 - 81 = (4x + 9)(4x - 9)$
4. Solving Quadratics ($ax^2 = b$)	<p>Isolate the x^2 term and square root both sides.</p> <p>Remember there will be a positive and a negative solution.</p>	$2x^2 = 98$ $x^2 = 49$ $x = \pm 7$
5. Solving Quadratics ($ax^2 + bx = 0$)	<p>Factorise and then solve = 0.</p>	$x^2 - 3x = 0$ $x(x - 3) = 0$ $x = 0 \text{ or } x = 3$
6. Solving Quadratics by Factorising ($a = 1$)	<p>Factorise the quadratic in the usual way.</p> <p>Solve = 0</p> <p>Make sure the equation = 0 before factorising.</p>	<p>Solve $x^2 + 3x - 10 = 0$</p> <p>Factorise: $(x + 5)(x - 2) = 0$</p> $x = -5 \text{ or } x = 2$
7. Quadratic Graph	<p>A 'U-shaped' curve called a parabola.</p> <p>The equation is of the form $y = ax^2 + bx + c$, where a, b and c are numbers, $a \neq 0$.</p> <p>If $a < 0$, the parabola is upside down.</p>	
8. Roots of a Quadratic	<p>A root is a solution.</p> <p>The roots of a quadratic are the x-intercepts of the quadratic graph.</p>	

9. Turning Point of a Quadratic	<p>A turning point is the point where a quadratic turns.</p> <p>On a positive parabola, the turning point is called a minimum.</p> <p>On a negative parabola, the turning point is called a maximum.</p>	
10. Factorising Quadratics when $a \neq 1$	<p>When a quadratic is in the form $ax^2 + bx + c$</p> <ol style="list-style-type: none"> 1. Multiply a by $c = ac$ 2. Find two numbers that add to give b and multiply to give ac. 3. Re-write the quadratic, replacing bx with the two numbers you found. 4. Factorise in pairs – you should get the same bracket twice 5. Write your two brackets – one will be the repeated bracket, the other will be made of the factors outside each of the two brackets. 	<p>Factorise $6x^2 + 5x - 4$</p> <ol style="list-style-type: none"> 1. $6 \times -4 = -24$ 2. Two numbers that add to give $+5$ and multiply to give -24 are $+8$ and -3 3. $6x^2 + 8x - 3x - 4$ 4. Factorise in pairs: $2x(3x + 4) - 1(3x + 4)$ 5. Answer = $(3x + 4)(2x - 1)$
11. Solving Quadratics by Factorising ($a \neq 1$)	<p>Factorise the quadratic in the usual way. Solve = 0</p> <p>Make sure the equation = 0 before factorising.</p>	<p>Solve $2x^2 + 7x - 4 = 0$</p> <p>Factorise: $(2x - 1)(x + 4) = 0$</p> <p>$x = \frac{1}{2}$ or $x = -4$</p>
12. Completing the Square (when $a = 1$)	<p>A quadratic in the form $x^2 + bx + c$ can be written in the form $(x + p)^2 + q$</p> <ol style="list-style-type: none"> 1. Write a set of brackets with x in and half the value of b. 2. Square the bracket. 3. Subtract $\left(\frac{b}{2}\right)^2$ and add c. 4. Simplify the expression. <p>You can use the completing the square form to help find the maximum or minimum of quadratic graph.</p>	<p>Complete the square of $y = x^2 - 6x + 2$</p> <p>Answer:</p> $(x - 3)^2 - 3^2 + 2$ $= (x - 3)^2 - 7$ <p>The minimum value of this expression occurs when $(x - 3)^2 = 0$, which occurs when $x = 3$</p> <p>When $x = 3$, $y = 0 - 7 = -7$</p> <p>Minimum point = $(3, -7)$</p>
13. Completing the Square (when $a \neq 1$)	<p>A quadratic in the form $ax^2 + bx + c$ can be written in the form $p(x + q)^2 + r$</p> <p>Use the same method as above, but factorise out a at the start.</p>	<p>Complete the square of $4x^2 + 8x - 3$</p> <p>Answer:</p> $4[x^2 + 2x] - 3$ $= 4[(x + 1)^2 - 1^2] - 3$ $= 4(x + 1)^2 - 4 - 3$ $= 4(x + 1)^2 - 7$
14. Solving Quadratics by Completing the Square	<p>Complete the square in the usual way and use inverse operations to solve.</p>	<p>Solve $x^2 + 8x + 1 = 0$</p> <p>Answer:</p> $(x + 4)^2 - 4^2 + 1 = 0$ $(x + 4)^2 - 15 = 0$

		$(x + 4)^2 = 15$ $(x + 4) = \pm\sqrt{15}$ $x = -4 \pm \sqrt{15}$
15. Solving Quadratics using the Quadratic Formula	<p>A quadratic in the form $ax^2 + bx + c = 0$ can be solved using the formula:</p> $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ <p>Use the formula if the quadratic does not factorise easily.</p>	<p>Solve $3x^2 + x - 5 = 0$</p> <p>Answer: $a = 3, b = 1, c = -5$</p> $x = \frac{-1 \pm \sqrt{1^2 - 4 \times 3 \times -5}}{2 \times 3}$ $x = \frac{-1 \pm \sqrt{61}}{6}$ <p>$x = 1.14 \text{ or } -1.47 \text{ (2 d.p.)}$</p>