The quadratic formula and the discriminant worksheet 8-9



1 The Quadratic Formula 8-9 and the Discriminant Warm UpLesson Presentation Lesson Quiz Holt McDougal Algebra 1 2 Warm Up Evaluate for x =-2, y = 3, and z = -1. 1. x2 4 2. xyz 6 3. x2 - yz 7 4. y - xz 1 5. -x 2 6. z2 - xy 7 3 Objectives Solve quadratic equations by using the Quadratic Formula. Determine the number of solutions of a quadratic equation by using the discriminant. 4 Vocabulary discriminant 5 In the previous lesson, you complete the square to solve quadratic Formula. The Quadratic Formula is the only method that can be used to solve any quadratic equation. 6 7 Example 1A: Using the Quadratic Formula. Solve using the Quadratic Formula. $6x^2 + 5x - 4 = 0$ for b, and c. Use the Quadratic Formula. Solve each equation. 9 Example 18: Using the Quadratic Formula Solve using the Quadratic Formula. $x^2 = x + 20$ Write in standard form. Identify a, b, and c. $1x^2 + (-1x) + (-20) = 0$ Use the quadratic formula. $x^2 = x + 20$ Simplify. Write as two equations. x = 5 or x = -4Solve each equation. 11 Check It Out! Example 1a Solve using the Quadratic Formula. -3x2 + 5x + 2 = 0 Identify a, b, and c. Use the Quadratic Formula. -3x2 + 5x + 2 = 0 Identify a, b, and c. Use the Quadratic Formula. -3x2 + 5x + 2 = 0 Simplify. Write as two equations. x = - or x = 2 Solve each equation. 13 Check It Out! Example 1b Solve using the Quadratic Formula. $2 - 5x^2 = -9x(-5)x^2 + 9x + (2) = 0$ Write in standard form. Identify a, b, and c. Use the Quadratic Formula. $2 - 5x^2 = -9x(-5)x^2 + 9x + (2) = 0$ Simplify. Write as two equations. x = - or x = 2 Solve each equation. 15 Many quadratic equations can be solved by graphing, factoring, taking the square root, or completing the square root, or completing the square root, or completing the square solved by any of these methods, but you can always use the Quadratic Formula to solve any quadratic equation. 16 Example 2: Using the Quadratic Formula to Estimate SolutionsSolve $x_2 + 3x - 7 = 0$ using the Quadratic Formula. Check reasonableness Use a calculator: $x \approx 3.87$ or $x \approx 0.13$. 18 If the quadratic equation is in standard form, the discriminant of a quadratic equation is b2 – 4ac, the part of the equations can have two, one, or no real solutions. You can determine the number of solutions of a quadratic equation by evaluating its discriminant. 19 20 21 Example 3: Using the Discriminant Find the number of solutions of each equation using the discriminant. A. B. C. $3x^2 - 2x + 2 = 0$ $2x^2 + 11x + 12 = 0$ $x^2 + 8x + 16 = 0$ a = 3, b = -2, c = 2 a = 2, b = 11, c = 12 a = 1, b = 8, c = 16 $b^2 - 4ac$ $b^2 - 4a$ solutions. $b_2 - 4ac$ is positive. There are two real solutions. $b_2 - 4ac$ is zero. There is one real solutions of each equation using the discdriminant. A. c. b. $2x_2 - 2x + 3 = 0$ $x_2 + 4x + 4 = 0$ $x_2 - 9x + 4 = 0$ a = 2, b = -2, c = 3 a = 1, b = 4, c = 4 a = 1, b = -9, c = 4 b2 - 4ac b2 in feet per second is given by h = -16t2 + vt + c, where c is the beginning height of the object above the ground. 24 If the object above the ground equals 0. Helpful Hint 25 Example 4: Application The height h in feet of an object shot straight up with initial velocity v in feet per second is given by $h = -16t^2 + vt + c$, where c is the initial height of the object above the ground. The ringer on a carnival strength test is 2 feet off the ground and is shot upward with an initial velocity of 30 feet per second. Will it reach a height of 20 feet? Use the discriminant to explain your answer. 26 Example 4 Continued $h = -16t^2 + vt + c$. 20 for h, 30 for v, and 2 for c. 20 = -16t2 + 30t + 20 = -16t2 + 30t + 20 = -16t2 + 30t + (-18) Subtract 20 from both sides. b2 - 4ac Evaluate the discriminant. 302 - 4(-16)(-18) = -252 Substitute -16 for a, 30 for b, and -18 for c. The discriminant is negative, so there are no real solutions. The ringer will not reach a height of 20 feet. 27 Check It Out! Example 4 What if...? Suppose the weight is shot straight up with an initial velocity of 20 feet per second from 1 foot above the ground. Will it ring the bell? Use the discriminant to explain your answer. h = -16t2 + vt + c Substitute 20 for h, 20 for v, and 1 for c. 20 = -16t2 + 20t + 10 = -16t2 + 20t + (-19) Subtract 20 from both sides. Evaluate the discriminant. b2 -4ac 202 - 4(-16)(-19) = -816 Substitute -16 for a, 20 for b, and -19 for c. The discriminant is negative, so there are no real solutions. The ringer will not reach a height of 20 feet. 28 There is no one correct way to solve a guadratic equation. Many guadratic equations can be solved using several different methods. 29 Example 5: Solving Using Different MethodsSolve $x^2 - 9x + 20 = 0$. Show your work. Method 1 Solve by graphing. Write the related quadratic function and graph it. $y = x^2 - 9x + 20 = 0$. Show your work. Method 2 Solve by factoring. $x^2 - 9x$ + 20 = 0 (x - 5)(x - 4) = 0 Factor. x - 5 = 0 or x - 4 = 0 Use the Zero Product Property. x = 5 or x = 4 Solve each equation. 31 Solve x2 - 9x + 20 = 0. Show your work. Example 5 Continued Solve x2 - 9x + 20 = 0. Show your work. Method 3 Solve by completing the square. x2 - 9x + 20 = 0 x2 - 9x = -20 Add to both sides. x2 - 9x = -20 + Factor and simplify. Take the square root of both sides. 32 Solve $x_2 - 9x + 20 = 0$. Show your work. Example 5 Continued Solve $x_2 - 9x + 20 = 0$. Show your work. Method 3 Solve by completing the square. Quadratic Formula. $1x^2 - 9x + 20 = 0$ Identify a, b, c. Substitute 1 for a, -9 for b, and 20 for c. Simplify. Write as two equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equations. x = 5 or x = 4 Solve each equation equations. x = 5 or x = 4 Solve each equation equations. x = 5 or x = 4 Solve each equation equation equations. x = 5 or x = 4 Solve each equation equatio = 0 Method 3 Solve by completing the square. $x^2 + 7x + 10 = 0$ $x^2 + 7x = -10$ Add to both sides. Factor and simplify. Take the square root of both sides. 37 Check It Out! Example 5a ContinuedSolve. Show your work. $x^2 + 7x + 10 = 0$ Method 3 Solve by completing the square. x = -2 or x = -5 Solve each equation. 38 Check It Out! Example 5a ContinuedSolve. Continued $x^2 + 7x + 10 = 0$ Method 4 Solve using the Quadratic Formula. $1x^2 + 7x + 10 = 0$ Identify a, b, c. Substitute 1 for a, 7 for b, and 10 for c. Simplify. Write as two equations. x = -5 or x = -2 Solve each equation. 39 Check It Out! Example 5b Solve. Show your work. $-14 + x^2 = 5x$ Method 1 Solve by graphing. $y = x^2 - 5x - 14$ Write the related quadratic function and graph it. The solutions are the x-intercepts, -2 and 7. 40 Check It Out! Example 5b ContinuedSolve. Show your work. $-14 + x^2 = 5x$ Method 2 Solve by factoring. $x^2 - 5x - 14 = 0$ Factor. (x - 7)(x + 2) = 0 X - 7 = 0 or x + 2 = 0 Use the Zero Product Property. x = 7 or x = -2 Solve each equation. 41 Check It Out! Example 5b ContinuedSolve. Show your work. $-14 + x^2 = 5x$ Method 3 Solve by completing the square. $x^2 - 5x = 14$ Add to both sides. Factor and simplify. Take the square root of both sides. 42 Check It Out! Example 5b ContinuedSolve. Show your work. $-14 + x^2 = 5x$ Method 3 Solve by completing the square. x = -2 or x = 7 Solve each equation. 43 Check It Out! Example 5b ContinuedMethod 4 Solve using the Quadratic Formula. 1x2 - 5x - 14 = 0 Identify a, b, c. Substitute 1 for a, -5 for b, and -14 for c. Simplify. Write as two equations. x = 7 or x = -2 Solve each equations. x = 7 or x = -2 + 4x - 21 Write the related quadratic function and graph it. The solutions are the x-intercepts, ≈ -4.39 and $\approx 2.39.45$ Check It Out! Example 5c ContinuedSolve. Show your work. $2x^2 + 4x - 21 = 0$ Method 2 Solve by factoring. $(2x^2 + 4x - 21) = 0$ Factor. Not factorable. Try another method. 46 Check It Out! Example 5c ContinuedMethod 3 Solve by completing the square cost of both sides by 2. Add to both sides. Factor and simplify. Take the square root of both sides. 47 Check It Out! Example 5c ContinuedMethod 3 Solve by completing the square root of both sides. 47 Check It Out! Example 5c ContinuedMethod 3 Solve by completing the square root of both sides. 47 Check It Out! Example 5c ContinuedMethod 3 Solve by completing the square root of both sides. 47 Check It Out! Example 5c ContinuedMethod 3 Solve by completing the square root of both sides. Out! Example 5c ContinuedMethod 4 Solve using the Quadratic Formula. 2x2 + 4x - 21 = 0 Identify a, b, c. Substitute 2 for a, 4 for b, and - 21 for c. Simplify. Use a calculator to compute the square root . 49 Check It Out! Example 5c ContinuedMethod 4 Solve using the Quadratic Formula. Write as two equations. Solve each equation. x ~ or x ~ -4.391 50 Sometimes one method is better for solving certain types of equations. The following table gives some advantages of the different methods. 51 52 Lesson Quiz: Part I 1. Solve -3x2 + 5x = 1 by using the Quadratic Formula. 2. Find the number of solutions of $5x^2 - 10x - 8 = 0$ by using the discriminant. ≈ 0.23 , $\approx 1.43 \ 2.53$ Lesson Quiz: Part II 3. The height of the object above the ground. An object is shot up from 4 feet off the ground with an initial velocity of 48 feet per second. Will it reach a height of 40 feet? Use the discriminant to explain your answer. The discriminant is zero. The object will reach its maximum height of 40 feet once. 4. Solve $8x^2 - 13x - 6 = 0$. Show your work.

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