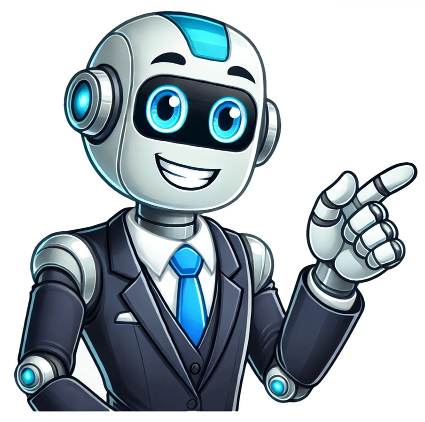

Complete the square practice problems

. . In order to continue enjoying our site, we ask that you confirm your identity as a human. Thank you very much for your cooperation. A quadratic equation is any equation in the form \(a{x}^{2}+bx+c=0\), where x is the unknown, and a, b, and c are known numbers, with a ≠ 0. The numbers a, b, and c are the coefficients of the equation and are called respectively, the quadratic coefficient, the linear coefficient and the constant term. Completing the square is the process of converting a quadratic expression from the form: \(a{x}^{2}+bx+c\) into the form: \(a{(x-h)}^{2}+k\) Why do we do this? The most common uses of completing the square are the following: 1) Solve quadratic equations. 2) Graph quadratic functions. 3) Solve integrals in calculus. To oomplete the square, first check your problem. If an expression follows the form \(a{x}^{2}+bx+c\), it is a candidate for this technique. Remember: Expressions such as \(2{x}^{2}+5x\) also fit this pattern — in this case, \(c\) is zero. Consider the first example below: \(3{x}^{2}+5x+4\) Step 1: Assign values using the template formula \(a{x}^{2}+bx+c\). In this case, \(a\) = \(3\), \(b\) = \(5\) and \(c\) = \(4\). Step 2: Factor out \(a\), which is 3, to give \(3({x}^{2}+\frac{5}{3}x+\frac{4}{3})\). Step 3: Introduce a constant, "\(k\)", which is obtained by using the formula \(k={(\frac{b}{2a})}^{2}\). In our equation, that yields \(\frac{25}{36}\), which must be both added and subtracted to the equation so its value does not change. This results in: \(3({x}^{2}+\frac{25}{36}-\frac{25}{36}+\frac{4}{3})\) Step 4: Factor using the Square of Difference Rule, which yields: \(3({(x+\frac{5}{6})}^{2}-\frac{25}{6}+\frac{4}{3})\). Step 5: Simplify by the two fractions at the end to produce: \(3({(x+\frac{5}{6})}^{2}+\frac{23}{36})\). Step 6: Finally, expand the equation to give: \(3{(x+\frac{5}{6})}^{2}+\frac{23}{12}\). We are done! The result is a simplified polynomial with only one \(x\) variable. Ready to give it a try? See if you can solve our completing the square practice problems at the top of this page, and use our step-by-step solutions if you get stuck. At Cymath, not only do we aim to help you understand the process of solving quadratic equations and other problems, but we also give you the practice you need to succeed over the long term. Need a full solution to a completing the square problem? Try our completing the square calculator. Ready to take your learning to the next level with "how" and "why" steps? Sign up for Cymath Plus today. Solving problems by completing the square is when you use a specific strategy for solving equations of the form ax^2 + bx + c = 0.You can solve any quadratic equation in this form by following the following 3-steps for completing the square:Step #1: Rearrange the equation to place all of the constants on one side.Step #2: + $(b/2)^2$ to both sides.Step #3: Factor and solve.For example, let's say that we wanted to find the solutions of the equation x^2 - 6x -16 = 0 by completing the square. In this case, we could find the solutions by using the 3-step method as follows:Step #1: Rearrange the equation to place all of the constants on one side.For our first step, we can start by identifying that the equation x^2 - 6x -16 = 0 is in ax^2 +bx + c = 0 form, with a=1, b=-6, and c=-16.We can complete the first step by moving all of the constants to one side of the equation as follows:x^2 - 6x -16 (+16) = 0 (+16)x^2 - 6x = 16Our result is the equation:Step #2: + $(b/2)^2$ to both sides.In this example, b=-6, so we can add $(b/2)^2$ to both sides of the equation by substituting b with -6 as follows:x^2 - 6x = 16x^2 - 6x + 9 = 16 + 9x^2 - 6x + 9 = 25Step #3: Factor and solve.For our final step, we simply have to factor and solve the trinomial on the left side of the equation as follows:x^2 - 6x + 9 = (x-3)(x-3)x^2 - 6x + 9 = $(x-3)^2$$x^2$ - 6x + 9 = 25$(x-3)^2$ = 25√[$(x-3)^2$] = √[25]x -3 = ± 5Now we just have to solve for x in each of the following equations:x - 3 = 5 → x = 8x - 3 = -5 → x = -2Final Answer: x = 8, x = -2Do you need more help with completing the square using our 3-step method? Click here to check out our free step-by-step student guide to completing the square to work through a few more practice problems. The process of completing the square is used to express a quadratic expression given as $latex ax^2+bx+c$ in the following form: $latex a(x+p)^2+q$ where p and q are constants. The simplest case of completing the square happens when we have a=1, that is, the quadratic term has a coefficient equal to 1. In these cases, we have: $$x^2+bx+c=\left(x+\frac{b}{2}\right)^2-\left(\frac{b}{2}\right)^2+c$$ $$=\left(x+\frac{b}{2}\right)^2-\left(\frac{b^2}{4}\right)+c$$ We can follow the steps below to complete the square of a quadratic expression. This method applies even when the coefficient a is different from 1. Step 1: If the coefficient a is different from 1, we divide the entire quadratic expression by a to obtain an expression where the quadratic term has a coefficient equal to 1: $latex x^2+bx+c$ Step 2: We divide the coefficient of x (the coefficient b) by 2: $$\left(\frac{b}{2}\right)$$ Step 3: We square the expression obtained in step 2: $$\left(\frac{b}{2}\right)^2$$ Step 4: We add and subtract the expression obtained in step 3 to the expression obtained in step 1: $$x^2+bx+\left(\frac{b}{2}\right)^2-\left(\frac{b}{2}\right)^2+c$$ Step 5: We factor the quadratic expression by applying the algebraic identity $latex x^2+2xy+y^2=(x+y)^2$: $$\left(x+\frac{b}{2}\right)^2-\left(\frac{b}{2}\right)^2+c$$ Step 6: We multiply the expression resulting from step 5 by the number by which we divided in step 1. The method of completing the square allows us to solve quadratic equations easily. When we have a quadratic expression in the form $latex (x-h)^2+k$, we can write it as follows: $latex (x-h)^2=-k$ Here, we can take the square root of both sides and easily solve for x. Complete the square of the expression $latex x^2+2x-5$. Since the coefficient of the quadratic term is equal to 1, we don't have to divide the expression by any numbers initially. We see that the coefficient b is equal to 2. Therefore, we have: $$\left(\frac{b}{2}\right)^2=\left(\frac{2}{2}\right)^2=1$$ Adding and subtracting this value, we have: $$x^2+2x-5=x^2+2x+1-1-5$$ Completing the square and simplifying, we have: $latex = (x+1)^2-1-5$ $latex = (x+1)^2-6$ Complete the square of the expression $latex x^2+4x+10$. We don't have to apply the first step, since the coefficient of the quadratic term is equal to 1. Now, we can see that the coefficient b is equal to 4. Therefore, we have: $$\left(\frac{b}{2}\right)^2=\left(\frac{4}{2}\right)^2$$ $$=2^2$$ When we add and subtract this expression, we have: $$x^2+4x+10=x^2+4x+2^2-2^2+10$$ Completing the square and simplifying, we have: $latex = (x+2)^2-4+10$ $latex = (x+2)^2+6$ Complete the square of the expression $latex 2x^2+6x+6$. Here, the expression has a quadratic term with a coefficient other than 1. Therefore, we can divide the entire expression by 2 to get the following ⇒ $latex x^2+3x+3$. Given that the coefficient b equals 3, we have: $$\left(\frac{b}{2}\right)^2=\left(\frac{3}{2}\right)^2$$ Adding and subtracting this value, we have: $$x^2+3x+3=x^2+3x+\left(\frac{3}{2}\right)^2-\left(\frac{3}{2}\right)^2+3$$ Completing the square and simplifying, we have: $latex = (x+\frac{3}{2})^2-\frac{9}{4}+3$ $latex = (x+\frac{3}{2})^2+\frac{3}{4}$ Since we divided the expression by 2 initially, we multiply the result by 2: ⇒ $latex 2(x+\frac{3}{2})^2+\frac{3}{2}$ Solve the equation $latex x^2+4x-5=0$ using the method of completing the square. In this equation, b is equal to 4. Therefore, we have: $$\left(\frac{b}{2}\right)^2=\left(\frac{4}{2}\right)^2$$ $$=2^2$$ Adding and subtracting this value to the quadratic equation, we have: $$x^2+4x-5=x^2+4x+2^2-2^2-5$$ Completing the square and simplifying, we have: $latex = (x+2)^2-4-5$ $latex = (x+2)^2-9$ Now, we can write the equation as follows: ⇒ $latex (x+2)^2=9$ Taking the square root of both sides, we have: ⇒ $latex x+2=\sqrt{9}$ ⇒ $latex x+2=3$ ⇒ $latex x=1$ Solve the equation $latex 2x^2-8x-8=0$ using the method of completing the square. We divide the equation by 2 to obtain an equation where the coefficient of the quadratic term is equal to 1: $latex x^2-4x-4=0$ Now, we see that the coefficient b is equal to -4. Therefore, we have: $$\left(\frac{b}{2}\right)^2=\left(\frac{-4}{2}\right)^2$$ $$=(-2)^2$$ Adding and subtracting that value to the equation, we have: $$x^2-4x-4=x^2-4x+(-2)^2-(-2)^2-4$$ Completing the square and simplifying, we have: $latex = (x-2)^2-4-4$ $latex = (x-2)^2-8$ Now, we write the equation as follows: ⇒ $latex (x-2)^2=8$ Taking the square root of both sides, we have: ⇒ $latex x-2=\sqrt{8}$ ⇒ $latex x=2\pm \sqrt{8}$ Find the solutions of the equation $latex 2x^2+12x-14=0$ using the method of completing the square. Dividing the equation by 2, we can make the coefficient of the quadratic term equal to 1: ⇒ $latex x^2+6x-7=0$ Now, we have that the coefficient b is equal to 6. Therefore, we have: $$\left(\frac{b}{2}\right)^2=\left(\frac{6}{2}\right)^2$$ $$=3^2$$ If we add and subtract this value to the equation, we have: $$x^2+6x-7=x^2+6x+3^2-3^2-7$$ Completing the square and simplifying, we have: $latex = (x+3)^2-9-7$ $latex = (x+3)^2-16$ We can write the equation as follows: $latex (x+3)^2=16$ Taking the square root of both sides, we have: ⇒ $latex x+3=4$ ⇒ $latex x=1$ Solve the quadratic equation $latex 3x^2-12x-3=0$ using the method of completing the square. We start by dividing the equation by 3 to make the coefficient of the quadratic term equal to 1: ⇒ $latex x^2-4x-1=0$ We see that the coefficient b is equal to -4. Therefore, we have: $$\left(\frac{b}{2}\right)^2=\left(\frac{-4}{2}\right)^2$$ $$=(-2)^2$$ Adding and subtracting this value to the equation, we have: $$x^2-4x-1=x^2-4x+(-2)^2-(-2)^2-1$$ Completing the square and simplifying, we have: $latex = (x-2)^2-4-1$ $latex = (x-2)^2-5$ We can write the equation as follows: $latex (x-2)^2=5$ We can solve the equation by taking the square root of both sides: ⇒ $latex (x-2)=\sqrt{5}$ ⇒ $latex x=2\pm \sqrt{5}$ Interested in learning more about completing the square? Take a look at these pages: