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Factorising quadratics notes

There is a quick trick to determine if you need to add a + or - sign to the brackets. There are three subtypes that we're going around. Subtype (a): Contains all positives These grids contain all positive terms, for example x^2 +5x + 6. When taken into account, both brackets will contain \bf{\bf{\large{+}}}. x^2 + 5x + 6 = (x+3)(x+2) Subtype (b): b is negative and c is positive These quadratic contain a negative b value and a positive value c. When factored in, both brackets will contain \bf{\large{-}}. x^2 -10x +21 = (x-7)(x-3) Sub-type (c): c is negative. If c is negative, when taken into account, one bracket will contain one \bf{+} the other will contain a \bf{\large{-}}. The order or these must be determined. These are the hardest guys and require more thought. x^2 + 3x -18 = (x+6)(x-3) When we say a=1, we refer to the number before x^2 in x^2+bx+c will be 1 (usually we do not write the 1). Any number that appears before a term x is called a coefficient, so in this case, a is the x^2 coefficient that has a value of 1. Example: Factor the following quadratic into two brackets, x^2\textcolor{blue}{-3}x+\textcolor{red}{2} Step 1: First we can type two brackets with an x placed in each bracket. (x\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,)) (x\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,)) Step 2: We can identify that it is a quadratic subtype (b), that is, both brackets will contain \large{-} (x\,\,\,,) (x\,,) (x\,\,\,\,\,\,\,\,\,\,\,) Step 3: We need to find two numbers that multiply to make \textcolor{red}{2} and when they are added together they do \textcolor{blue}{-3}. We know both numbers will be negative. -2 \times -1 = \textcolor{red}{2} -2 + -1 = \textcolor{blue}{-3} Finally add these numbers to the brackets. (x-2) (x-1) In this case, the overall form of the equation is ax^2+bx+c on a>1. Example: Factorize the following square 4x^2+\textcolor{blue}{3x}\textcolor{red}{-1} Step 1: When a>1 makes things more complicated. It is not immediately obvious what the coefficient of each x term should be. There are two possible options, (4x \kern{1 cm}) (x \kern{1 cm}) or (2x \kern{1 cm}) (2x \kern{1 cm}) Step 2: We can identify that this quadratic is part of the subtype (c) which means it can contain + and - This is more important for quadratic pairs that are not symmetrical by creating a third option, all three are shown below. \begin{aligned}(4x \kern{0.4 cm} +\kern{0.4 cm})&&(x \kern{0.4 cm}-\kern{0.4 cm})&amp ;amp;(x \kern{0.4 cm}-\kern{0.4 4 cm})\\ (4x \kern{0.4 cm} -\kern{0.4 cm})&(x \kern{0.4 cm}+\kern{0.4 cm})&&(x \kern{0.4 cm}+\kern{0..4 cm})\\(2x \kern{0.4 cm}+\kern{0.4 cm})&&(2x \kern{0.4 cm}-\kern{10.4 cm})\end{ aligned} Step 3 : We need to find two numbers that when multiplied to make \textcolor{red}{-1} \textcolor{red}{-1} has only one factor. -1 \times 1 = -1 Step We need to find a combination that gives \textcolor{blue}{3x} We can try our 3 3 \begin{aligned}(4x+1)(x -1) &= 4x^2 -3x -1 \\(4x-1)(x+1) &= 4x^2 + 3x -3x -11 \\(2x+1)(2x-1) &= 4x^2 -1\end{aligned} As we can see (4x-1) (x+1) gives the correct expansion and is therefore the answer. Factorise x^2 - x - 12. [2 brands] Step 1: Draw empty brackets (x \kern{1 cm}) (x \kern{1 cm}) Step 2: Identify subtype (b) (x \kern{0.4cm} + \kern{0.4cm}) (x \kern{0.4 cm} - \kern{0.4cm}) Step 3: We are looking for two numbers that multiply to make \textcolor{red}{-12} and add to do \textcolor{orange}{-1}. Consider some pairs of factors of -12. \begin{aligned}(-1)\times12&=-12 \,\,\text{ and } } -1 + 12 = 11\\(-2)\times6&amp ;=-12 \,\,\text{ and } } -2 + 6 = 4\\ (-6)\times2&=-12 \,\,\text{ and } } -6+ 2 4\\ (-3)\times4&=-12 \,\,\text{ and } } -3 +4 = 1\\\textcolor{blue}{(-4)\times3}&&\textcolor{blue}{=-12 }\,\,\text{ and } } \textcolor{blue}{-4 + 3 = -1}\end{aligned} We could go ahead , but there is no need for the last pair , -4 and 3, add it to make -1. This pair fills both criteria (as highlighted above) so factoring x^2 -x -12 is (x -4) (x +3) Note: You can try to enlarge the double brackets to check that your answer is correct. You should always get your original quadratic equation if you do it correctly. Factorise 2x^2 + 7x + 3. [3 brands] Step 1: Draw the empty brackets. Although a>1 there is only one possible option this time. (2x \kern{1 cm}) (x \kern{1 cm}) Step 2: Identify the subtype (a), i.e. the two brackets contain +. (2x \kern{0.4cm} + \kern{0.4cm}) (x \kern{0.4 cm} + \kern{0.4cm}) Step 3: Find two numbers that multiply to give \textcolor{red}{3} 3 has only one factor. 3 \times 1 = 3 Step 4: Find the combination that gives 7x \begin{aligned}\textcolor{blue}{(2x \,\, +\,\, 1) (x\,\, + \,\,3) }&\textcolor{blue}{=2x^2 + 7x +3} \\ (2x\,\, +\,\, 3) (x\,\, + \,\,1) &= 2x^2 +5x + 3\end{aligned} As we can see, (2x + 1)(x + 3), gives the correct expansion and is therefore the correct answer. We are looking for two numbers that are added to make 1 and multiply to make -30. The factors of 30 that meet these two needs are 5 and 6. Therefore, the complete factorization of a ^2+ to - 30 is (a - 5)(a + 6) We are looking for two numbers that are added to make -5 and multiply to make 6. The factors of 6 that meet these two needs are -2 and -3. Therefore, the complete factorization of k^ 2 - 5k + 6 is (k - 2) (k - 3) We are looking for two numbers that are added to make 7 and multiply to make 12. The factors of 12 that meet these two needs are 3 and 4. Therefore, the complete factorization of x^2 + 7x + 12 is, (x + 3)(x + 4) In the quadratic, a = 3, 11 is positive andc is positive. We can configure the brackets as follows: (3x \,\,\,\, - \,\,\,\, - \,\,\,\,). We are looking for two positive numbers that multiply to do6. Possible factors of 6 are \begin{aligned}(6)\times(1)&&=6 \begin{aligned}(6)\times(1)&&=6 (3)\times(2)&&=6 \end{aligned} Now we try all combinations: \begin{aligned}(3x+6)(x+1)&&=3x^2+6x+3x+6 \\ (3x+1)(x+6)&&= 3x^2+x+18x+6 \\ (3x+3)(x+2 3x^2+6x+3x+6 \\ (3x+2)(x+3) &; = 3x^2+9x+2x+6\end{aligned} Hence the correct factorization is (3x+2)(x+3) \\ We can see that this is a subtype(c) which means containing both + and - Factors of -6 (-1) \times 6 = -6(-6) \times 1 = -6 (-2) \times 3 = -6 (-3) \times 2 = -6 We will find the options they give - 5m (2m +2m (2m-3) = 4m^2 - 2m - 6 (4m + 1)(m-6) = 4m^2 -23m-6 (4m-1)(m+6) = 4m^2 +23m -6... (4m+3) (m-2) = 4m^2 -5m -6 We can see that the last option with +3 and -2 is the correct combination. This gives the final answer to: (4m +3)(m-2) Factorising - Bracket Enlargement This section shows you how to factor in and includes examples, sample questions and videos. The brackets must be enlarged in the following ways: For a form expression a(b +c), the expanded version is ab + ac, i.e. multiply the term outside the parenthesis by everything inside the parenthesis (e.g. 2x(x + 3) = 2x² + 6x [remember x × x is x²]). For an expression of the form (a + b)(c + d), the expanded version is ac + ad + bc + bd, that is, everything in the first parenthesis must be multiplied by everything in the second. Example Expand (2x + 3)(x - 1): (2x + 3)(x - 1) = 2x² - 2x + 3x - 3 = 2x² + x - 3 Factorization factorizing is the back of the expanding supports, so it is, for example, putting 2x² + x - 3 on the form (2x + 3) (x - 1). This is an important way to solve quadratic equations. The first step of factoring an expression is to remove the common factors that have the terms. So if you were asked to factor x² + x, since x enters both terms, I would write x(x + 1). Quadratic Factorization This video shows you how to solve a quadratic equation by lying. There is no simple method of factoring a quadratic expression, but with a little practice it becomes easier. A systematic method, however, is as follows: Example Factorise 12y² - 20y + 3 = 12y² - 18y - 2y + 3 [here the 20y has been divided into two numbers another multiple is 36.36 was chosen because this is the product of 12 and 3, the other two numbers]. The first two terms, 12y² and -18y both are divided by 6y, so 'remove' that factor of 6y. 6y(2y - 3) - 2y + 3 [we can do this because 6y(2y - 3) is the same as 12y² - 18y] Now, make the last two expressions look like the expression in the parenthesis: 6y(2y - 3) - 1(2y - 3) The answer is (2y - 3)(6y - 1) Example Factorise x² + 2x - 8 We have to divide the 2x into two numbers that multiply to give -8. This must be 4 and -2. x² + 4x - 2x - 8 x(x + 4) - 2x - 8 x(x + 4)- 2(x + 4)(x + 4)(x - 2) Once you work out what is happening, this method facilitates the factorization of any expression. Worth it these examples even more if you don't understand what's going on. Unfortunately, the only one factorization method is by trial and error. The difference of two squares If you are asked to factor in an expression that is one square number minus another, you can factor it immediately. This is because a² - b² = (a + b)(a - b) . Example Factorise 25 - x² = (5 + x)(5 - x) [imagine a = 5 and b = x] Click here to find out more about quadratic equations. Factoring quadratic expressions requires two pairs of brackets. A quadratic expression always contains a term \(x^2\). Before trying to factor in quadratic expressions you should first make sure that you can expand and simplify the two brackets and factor linear expressions. How to factor quadratic expressions Example 1 - Factorization of a quadratic expression a) Factorise \(x^2 + 5x + 6\). We need to find two numbers that multiply together to give \(6\) and add together to give \(5\). In this case \(2 × 3 = 6\) and \(2 + 3 = 5\). So \(2\) and \(3\) are the numbers we put in double brackets. \(x^2 + 5x + 6 = (x + 2)(x + 3)\). You can always check your response by expanding and simplifying the brackets to make sure you reach your original expression. b) Factorise \(x^2 + 3x - 10\). This time we need to find two numbers with a product of \(-10\) and a sum of \(3\). One of the numbers must be negative. \(5 × -2 = -10\) and \(5 + (-2) = 3\). Put \(5\) and \(-2\) in double brackets gives: \(x^2 + 3x - 10 = (x + 5)(x - 2)\). c) Factorise \(x^2 - 4x - 32\). Find two numbers with a product of \(-32\) and a sum of \(-4\). \(4 × -8 = -32\) and \(4+ (-8) = -4\). \(x^2 - 4x - 32 = (x + 4)(x - 8)\). d) Factorise \(x^2 - 13x + 42\). The only way to get two numbers with a product of \(42\) and a sum of \(-13\) is if both numbers are negative. \(-6 × -7 = 42\) and \(-6 + (-7) = -13\). \(x^2 - 13x + 42 = (x - 6)(x - 7)\). Example 2 - Factorizing a harder quadratic expression a) Factorise \(2x^2 + 13x + 15\). When the term coefficient \(x^2\) is not one there is a better chance of testing. Given a term \(2x^2\) the solution must be of the form \((2x + a)(x + b)\). \(2x^2 + 13x + 15 = (2x + 3)(x + 5)\). a) Factorise \(6x^2 + 14x - 12\). Given a term \(6x^2\) the solution must be of the form \((6x + a)(x + b)\) or \((3x + a)(2x + b)\). In addition, since \(a × b = -12\) we have six possible pairs of values to test: \(-12\) and \(1\) \(12\) and \(-1\) \(-2\) and \(6\) \(2\) and \(-6\) \(-3\) and \(4\) \(3\) and \(-4\) Testing these gives: \(6x^2 + 14x - 12 = (3x - 2)(2x + 6)\). Example 3 - Difference of two squares a) Factorise \(a^2 - b^2\). When factoring in a difference of two square terms, the second support will be the same as the first, except for one minus sign. This is called conjugate factor. The linear terms of the expression are canceled to each other when they are expanded. \(a^2 - b^2 = (a + b)(a - b)\). b) \(x^2 - 25\). The difference of two square method works for and letter terms: \(x^2 - 25 = (x + 5)(x - 5)\). c) Factorise \(4x^2 - 36y^2\). For combinations of square numbers and font terms, the method remains the same: \(4x^2 - 36y^2 = (2x + 6y)(2x - 6y)\). Worksheets to practice linear and quadratic factorizing expressions Try these worksheets to practice your skills. Skills.

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