Name________________________ Class______________ Date__________

8-8

Video Tutor

Completing the Square

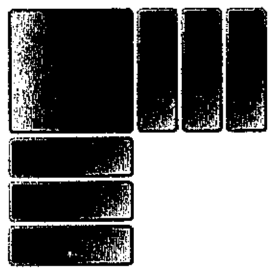
Essential question: *How can you solve quadratic equations without factoring?*

CC.9-12.A.REI.4a

1 EXPLORE Completing the Square

The diagram below represents the expression $x^2 + 6x + c$ with the constant term missing.

A Complete the diagram by filling the bottom right corner with 1-tiles to form a square.



B How many 1-tiles did you add to the expression? ________

C Write the trinomial represented by the algebra tiles for the complete square.

$x^2 + \quad x + $

D You should recognize this trinomial as an example of the special case $(a + b)^2 = a^2 + 2ab + b^2$. Recall that trinomials of this form are called perfect square trinomials. Since the trinomial is a perfect square, you can factor it into two binomials that are the same.

$x^2 + \quad x + \quad = (\quad x + \quad)^2$

REFLECT

1a. Look at the algebra tiles above. The x-tiles are divided equally, with 3 tiles on the right and bottom sides of the x^2-tile. How does the number 3 relate to the total number of x-tiles? How does the number 3 relate to the number of 1-tiles you added?

____

1b. How would algebra tiles be arranged to form a perfect square trinomial $x^2 + 8x + c$? How many 1-tiles must be added? How is this number related to the number of x-tiles?

____

____

Completing the Square Finding the value of c needed to make an expression such as $x^2 + 6x + c$ into a perfect square trinomial is called **completing the square.**

Using algebra tiles, half of the x-tiles are placed along the right and bottom sides of the x^2-tile. The number of 1-tiles added is the square of the number of x-tiles on either side of the x^2-tile.

To complete the square for the expression $x^2 + bx + c$, replace c with $\left(\frac{b}{2}\right)^2$. The perfect square trinomial is $x^2 + bx + \left(\frac{b}{2}\right)^2$ and factors as $\left(x + \frac{b}{2}\right)^2$.

Prep for CC.9–12.A.REI.4a

2 EXAMPLE Completing the Square

Complete the square to form a perfect square trinomial. Then factor the trinomial.

A $x^2 + 12x + c$

Identify b. $b =$ ______

Find c. $c = \left(\frac{b}{2}\right)^2 = \left(\frac{\quad}{2}\right)^2 =$ ______

Write the trinomial. $x^2 +$ $x +$

Factor the trinomial. $x^2 +$ $x +$ $= (\qquad)^2$

B $z^2 - 24z + c$

Identify b. $b =$ ______

Find c. $c = \left(\frac{b}{2}\right)^2 = \left(\frac{\quad}{2}\right)^2 =$ ______

Write the trinomial. $z^2 +$ $z +$

Factor the trinomial. $z^2 +$ $z +$ $= (\qquad)^2$

REFLECT

2a. In Part A, b is positive and in Part B, b is negative. Does this affect the sign of c? Why or why not?

______

______

2b. How can you confirm that you have factored each trinomial correctly?

______

______

Completing The Square Continued

*You can solve any quadratic equation by <u>completing the square.</u> This method turns every expression $x^2 + bx$ into a <u>perfect-square trinomial</u>. You complete the square by adding $\left(\frac{b}{2}\right)^2$ to $x^2 + bx$, where b is the coefficient of the x-term.

* When a trinomial is a perfect square, there is a relationship between the coefficient of the x-term and the constant term.

$x^2 + 6x + 9$ $\qquad$ $x^2 - 8x + 16$

$\left(\frac{6}{2}\right)^2 = 9$ $\qquad$ $\left(\frac{-8}{2}\right)^2 = 16$

WORDS	NUMBERS	ALGEBRA
To complete the square of $x^2 + bx$, add $\left(\frac{b}{2}\right)^2$ to the expression. This will form a perfect-square trinomial.	$x^2 + 6x +$ _______ $x^2 + 6x + \left(\frac{6}{2}\right)^2$ $x^2 + 6x + 9$ $(x + 3)^2$	$x^2 + bx +$ _____ $x^2 + bx + \left(\frac{b}{2}\right)^2$ $\left(x + \frac{b}{2}\right)^2$

<u>Examples</u>: Complete the square to form a perfect-square trinomial. Then factor the trinomial.

1) $x^2 + 32x$

2) $c^2 - 16c$

3) $8x + x^2$

4) $w^2 - 13w$

5) $x^2 - 9x$

6) $x^2 + 22x$

7) $m^2 + 10m$

8) $x^2 - 5x$

9) $x^2 + 15x$

10) $y^2 + 2y$

11) $b^2 + 4b$

12) $g^2 - 20g + 15$

13) $x^2 + 17x + 25$

14) $x^2 - 8x - 18$