Completing the Square

A method for going from standard form to vertex form of an equation

You just completed some factoring warm up with perfect squares trinomials; let's recall:

$y = x^2 + 6x + 9$ know it's a perfect square because:

What numbers would need to be added to make these a perfect square?

$x^2 + 8x + \underline{\sqrt{16}}$ $x^2 - 10x + \underline{\sqrt{25}}$

$(1x + 4)^2$ $(1x - 5)^2$

$(\sqrt{a}x^2)(\sqrt{c})(2) = b$

$(1)(4)(2)$

Now the problem is that given an equation:

$y = x^2 + 6x +$ 9 you can't simply +9 because

L.S = R.S.

so, you have to also subtract 9

Now you have: $y = (x^2 + 6x + 9) - 9$

$y = (x + 3)^2 - 9$

Steps for completing the square:

Step 1: Verify Equation is in standard form

Step 2: Factor the coefficient of the x^2 term from the **first two terms**

Step 3: Create a perfect squares trinomial inside the brackets by adding and subtracting $\left(\frac{b}{2}\right)^2$

Step 4: Remove the value of $-\left(\frac{b}{2}\right)^2$ from the brackets by multiplying it by "a"

Step 5: Factor the perfect squares trinomial to give you $(x-h)^2$ and collect like terms outside the bracket to give you the value of "k"

Let's try it:

$y = 2x^2 + 12x + 4$

$y = \underbrace{2x^2+12x}_{\text{GCF "2"}} + 4$

Step 2: "a" GCF $y = 2(x^2+6x+9-9) + 4$

Step 3: $\left(\frac{b}{2}\right)^2 = \left(\frac{6}{2}\right)^2$

$= 3^2$

$= 9$

Step 4 $y = 2(x^2+6x+9-9) + 4$

$y = 2(x^2+6x+9) - 18 + 4$

$y = 2(x^2+6x+9) - 14$

$y = 2(x+3)^2 - 14$

vertex $(-3, -14)$

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