Unit 8 Day 10 Notes on Completing the Square

Key

Warm-Up!
Square the binomial.

1. $(x+3)^2$ $(x+3)(x+3)$
$x^2+3x+3x+9$
x^2+6x+9

2. $(x+4)^2$ $(x+4)(x+4)$
$x^2+4x+4x+16$
$x^2+8x+16$

3. $(x-7)^2$ $(x-7)(x-7)$
$x^2-7x-7x+49$
$x^2-14x+49$

Let's look at a pattern here:

1. $\frac{6}{2}=3$ AND $3^2=9$

2. $\frac{8}{2}=4$ AND $4^2=16$

3. $\frac{-14}{2}=-7$ AND $(-7)^2=49$

Complete the Square.
How can we reverse the procedure? Find the number that "completes the square":

1. $x^2+4x+\underline{4}=(x+\underline{2})^2$
$\frac{4}{2}=2$ $2^2=4$

2. $x^2-16x+\underline{64}=(x-\underline{8})^2$
$\frac{-16}{2}=-8$ $(-8)^2=64$

3. $x^2+12x+\underline{36}=(x+\underline{6})^2$
$\frac{12}{2}=6$ $6^2=36$

4. $x^2-22x+\underline{121}=(x-\underline{11})^2$
$\frac{-22}{2}=-11$ $(-11)^2=121$

Let's Practice!
Find the value of c such that each expression is a perfect-square trinomial. Then write the expression as the square of a binomial.

5. $x^2+18x+c$ c
$\frac{18}{2}=9$, $9^2=81$
$(x+9)^2$

6. q^2-4q+c c
$\frac{-4}{2}=-2$, $(-2)^2=4$
$(q-2)^2$

7. $p^2-30p+c$ c
$\frac{-30}{2}=-15$, $(-15)^2=225$
$(p-15)^2$

Completing the Square

You can change the expression x^2+bx into a perfect-square trinomial by adding $\left(\frac{b}{2}\right)^2$ to x^2+bx.

BUT! You must keep the expression ***balanced***.

Put the Following in Vertex Form. * Completing the square *

8. $x^2 - 16x + 15 = y$

$(x^2 - 16x + 64) + 15 - 64$ (opposites)

$\frac{-16}{2} = -8, (-8)^2 = 64$

$y = (x - 8)^2 - 49$

9. $x^2 + 6x - 1 = y$

$(x^2 + 6x + 9) - 1 - 9$ (opposites)

$\frac{6}{2} = 3, 3^2 = 9$

$y = (x + 3)^2 - 10$

10. $x^2 - 2x - 7 = y$

$(x^2 - 2x + 1) - 7 - 1$ (opp.)

$\frac{-2}{2} = -1, (-1)^2 = 1$

$y = (x - 1)^2 - 8$

11. $x^2 + 10x + 9 = y$

$(x^2 + 10x + 25) + 9 - 25$ (opp)

$\frac{10}{2} = 5, 5^2 = 25$

$y = (x + 5)^2 - 16$