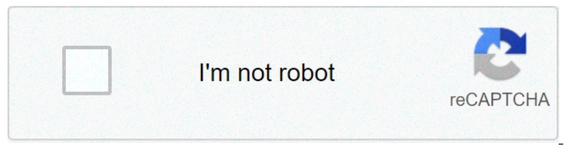

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arrow_back Back to Solving Quadratic Equations Whether you want a homework, some cover work, or a lovely bit of extra practise, this is the place for you. And best of all they all (well, most!) come with answers. Contents Mathster is a fantastic resource for creating online and paper-based assessments and homeworks. They have kindly allowed me to create 3 editable versions of each worksheet, complete with answers. Worksheet Name 1 2 3 Quadratic Equations - Basic Factorisation 1 2 3 Quadratic Equations - Advanced Factorisation 1 2 3 Quadratic Equations - Difference of 2 Squares 1 2 3 Quadratic Equations - Completing the Square 1 2 3 Quadratic Equations - Quadratic Formula 1 2 3 Quadratic Equations - Solving by Graph 1 2 3 Quadratic Equations - All skills together 1 2 3 Corbett Maths keyboard_arrow_up Back to Top Corbett Maths offers outstanding, original exam style questions on any topic, as well as videos, past papers and 5-a-day. It really is one of the very best websites around. Here we will learn about quadratic equations and how to solve quadratic equations using four methods: factorisation, using the quadratic formula, completing the square and using a graph.There are also quadratic equation worksheets based on Edexcel, AQA and OCR exam questions, along with further guidance on where to go next if you're still stuck.A quadratic equation is a quadratic expression that is equal to something.Quadratic algebraic equations are equations that contain terms up to x2; the highest power for a quadratic equation is 2.Quadratic equations are a type of polynomial equation because they consist of two or more algebraic terms.To solve a quadratic equation it must equal 0.E.g.\[\begin{aligned} x^{2}+5&=0\\ x^{2}-2x+1&=0\\ 2x^{2}+3x-2&=0\ \end{aligned}\] When we solve a quadratic equation we normally get two solutions.The general example of a quadratic equation is written as:a is coefficient (number in front) of the x2 termb is coefficient (number in front) of the x termc is the constant term (number on its own)At GCSE the solutions to polynomial equations such as quadratics will always give real numbers but they can be either irrational and rational numbers. Get your free quadratic equation worksheet of 20+ questions and answers. Includes reasoning and applied questions. DOWNLOAD FREE x Get your free quadratic equation worksheet of 20+ questions and answers. Includes reasoning and applied questions. DOWNLOAD FREEIn order to solve a quadratic equation we must first check that it is in the form:If it isn't, we will need to rearrange the equation.Example:Although the most common way of solving quadratic equations is through factorising, there are in fact three other ways to solve them as well. We will explore how to solve the same quadratic equation in each of the four ways.Example of solving a quadratic by factorisation:Solve\[(x-6)(x+4)=0\] \[\begin{aligned} x-6&=0 \quad &x+4&=0\\ x&=6 \quad &x&=-4 \end{aligned}\]Step by step guide: Solving quadratic equations by factorising\[x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}\]Example of solving a quadratic by using the quadratic formula:SolveThe standard form of a quadratic equation is given by\[a=1, \quad b=-2, \quad c=-24\] \[x=\frac{-(-2)\pm\sqrt{(-2)^2-4(1)(-24)}}{2(1)}\] \[x=6 \quad and \quad x=-4\]Step by step guide: Quadratic formulaExample of solving a quadratic by completing the squareSolve\[x=6\quad and \quad x=-4\]Step by step guide: Completing the squareExample of solving a quadratic by using a quadratic graphSolveThe real roots/solutions are shown where the graph crosses the horizontal x-axis.\[x=6\quad and \quad x=-4\]Step by step guide: Quadratic graphsExample of solving a quadratic equation by factorising (also known as factoring).To solveFully factorise the quadratic equation.We can factorise a quadratic into two brackets when it is in the form ax2 + bx + c or when two square numbers (perfect squares) are subtracted from each other in the form a2 − b2, also known as the difference of two squares.Factors1, 242, 123, 84, 6\[\begin{aligned} -6+4&=-2\\ -6\times 4&=-24 \end{aligned}\]2 Set each bracket equal to 0.\[x-6=0\qquad \qquad x+4=0\]3 Solve each equation to find x.\[\begin{aligned} x-6&=0 \quad &x+4&=0\\ x&=6 \quad &x&=-4 \end{aligned}\]We can check that our solution is correct by substituting it into the original equation. Example of solving a quadratic equation by using the quadratic formula.To solve\[a=1, \quad b=-2, \quad c=-24\]2 Substitute the these values into the quadratic formula.Thepart of the quadratic formula is called the discriminant and tells us how many real roots (solutions) the equation has.\[x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}\]\[x=\frac{-(-2)\pm\sqrt{(-2)^2-4(1)(-24)}}{2(1)}\]Using brackets will help to make the calculation clear.3 Use a calculator to solve the equation with a +, and then with a −.\[\begin{aligned} x&=\frac{-(-2)+\sqrt{(-2)^2-4(1)(-24)}}{2(1)} \quad &x&=\frac{-(-2)-\sqrt{(-2)^2-4(1)(-24)}}{2(1)}\\ x&=6 \quad &x&=-4 \end{aligned}\]We can check that our solution is correct by substituting it into the original equation.Example of solving a quadratic equation by completing the square.To solveComplete the square to rewrite the quadratic equation in the form a(x + d)2 + e = 0.2 Rearrange the equation to work out the unknown variable (x).The opposite of − 25 is + 25, so + 25 to both sides of the equation.The opposite of squaring is square root, so take the square root of the left hand side, and the right hand side.Remember a square root has a positive and a negative solution, so use the ± sign.3 The square root has a + and – answer, write down both versions of the calculation to find the two solutions of x.\[\begin{aligned} x&=\sqrt{25}+1 \quad &x&=-\sqrt{25}+1\\ x&=5+1 \quad &x&=-5+1\\ x&=6 \quad &x&=-4 \end{aligned}\]We can check that our solution is correct by substituting it into the original equation. We can plot a quadratic equation to form a quadratic graph to help us to solve it.We can substitute values for x into quadratic function to produce values for y. When we plot these values on an x, y grid we get a special 'U' shaped curve called a parabola.Example of solving a quadratic equation by drawing the graph:To solvewe need to:2 The solutions/roots of equation are where the graph crosses the x -axis (when y =0)We know that to solve a quadratic it must be equal to 0. Because x2 – 2x – 24 = 0 we are looking for the values of x that when substituted into the equation will give us a y value of 0On the graph the coordinates for x where y = 0 are given where the graph crosses the x axisSo the solutions or roots of the equationare\[x=6 \quad and \quad x=-4\]We can check that our solution is correct by substituting it into the original equation. Step by step guide: Solving quadratic equations by using graphs (coming soon)Practice quadratic equation questionsSolve the following by either using factorising, the quadratic formula, or completing the square.What would the quadratic graph look like?1. Solve {x}^2 + x – 6 = 0 x = 2 \quad \quad x = -3 2. Solve {x}^2 – 4x – 1 = 0 x=-0.236 (3.s.f) \quad \quad x=4.23 (3.s.f) 3. Solve 2{x}^2 – 7x + 6 = 0 x=1.5 \quad \quad x=2 4. Solve 3{x}^2 + 5x – 2 = 0 x=-2 \quad \quad x=\frac{1}{3}=0.333(3.s.f) Quadratic equation GCSE questions1. (a) Factorise x^{2}-x-30 (2 marks) (x + 5) or (x – 6) (1) (x + 5) (x – 6) (1)1. (b) Hence or otherwise solve the equation x^{2}-x-30=0 (1 mark)2. Solve 2 x^{2}+10 x+12=0 (3 marks) (2x + 4)(x + 3) (1) x = -3 (1) x = -2 (1)Did you know that Al-Khwarizmi (Abu Ja'far Muhammad ibn Musa al-Khwarizmi) was one of the first people in history to write about algebra? He lived in Baghdad around 780 to 850 AD and his book "Hisab Al-jabr w'al-muqabala" is where we get the word 'algebra' (meaning 'restoration of broken parts'). Copyright (c) 2021 by khaled (Did you know the ancient Babylonians could solve quadratic equations using a method equivalent to the quadratic formula, despite not using algebraic notation!Did you know that the ancient Greek mathematician Euclid used geometric methods to solve quadratic equations way back in 300BC! His book, The Elements, is one of the most studied books in human history.The history of mathematics is amazing!You have now learned how to:Solve quadratic equations algebraically by factorisingSolve quadratic equations algebraically by using the quadratic formula (H)Solve quadratic equations algebraically by completing the square (H)Solve quadratic equations by finding approximate solutions using a graphFactorising quadraticsSolving equationsSimultaneous equationsPrepare your KS4 students for maths GCSEs success with Third Space Learning. Weekly online one to one GCSE maths revision lessons delivered by expert maths tutors.Find out more about our GCSE maths revision programme.We use essential and non-essential cookies to improve the experience on our website. Please read our Cookies Policy for information on how we use cookies and how to manage or change your cookie settings.AcceptPrivacy & Cookies Policy Solve the quadratic equations : Solve the quadratic equations with absolute value : Solve the quadratic inequalities : Solve the rational quadratic inequalities : Solve the quadratic inequalities with absolute value : You might be also interested in: An example of a Quadratic Equation: The function makes nice curves like this one: Name The name Quadratic comes from "quad" meaning square, because the variable gets squared (like x2). It is also called an "Equation of Degree 2" (because of the "2" on the x) Standard Form The Standard Form of a Quadratic Equation looks like this: a, b and c are known values. a can't be 0. "x" is the variable or unknown (we don't know it yet). Here are some examples: 2x2 + 5x + 3 = 0 In this one a=2, b=5 and c=3 x2 − 3x = 0 This one is a little more tricky: Where is a? Well a=1, as we don't usually write "1x2" b = −3 And where is c? Well c=0, so is not shown. 5x − 3 = 0 Oops! This one is not a quadratic equation: it is missing x2 (in other words a=0, which means it can't be quadratic) Have a Play With It Play with the "Quadratic Equation Explorer" so you can see: the function's graph, and the solutions (called "roots"). Hidden Quadratic Equations! As we saw before, the Standard Form of a Quadratic Equation is But sometimes a quadratic equation doesn't look like that! For example: In disguise In Standard Form a, b and c x2 = 3x − 1 Move all terms to left hand side x2 − 3x + 1 = 0 a=1, b=−3, c=1 2(w2 − 2w) = 5 Expand (undo the brackets), and move 5 to left 2w2 − 4w − 5 = 0 a=2, b=−4, c=−5 z(z−1) = 3 Expand, and move 3 to left z2 − z − 3 = 0 a=1, b=−1, c=−3 How To Solve Them? The "solutions" to the Quadratic Equation are where it is equal to zero. They are also called "roots", or sometimes "zeros" There are usually 2 solutions (as shown in this graph). And there are a few different ways to find the solutions: Or we can Complete the Square Or we can use the special Quadratic Formula: Just plug in the values of a, b and c, and do the calculations. We will look at this method in more detail now. First of all what is that plus/minus thing that looks like ± ? The ± means there are TWO answers: x = −b + √(b2 − 4ac) 2a x = −b − √(b2 − 4ac) 2a Here is an example with two answers: But it does not always work out like that! Imagine if the curve "just touches" the x-axis. Or imagine the curve is so high it doesn't even cross the x-axis! This is where the "Discriminant" helps us ... Discriminant Do you see b2 − 4ac in the formula above? It is called the Discriminant, because it can "discriminate" between the possible types of answer: when b2 − 4ac is positive, we get two Real solutions when it is zero we get just ONE real solution (both answers are the same) when it is negative we get a pair of Complex solutions Complex solutions? Let's talk about them after we see how to use the formula. Using the Quadratic Formula Just put the values of a, b and c into the Quadratic Formula, and do the calculations. Coefficients are:a = 5, b = 6, c = 1 Quadratic Formula:x = −b ± √(b2 − 4ac) 2a Put in a, b and c:x = −6 ± √(62 − 4×5×1) 2×5 Solve:x = −6 ± √(36 − 20) 10 x = −6 ± √(16) 10 x = −6 ± 4 10 x = −0.2 or −1 Answer: x = −0.2 or x = −1 And we see them on this graph. Check -0.2: 5×(−0.2)2 + 6×(−0.2) + 1 = 5×(0.04) + 6×(−0.2) + 1 = 0.2 − 1.2 + 1 = 0 Check -1: 5×(−1)2 + 6×(−1) + 1 = 5×(1) + 6×(−1) + 1 = 5 − 6 + 1 = 0 Remembering The Formula A kind reader suggested singing it to "Pop Goes the Weasel": ♫ "x is equal to minus b ♫ "All around the mulberry bush plus or minus the square root The monkey chased the weasel of b-squared minus four a c The monkey thought 'twas all in fun ALL over two a" Pop! goes the weasel" Try singing it a few times and it will get stuck in your head! Or you can remember this story: x = −b ± √(b2 − 4ac) 2a "A negative boy was thinking yes or no about going to a party, at the party he talked to a square boy but not to the 4 awesome chicks. It was all over at 2 am." Complex Solutions? When the Discriminant (the value b2 − 4ac) is negative we get a pair of Complex solutions ... what does that mean? It means our answer will include Imaginary Numbers. Wow! Coefficients are:a=5, b=2, c=1 Note that the Discriminant is negative:b2 − 4ac = 22 − 4×5×1 = −16 Use the Quadratic Formula:x = −2 ± √(−16) 10 √(−16) = 4i (where i is the imaginary number √−1) So:x = −2 ± 4i 10 Answer: x = −0.2 ± 0.4i The graph does not cross the x-axis. That is why we ended up with complex numbers. In some ways it is easier: we don't need more calculation, just leave it as −0.2 ± 0.4i. Coefficients are:a=1, b=−4, c=6.25 Note that the Discriminant is negative:b2 − 4ac = (−4)2 − 4×1×6.25 = −9 Use the Quadratic Formula:x = −(−4) ± √(−9) 2 √(−9) = 3i (where i is the imaginary number √−1) So:x = 4 ± 3i 2 Answer: x = 2 ± 1.5i The graph does not cross the x-axis. That is why we ended up with complex numbers. BUT an upside-down mirror image of our equation does cross the x-axis at 2 ± 1.5 (note: missing the i). Just an interesting fact for you! Summary Quadratic Equation in Standard Form: ax2 + bx + c = 0 Quadratic Equations can be factored Quadratic Formula: x = −b ± √(b2 − 4ac) 2a When the Discriminant (b2−4ac) is: positive, there are 2 real solutions zero, there is one real solution negative, there are 2 complex solutions (Hard Questions: 1 2 3 4 5 6 7 8)

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