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Richard Crooks's WebsiteConverting Factored Form to Standard FormQuadratic equations in the factored form can be converted to the standard format simply. If we take the example of the equation (eq. 1) to show the process.Eq. 1: \(y=(x+4)(x+3)\)Using a process called FOIL, standing for first, outside, inside, last. This describes the order in which the components of each bracket are multiplied in (Figure 1a). Alternatively, you can think of this in terms of a table (Figure 1b), which is a way I prefer to visualize it.Figure 1: Multiplying the terms contained in each bracket by one another using the FOIL method, by multiplying the First terms in the brackets, the Outisde terms, the Inside terms, and the Last terms. This can also be shown in the table form.Whichever way is used, you will finish off with a selection of terms that can be combined into a single expression (eq. 2).Eq. 2: \(y=x^2+3x+4x+12\)Some of these terms (the 3x and 4x terms) can be combined, as they are like terms. Thus giving the quadratic equation in the standard form (eq. 3).Eq. 3: \(y=x^2+7x+12\)This then completes the quadratic equation in the standard form. Given one of the forms of a quadratic function, convert to the other two forms.Problem 1 :y = x2 6x 7(i) Vertex form(ii) Factored formSolution :(i) Converting into vertex form :y = x2 6x 7Coefficient of x2 is 1. So, don't have to factoriesanything.Write the coefficient of x as multiple of 2.y = x2 2x3 + 32 - 32 -7y = (x - 3)2- 32-7y = (x - 3)2- 9 -7y = (x - 3)2- 16y = (x - h)2 + kVertex (h, k) is (3, -16).(i) Converting into factored form :y = x2 6x 7Decomposing -7, we get 1 (-7).1(-7) = -7, 1 + (-7) = -6y = x2+ 1x - 7x 7y = x(x + 1) - 7(x + 1)y = (x + 1) (x - 7)So, -1 and 7 are x-intercepts.Problem 2 :y = 3(x 1)2 3(i) Standard form(ii) Factored formSolution :(i) Converting into standard form :y = 3(x 1)2 3Here (x-1)2 looks like (a - b)2.(a - b)2 = a2 - 2ab + b2(x 1)2= x2- 2x(1) + 12(x 1)2= x2- 2x - 3y = 3(x2- 2x + 1) - 3y = 3x2- 6x + 3 - 3y = 3x2- 6x(ii) Converting into factored form :y = 3x2- 6xFactor 3x, we get= 3x (x - 2)So, 0 and 2 are x-intercepts.Problem 3 :y = 2(x 3)(x + 5)(i) Vertex form:(ii) Standard form:Solution :(i) Converting into vertex form :y = 2(x 3)(x + 5)y = 2(x2 + 5x - 3x - 15)y = 2(x2+ 2x - 15)y = 2(x2+ 2x1 + 12 - 12- 15)y = 2[(x + 1)2- 12- 15]y = 2[(x + 1)2- 16]y = 2(x + 1)2- 32So, vertex is (-1, -32).(ii) Converting into standard form :y = 2(x 3)(x + 5)y = 2(x 3)(x + 5)y = 2(x2+ 5x - 3x - 15)y = 2(x2+ 2x - 15)Distributing 2, we gety = 2x2+ 4x - 30Problem 4 :y = 2x2 + 8x + 10(i) Vertex form:(ii) Factored formSolution :(i) Converting into vertex form :y = 2x2+ 8x - 10y = 2(x2+ 4x - 5)y = 2(x2+ 2x2 + 22 - 22- 5)y = 2[(x+2)2- 4- 5)]y = 2[(x+2)2- 9]y = 2(x+2)2- 18So, the vertex is (-2, -18).(ii) Converting into factored form :y = 2x2+ 8x - 10y = 2(x2+ 4x - 5)y = 2(x - 52+ 4x - 5)Problem 5 : = 2(+ 1)2 8(i) Standard form(ii) Factored formSolution :(i) Converting into standard form : = 2(+ 1)2 8Using the algebraic identity (a + b)2, we can find the expansion of (x + 1)2(x + 1)2 = x2 + 2x1 + 12(x + 1)2= x2+ 2x + 1y = 2(x2+ 2x + 1) 8y = 2x2+ 4x + 2 8y = 2x2+ 4x 6(ii) Converting into factored form :y = 2x2+ 4x 6Factoring 2, we gety = 2(x2+ 2x 3)y = 2(x - 1) (x + 3)Problem 6 :y = 4(x + 1)(2x 5)(i) Vertex form:(ii) Standard form:Solution :(i) Converting into vertex form :y = 4(x + 1)(2x 5)y = 4(2x2 - 5x + 2x - 5)y = 4(2x2- 3x - 5)y = 4(2x2- 3x - 5)y =-42x2-3xy = -8x2 - 32x52y=-8x2 - 22x32+342-342-52y=-8x2 - 2x34+342-342-52y=-8x2 - 2x34+342+ (-9-40)16y=-8x - 342+ 84916y=-8x - 342+492So, the vertex is (3/4, 49/2).(ii) Converting into standard form :y = 4(x + 1)(2x 5)y = 4(2x2- 5x + 2x - 5)y = 4(2x2- 3x - 5)y = 4(2x2- 3x - 5)y = 8x2+ 12x + 20 This book may not be used in the training of large language models or otherwise be ingested into large language models or generative AI offerings without OpenStax's permission. 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The OpenStax name, OpenStax logo, OpenStax book covers, OpenStax CNX name, and OpenStax CNX logo are not subject to the Creative Commons license and may not be reproduced without the prior and express written consent of Rice University.To convert the standard form to factored form, we should know about about how to factorize the quadratic polynomial.To factorize the quadratic polynomial which is in the form ax2 + bx + c, first we will check the coefficient of x2.Step 1 :If the coefficient of x2 is 1, take c and decompose it into two parts.If the coefficient of x2 is not 1, take ac and decompose it into two parts.Step 2 :Such that the product of those two factors is equal to c or ac and the when we combine it we should get the middle term (b).Step 3 :Write the middle term as sum of those two factors that we have receivedfrom step 2.Step 4 :Using grouping, write them as product of factors. Problem 1 :Convert f(x) = 3x2 + 18x - 48 to factored form.Solution :f(x) = 3x2+ 18x - 48Here every term is a multiple of 3. Factoring 3 out.f(x) = 3(x2+ 6x - 16)-16 = -28f(x) = 3(x2-2x + 8x - 16)f(x) = 3[x(x-2) + 8(x - 2)]f(x) = 3(x - 2) (x + 8)Problem 2 :Factorize2x2 +4x + 2Solution :Letf(x) = 2x2 +4x + 2f(x) = 2(x2+ 2x + 1)f(x) = 2(x2+x + x+ 1)f(x) = 2[x(x + 1) + (x + 1)]f(x) = 2 (x + 1) (x + 1)Problem 3 :The height of the foot ball kicked from the ground is given by the function h(t) = -5t2 + 20, where h(t) is height in meters and t is the time in seconds from its release.(i) Write the function in factored form.(ii) When will the foot ball hit the ground ?Solution :(i) h(t) = -5t2+ 20Factoring -5, we geth(t) = -5(t2 - 4)h(t) = -5(t2- 22)t2- 22 looks like a2 - b2The expansion of a2- b2 = (a + b)(a - b)h(t) = -5(t + 2) (t - 2)(ii) When it hits the ground, the height will become zero.0 = -5(t + 2) (t - 2)Equating each factor to zero, we gett + 2 = 0 and t - 2 = 0t = -2 and t = 2Problem 4 :Solve x2 - 8x + 12 = -3Move everything to one side and find zeros.Solution :x2- 8x + 12 = -3Add 3 on both sides, we getx2- 8x + 12 + 3 = 0x2- 8x + 15 = 0x2- 3x - 5x + 15 = 0Using grouping, we getx(x - 3) - 5(x - 3) = 0(x - 5)(x - 3) = 0Equating each factor to zero, we getx - 5 = 0 and x - 3 = 0x = 5 and x = 3Problem 5 :Find the points of intersections of the graphsf(x) = x2 - 8x + 12 and g(x) = -3Solution :f(x) = x2- 8x + 12 -----(1)g(x) = -3-----(2)(1) = (2)x2- 8x + 12 = -3Add 3 on both sides on both sides.x2- 8x + 12 + 3 = 0x2- 8x + 15 = 0x2- 3x - 5x + 15 = 0Using grouping, we getx(x - 3) - 5(x - 3) = 0(x - 5)(x - 3) = 0Equating each factor to zero, we getx = 5 and x = 3So, points of intersections are (5, -3) and (3, -3).Problem 6 :The path a dolphin travels when it rises above the oceans surface can be modelled by the functionh(d) = -0.2d2 + 2dwhere h(d) is the height of the dolphin above the waters surface and d is the horizontal distance from the point where the dolphin broke the waters surface, both in feet. When will the dolphin reach a height of 1.8 feet?Solution :h(d) = -0.2d2+ 2dWhen h(d) = 1.81.8 = -0.2d2+ 2d-0.2d2+ 2d = 1.8-0.2d2+ 2d - 1.8 = 0Multiply the equation by -10, we get2d2 + 20d + 18 = 0Dividing by 2, we getd2- 10d + 9 = 0(d - 1) (d - 9) = 0Equating each factor to zero.d - 1 = 0 and d - 9 = 0d = 1 and d = 9So, at d = 1 and d = 9 the dolphin will reach the height 200 m. Related Pages Looking to understand the different forms of quadratic equations? Read below for an explanation of the three main forms of quadratics (standard form, factored form, and vertex form), examples of each form, as well as strategies for converting between the various quadratic forms. Your mathematics journey has taken you far. There was a time when the words variable and equation were only concepts you would someday understand. The skills you developed then gave you a foundation of using mathematics to solve simple problems. Then, you delved into variables and unknown values. You conquered solving equations for the value of x. You are able to create and interpret graphs of equations. Now, we are opening a new tool: quadratics! Quadratic equations may feel different, scary, exciting, or all of the above. Regardless of how you feel going into learning quadratic equations, know that you can conquer this, too. You are entering a new level of mathematical understanding and a new world of real-life situations to model. Lets get started! There are three commonly-used forms of quadratics: 1. Standard Form: y=ax^2+bx+c2. Factored Form: y=a(x-r_1)(x-r_2)3. Vertex Form: y=a(x-h)^2+k Each quadratic form looks unique, allowing for different problems to be more easily solved in one form than another. We will unpack the features of each form and how to switch between forms. Return to the Table of Contents Each form of a quadratic equation includes specific advantages. Recognizing the benefits of each different form can make it easier to understand and solve different situations. Let us begin with the benefits of standard form. In standard mathematical notation, formulas and equations are written with the highest degree first. The degree refers to the exponent. In the case of quadratic equations, the degree is two because the highest exponent is two. Following the x^2 term is the term with an exponent of one followed by the term with an exponent of zero. Standard Form of Quadratic Equation: y=ax^2+bx+c The benefits of standard form include quickly identifying the end behavior of a function and identifying the values of a, b, and c. The end behavior of a function is identified by the leading coefficient and the degree of a function. The degree of a quadratic equation is always two. The leading coefficient of a quadratic equation is always the term a when written in standard form. If the value of a is positive, the parabola opens up, meaning the function rises to the left and rises to the right. If the value of a is negative, the parabola opens down, meaning the function falls to the left and falls to the right. y=3x^2+2x-1 Notice: positive a value, degree of 2, parabola opens upy=-3x^2+2x+1 Notice: negative a value, degree of 2, parabola opens down One method for solving a quadratic equation is to use the quadratic formula. To do so, we must identify the values of a, b, and c. To learn more about this, read our detailed review article on the quadratic formula. Next, lets now consider why factored form is useful. To get to factored form, we do exactly what it sounds like: we factor the equation from standard form. Factored Form of Quadratic Equation: y=a(x-r_1)(x-r_2) In the factored form of a quadratic, we are also able to determine end behavior using the value of a. Although the degree is not as easily identifiable, we know there are only two factors, making the degree two. The end behavior follows the same rules explained above. The additional benefit of factored form is identifying zeros, or x-intercepts, of the function. The value of r_1 and the value of r_2 are both zeros (also called solutions) of the quadratic function. y= - (x + 2)(x - 3) Zeros: x = -2 \text{ and } x= 3 We must note that not all quadratics have real zeros (some quadratics require imaginary numbers as their zeros), so factored form may not always be applicable. Finally, we have the vertex form of a quadratic. Remember, the vertex is the point where the axis of symmetry intersects the parabola. It is also the lowest point of a parabola opening up or the highest point of a parabola opening down. Vertex Form of Quadratic Equation: y=a(x-h)^2+k As you may expect, the main benefit of vertex form is easily identifying the vertex. The vertex of a parabola, or a quadratic equation, is written as (h,k) where the h is the x-coordinate and the k is the y-coordinate. As we can see, the value of h and the value of k are easily identifiable in this form. Additionally, we can still determine the end behavior using the value of a. y= 3(x-2)^2 - 1 Vertex: (2,-1) Return to the Table of Contents Standard Form of Quadratic Equation: y=ax^2+bx+c Remember, standard form provides us values for the coefficients a, b, and c, while x and y are the variables. For example, the equation: y=3x^2+7x-9 is in standard form, telling us that a=3, b=7, and c=-9. Factored Form of Quadratic Equation: y=a(x-r_1)(x-r_2) In factored form, we can see the zeros, also called x-intercepts, are r_1 and r_2. Our variables remain x and y, and a is a coefficient. In the factored form equation: y=3(x+8)(x-6) the two x-intercepts are -8 and 6, and the value of a equals 3. Vertex Form of Quadratic Equation: y=a(x-h)^2+k In vertex form, the variables x and y and the coefficient of a still remain, but now we can identify the vertex using the values of h and k. For instance, in the equation: y=-7(x-2)^2+16 which is in vertex form, the vertex is (2,16) and the value of a is -2. Often, we need many different pieces of information about quadratic equations. It can be useful to see the same quadratic equation in the multiple forms. Just like a chameleon can change colors in different situations, we can change the forms of quadratics to suit our needs. Change forms of a quadratic like a chameleon! The ability to switch between forms quickly and accurately enables us to understand the quadratic equation well and easily identify needed pieces of information. For example, you may be asked to determine the zeros of a quadratic equation given in standard form. In order to identify the zeros, we first must change the equation to factored form. Return to the Table of Contents Let us begin with the equation: y=x^2+5x-24 We may be asked for the zeros of the equation. In order to determine the zeros, we can change this into factored form. To change this into factored form, we must factor the expression x^2+5x-24. Lets remember what Factored Form looks like: Factored Form of Quadratic Equation: y=a(x-r_1)(x-r_2) In order to factor the expression, we must determine the factors of -24 that have a sum of 5. We can list the factors of -24 and their sums: FactorsSum of Factors-24 and 1 -24 + 1 = -23-1 and 24 -1 + 24 = 23-12 and 2 -12 + 2 = -10-2 and 12 -2 + 12 = 10-6 and 4 -6 + 4 = -2-4 and 6-4 + 6 = 2 -8 and 3 -8 + 3 = -5-3 and 8 -3 + 8 = 5 The two values that multiply to -24 and have a sum of 5 are -3 and 8. Therefore, we can rewrite our quadratic equation by factoring. y=x^2+5x-24 y=(x-3)(x+8) To determine the zeros, we set the equation equal to zero. Then, we can solve by setting each factor equal to zero: (x-3)(x+8)=0 Therefore, the zeros of the function are 3 and -8. The final factored form the equation is: y=(x-3)(x+8) To learn more about this approach by reading our article on solving quadratic equations by factoring. Return to the Table of Contents Instead of being asked for the zeros, we could be asked for the vertex of a quadratic equation. Let us begin with the quadratic equation: y=x^2+6x-5 which is given in standard form, and determine the vertex of the equation. In order to do so, we will convert this into vertex form. To convert into vertex form, we must complete a process called completing the square. Essentially, we are setting up a trinomial that we can factor into a perfect square. Let us remember what vertex form of a quadratic looks like: Vertex Form of Quadratic Equation: y=a(x-h)^2+k We need to set up the equation just right so that we can factor it to create (x-h)^2. This may sound intimidating, but there is a step-by-step process that always works! First, isolate the x. This means we need to move any constants to the side with y. Constants are terms with no variable attached. y=x^2+6x-5 y+5=x^2+6x If we had a leading coefficient other than one, we would divide all terms by the leading coefficient. Remember, the leading coefficient is the number in front of x^2. In our case, we have a leading coefficient of one, so we can skip this step. From here, we need to determine what value to add to both sides. To determine this value, we look at the number in front of x. In our case, this value is 6. We have half of this value and then square the result. \dfrac{1}{2} (6) = 3 3^2=9 The value we must add to both sides of our equation is 9. Remember this will create a trinomial which is a perfect square (thus, the name completing the square). y+5=x^2+6x y+5\textcolor{blue}{+9}=x^2+6x\textcolor{blue}{+9} Now we have created a trinomial, x^2+6x+9, which we can factor into a perfect square. This factors into (x+3)^2. Notice this matches the step where we took half of 6. After we factor it, we will then solve for y. y+5+9=x^2+6x+9 y+5+9=(x+3)^2 y+14=(x+3)^2 y=(x+3)^2-14 Now that the equation is in vertex form, we can identify the vertex as (-3,-14). The vertex form of the quadratic equation is: y=(x+3)^2-14 Converting from quadratic form to standard form is quite common, so you can also check out this helpful video for another example. Return to the Table of Contents To convert an equation from factored form into standard form simply involves multiplying the factors. For example, let us change the quadratic equation: y=(3x-2)(-x+7) into standard form. We will use double distribution to multiply the factors (3x-2) and (-x+7) together. y=(3x-2)(-x+7) y=(3x \times -x) + (3x \times 7) + (-2 \times -x) + (-2 \times 7) y=-3x^2+21x+2x-14 y=-3x^2+23x-14 Therefore, the standard form of the quadratic equation is y=-3x^2+23x-14. Return to the Table of Contents Finally, we may also need to convert an equation from vertex form into standard form. For example, we can change the equation: y=2(x+7)^2-10 into standard form. We will expand the expression (x+7)^2 and again use double distribution. Then, we will continue simplifying the equation. y=2(x+7)^2-10 y=2(x+7)(x+7)-10 y=2(x^2+14x+49)-10 y=2x^2+28x+98-10 y=2x^2+28x+88 Therefore, the standard form of the quadratic equation is y=2x^2+28x+88. Return to the Table of Contents For some practice questions covering the forms of quadratics, check out Alberts Algebra 1 practice course! All of Alberts questions include explanations of solutions and how to avoid common mistakes. Additionally, licensed Albert teachers can assign students this short Algebra 1 Topic Quiz that focuses on vertex, roots, and the various forms of quadratics. Finally, check outour other detailed Algebra 1 review guidesto learn more about quadratic. Quadratic equations will be written in three forms.(i) Standard form(ii) Factored form(iii) Vertex formHere we see examples to show how to convert standard form to factored form.The general form any quadratic equation will be in the formax2 + bx + cTo factorize a quadratic polynomial, we have to check whether the coefficient of x2 is 1 or not equal to 1.If it is 1, take the constant alone and decompose it into two parts. Such that the product of those two terms should be equal to c and when we simplify, we should get b.If it is not 1, take the constant alone and decompose it into two parts. Such that the product of those two terms should be equal to ac and when we simplify, we should get b.Quadratic functiony = ax2+ bx + cy = ax2- bx + cy = ax2- bx - cy = ax2+ bx - cSign of factorsBoth factors are positiveBoth factors are negativeThe greater number will be positive, smaller number will be negativeThe greater number will be negative, smaller number will be positiveConvert the following quadratic function from standard form to factored form.Example 1 :y = x2 - 4x + 4Solution :y = x2 - 4x + 4Leading coefficient = 1 (coefficient of x2)Constant = 4Factors of 4 = -2 (-2) and -2 + (-2) ==> -4y = x2 - 2x - 2x + 4Factoring x from first two terms and factoring 2 from third and fourth term.y = x(x - 2) - 2(x - 2)Factored form :y = (x - 2) (x - 2)Example 2 :y = 2x2 - x - 1Solution :y = 2x2 - x - 1Leading coefficient = 2 (coefficient of x2)Constant = -1Factors of -2 = -2 1 and -2 + 1 ==> -1y = 2x2 - 2x + 1x - 1y = 2x(x - 1) + 1(x - 1)Factored form :y = (2x + 1) (x - 1)Example 3:y = x2 - 5x + 6Solution :y = x2 - 5x + 6Leading coefficient = 1 (coefficient of x2)Constant = -6Factors of -6 = -2 (-3) and -2 + (-3) ==> -5y = x2 - 2x - 3x + 6y = x(x - 2) - 3(x - 2)Factored form :y = (x - 2) (x - 3)Example 4 :y = x2 - 5x - 6Solution :y = x2 - 5x - 6Leading coefficient = 1 (coefficient of x2)Constant = -6Factors of -6 = 1 (-6) and 1+ (-6) ==> -5y = x2+ 1x - 6x - 6y = x(x + 1) - 6(x + 1)Factored form :y = (x - 6) (x + 1)Example 5 :y = x2 - 17x + 72Solution :y = x2 - 17x + 72Leading coefficient = 1 (coefficient of x2)Constant = 72Factors of 72 = -8 (-9) and -8+ (-9) ==> -17y = x2 - 8x - 9x + 72y = x(x - 8) - 9(x - 8)Factored form :y = (x - 8) (x - 9)Example 6 :y = 4x2 - 12x + 9Solution :y = 4x2 - 12x + 9Leading coefficient = 4 (coefficient of x2)Constant = 9Factors of 36 = -6 (-6) and -6+ (-6) ==> -12y = 4x2 - 6x - 6x + 9Factoring 2x from4x2 - 6x and factoring -3 from- 6x + 9, we gety = 2x(2x - 3) - 3(2x - 3)Factored form :y = (2x - 3) (2x - 3)Example 7 :y = 4x2+ 28x + 49Solution :y = 4x2+ 28x + 49Leading coefficient = 4 (coefficient of x2)Constant = 49Factors of 196 = 14 14 and 14+ 14 ==> 28y = 4x2+ 14x + 14x + 49Factoring 2x from4x2+ 14x and factoring 7 from 14x + 49, we gety = 2x(2x + 7) + 7(2x + 7)Factored form :y = (2x + 7) (2x + 7)Example 8 :y = 9x2+ 6x + 1Solution :y = 9x2+ 6x + 1Leading coefficient = 9 (coefficient of x2)Constant = 1Factors of 9 = 3 3 and 3+ 3 ==> 6y = 9x2+ 3x + 3x + 1Factoring 3x from 9x2+ 3x and factoring 1 from 3x + 1, we gety = 3x(3x + 1) + 1(3x + 1)Factored form :y = (3x + 1) (3x + 1) Learn how to write a polynomial from factored form to standard form with a couple of good examples.Example #1Write the expression (x + 2)(x + 3)(x + 4) as a polynomial in standard formMultiply (x + 3) and (x + 4)(x + 2)(x + 3)(x + 4) = (x + 2)(x2 + 4x + 3x + 12)Simplify(x + 2)(x + 3)(x + 4) = (x + 2)(x2 + 7x + 12)Use the distributive property(x + 2)(x + 3)(x + 4) = x(x2+ 7x + 12) + 2(x2+ 7x + 12)Multiply(x + 2)(x + 3)(x + 4) = x3+ 7x2 + 12x + 2x2+ 14x + 24Combine like terms(x + 2)(x + 3)(x + 4) = x3+ 7x2+ 2x2+ 12x + 14x + 24Simplify(x + 2)(x + 3)(x + 4) = x3+ 9x2+ 26x + 24The expression (x + 2)(x + 3)(x + 4) is the factored form of x3+ 9x2+ 26x + 24 Example #2Write the expression (x - 5)(x + 1)(x + 1) as a polynomial in standard formMultiply (x + 1) and (x + 1)(x - 5)(x + 1)(x + 1) = (x - 5)(x2 + x + x + 1)Simplify(x - 5)(x + 1)(x + 1) = (x - 5)(x2+ 2x + 1)Use the distributive property(x - 5)(x + 1)(x + 1) = x(x2+ 2x + 1) + -5(x2+ 2x + 1)Multiply(x - 5)(x + 1)(x + 1) = x3+ 2x2 + x + -5x2+ -10x + -5Combine like terms(x - 5)(x + 1)(x + 1) = x3+ 2x2+ -5x2+ x + -10x + -5Simplify(x - 5)(x + 1)(x + 1) = x3+ -3x2+ -9x + -5The expression (x - 5)(x + 1)(x + 1) is the factored form of x3+ -3x2+ -9x + -5 Convert the quadratic function from standard form toi) Vertex formii) Factored formProblem 1 :y = x2 - 8x + 15Solution:Vertex Form:y = a(x - h)2 + ky = x2 - 8x + 15y = x2 - 8x + 42 + 15 - 42y = (x - 4)2 - 1Factored Form:y = a(x - p) (x - q)y = x2 - 8x + 15y = x2 - 5x - 3x + 15y = x(x - 5) - 3(x - 5)y = (x - 3) (x - 5)Problem 2 :y = x2 - 4xSolution:Vertex Form:y = a(x - h)2 + ky = x2 - 4x + 22 - 22y = (x - 2)2 - 4Factored Form:y = a(x - p) (x - q)y = x2 - 4xy = x(x - 4)Problem 3 :y = x2 + 4x + 3Solution:Vertex Form:y = a(x - h)2 + ky = x2 + 4x + 3y = x2 + 4x + 22 + 3 - 22y = (x + 2)2 - 1Factored Form:y = a(x - p) (x - q)y = x2 + 4x + 3y = x2 + x + 3x + 3y = x(x + 1) + 3(x + 1)y = (x + 1) (x + 3)Problem 4 :y = 3x2 - 6x + 3Solution:Vertex Form:y = a(x - h)2 + ky = 3x2 - 6x + 3y = 3(x2 - 2x + 1)y = 3(x2 - 2x + 12 + 1 - 12)y = 3(x - 1)2+ 0Factored Form:y = a(x - p) (x - q)y = 3x2 - 6x + 3y = 3(x2 - 2x + 1)y = 3(x - 1)(x - 1)Problem 5 :y = x2+ 6x + 5Solution:Vertex Form:y = a(x - h)2 + ky = x2+ 6x + 5y = x2 + 6x + 32 + 5 - 32y = (x + 3)2 - 4Factored Form:y = a(x - p) (x - q)y = x2+ 6x + 5y = x2 + x + 5x + 5y = x(x + 1) + 5(x + 1)y = (x + 1) (x + 5)Converting From Factored FormConvert the quadratic function from factored toi) Standard formii) Vertex formProblem 6 :y = (x + 4)(x + 3)Solution:Standard Form:y = ax2 + bx + cy = (x + 4)(x + 3)y = x2 + 3x + 4x + 12y = x2 + 7x + 12Vertex Form:y = a(x - h)2 + ky = x2 + 7x + 12y=x2+7x+722-722+12y=x+722-494+12y=x+722-14Problem 7 :y = -2(x + 2)(x - 1)Solution:Standard Form:y = ax2 + bx + cy = -2(x + 2)(x - 1)y = -2(x2 - x + 2x - 2)y = -2(x2 + x - 2)y = -2x2 - x + 4Vertex Form:y = a(x - h)2 + ky = -2x2 - x + 4y=-2x2+12x-2y=-2x2+12x+142-142-2y=-2x+142-142-2y=-2x+142-3316y=-2x+142+338Problem 8 :y = 3(2x - 1)(x - 1)Solution:Standard Form:y = ax2 + bx + cy = 3(2x - 1)(x - 1)y = 3(2x2 - 2x - x + 1)y = 3(2x2 - 3x + 1)y = 6x2 - 9x + 3Vertex Form:y = a(x - h)2 + ky = 6x2 - 9x + 3y=6x2-32x+12y=6x2-32x+342-342+12y=6x-342-342+12y=6x-342-116y=6x-342-38Problem 9 :y = (5x + 1)(x - 3)Standard Form:y = ax2 + bx + cy = (5x + 1)(x - 3)y = 5x2 - 15x + x - 3y = 5x2 - 14x - 3Vertex Form:y = a(x - h)2 + ky = 5x2 - 14x - 3y=5x2-145x-35y=5x2-145x+752-752-35y=5x-752-752-35y=5x-752-6425y=5x-752-645Problem 10 :y = (x - 10)(x - 6)Solution:Standard Form:y = ax2 + bx + cy = (x - 10)(x - 6)y = x2- 6x - 10x + 60y = x2- 16x + 60Vertex Form:y = a(x - h)2 + ky = x2- 16x + 60y = x2 - 16x + 82 - 82 + 60y = (x - 8)2 - 4Converting From Vertex FormConvert the quadratic function from vertex form toi) Standard formii) Factored formProblem 11 :y = (x - 4)2 - 9Solution:Standard Form:y = ax2 + bx + cy = (x - 4)2 - 9y = (x2 + 16 - 8x) - 9y = x2 - 8x + 7Factored Form:y = a(x - p) (x - q)y = x2 - 8x + 7y = x2 - x - 7x + 7y = x(x - 1) -7(x - 1)y = (x - 1) (x - 7)Problem 12 :y = (x + 2)2 - 9Standard Form:y = ax2 + bx + cy = (x + 2)2 - 9y = x2 + 4 + 4x - 9y = x2 + 4x - 5Factored Form:y = a(x - p) (x - q)y = x2 + 4x - 5y = x2 - x + 5x - 5y = x(x - 1) + 5(x - 1)y = (x - 1) (x + 5)Problem 13 :y=x+722-14Solution:Standard Form:y = ax2 + bx + cy=x+722-14y=x2+494+7x-14y=x2+7x+12Factored Form:y = a(x - p) (x - q)y = x2 + 7x + 12y = (x + 4)(x + 3)Problem 14 :y=6x-342-38Solution:Standard Form:y = ax2 + bx + cy=6x-342-38y=6x2+916-32x-38y=6x2+278-9x-38y=6x2-9x+3Factored Form:y = a(x - p) (x - q)y = 6x2 - 9x + 3y = 6x2 - 6x - 3x + 3y = 6x(x - 1) - 3(x - 1)y = (6x - 3) (x - 1)y = 3(2x - 1) (x - 1)Problem 15 :y=5x-752-645Solution:Standard Form:y = ax2 + bx + cy=5x-752-645y=5x2+4925-145x-645y=5x2+495-14x-645y=5x2-14x-3Factored Form:y = a(x - p) (x - q)y = 5x2 - 14x - 3y = 5x2 + x - 15x - 3y = x(5x + 1) - 3(5x + 1)y = (5x + 1) (x - 3)

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