

Content and Language Objective:

Students will use what they know about multiplying binomials and learn another process for changing equations from the general form of an equation to vertex form.

Warm - Up

Rewrite in general form.

1. $(x + 1)(x - 5) + 12$

$$x^2 - 5x + x - 5 + 12$$
$$x^2 - 4x + 7$$

2. $2(x - 3)(x - 4) - 9$

$$2x^2 - 14x + 15$$
$$2(x^2 - 7x + 12) - 9$$
$$2x^2 - 14x + 24 - 9$$
$$2x^2 - 7 + 3$$

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Completing the square is a reference used to describe a technique for solving quadratic equations. There are several techniques for solving quadratics, like graphing and using the quadratic formula. This lesson will focus on only the completing the square technique.

In order to understand this technique, one first needs to understand perfect square trinomials. To understand them, we need to look at a few problems.

Let's square a binomial.

$$(x + 2)^2 \quad (x+2)(x+2)$$
$$x^2 + 4x + 4$$

The trinomial that we just found is called a

perfect square trinomial

$$\text{trinomial} = 3 \text{ terms} = \underset{1^{\text{st}}}{ax^2} + \underset{2^{\text{nd}}}{bx} + \underset{3^{\text{rd}}}{c}$$

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Try another one.

$$\begin{array}{l} (x-3)^2 \\ x^2 - 3x - 3x + 9 \\ x^2 - 6x + 9 \end{array} \quad \begin{array}{c} \text{Diagram showing the multiplication of } (x-3)(x-3) \text{ using the distributive property (FOIL).} \\ \text{The first binomial } (x-3) \text{ is circled in pink.} \\ \text{The second binomial } (x-3) \text{ is circled in pink.} \\ \text{Arrows indicate the multiplication of terms: } x \cdot x, x \cdot (-3), (-3) \cdot x, \text{ and } (-3) \cdot (-3). \end{array}$$

What are some things that you notice about these trinomials?

$$(x+2)^2 = (x+2)(x+2) = x^2 + 4x + 4 \quad \text{variable, constant}$$

$$(x-3)^2 = (x-3)(x-3) = x^2 - 6x + 9 \quad \# \text{ in } () \text{ is doubled, then squared}$$

format intersect when graphed

both being squared two negatives = positive

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The central theme to the technique called, 'completing the square,' involves understanding several relationships. To gain insight to these relationships, we will look at a few perfect square situations with blanks.

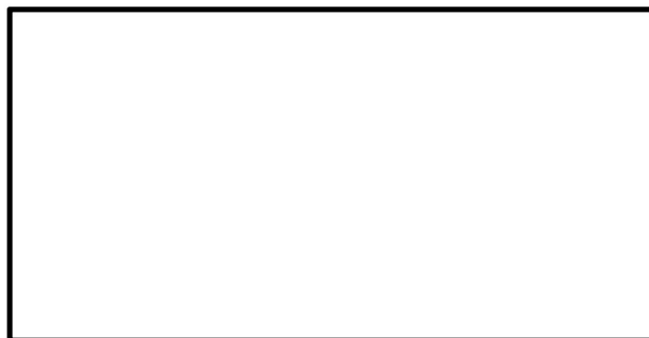
Here is one situation.

$$(x + \underline{5})^2 = x^2 + 10x + \underline{25}$$

What would we have to do in order to complete this equation?

The relationship involves two steps:

1. Divide 10 by 2. The result is 5.
2. Square the 5. 5^2 is 25.



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Try another one

$$x^2 + 8x + \underline{16} = (x + \underline{4})^2$$

$$\frac{8}{2} = (\underline{4})^2 = 16$$

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Example 1:

$$x^2 + 8x + 12 = 0$$

$-12 \quad -12$

Since this is not a perfect square we approach it slightly different, first, subtract the 12 from both sides

$$x^2 + 8x = -12$$

To use the complete the square technique, we need to determine what to add to both sides to create a perfect square on the left side of the equation.

$$x^2 + 8x + \underline{16} = -12 + \underline{16}$$

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

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