

Vertex Form of a Quadratic Function contains a perfect square trinomial in factored form.

Vertex Form:
$$f(x) = a(x - h)^2 + k$$

$$f(x) = -2(x-2)^2 + 5 \qquad \qquad f(x) = 3(x+1)^2 - 6$$

In order to rewrite standard form, $f(x) = ax^2 + bx + c$ in vertex form, $f(x) = a(x - h)^2 + k$, we must learn how to create a perfect square trinomial.

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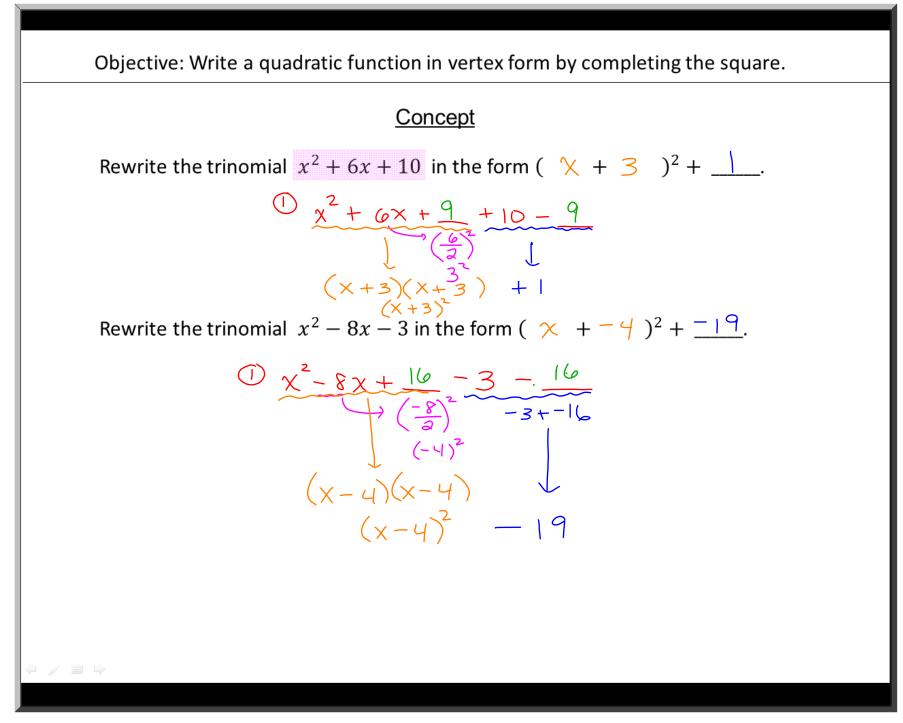
<u>Concept</u>

Consider the two perfect square trinomials below. What is a mathematical relationship between the values of b and c in both trinomials? In other words, how could you use the value of b to get the value of c?

$$x^2 + 10x + 25 \qquad \qquad x^2 - 4x + 4$$

I could take the value of b, divide it by 2, and then square the number to find c.

$$\left(\frac{10}{2}\right)^2 = 25 \qquad \qquad \left(\frac{-4}{2}\right)^2 = 4$$



Captured on Wed Nov 15 2017 13:11:30

Concept

Steps to Create Vertex Form, $f(x) = a(x - h)^2 + k$, from Standard Form, $f(x) = ax^2 + bx + c$, by Completing the Square

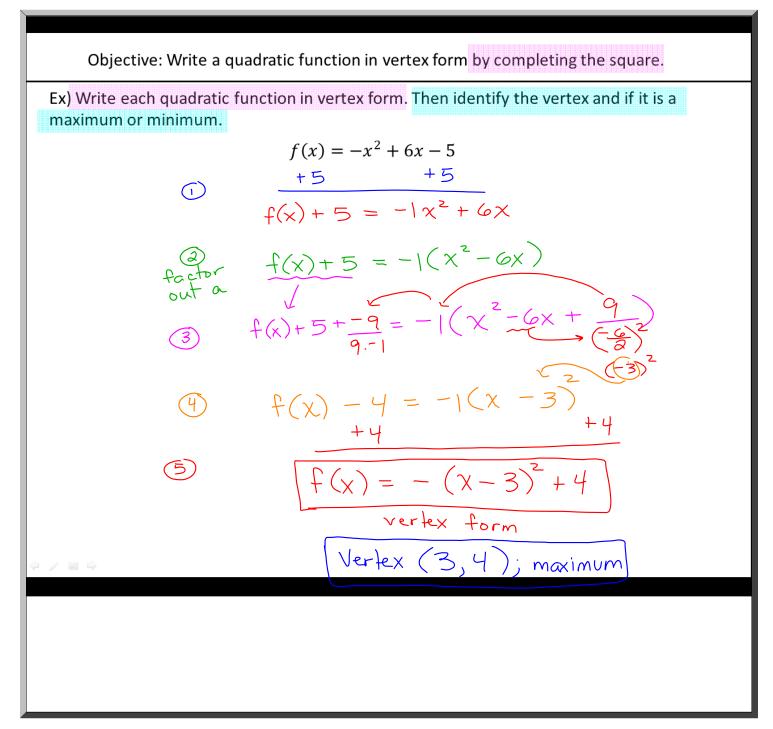
1. Move the constant term to the function side:

 $f(x) = ax^2 + bx + c \rightarrow f(x) - c = ax^2 + bx$ 2. Factor out the value of a: $f(x) - c = ax^2 + bx \rightarrow f(x) - c = a(x^2 + dx)$ 3. Create a perfect square trinomial. Make sure you balance the equation by adding to both sides.

$$f(x) - c = a(x^2 + dx) \rightarrow f(x) - c + a\left(\frac{d}{2}\right)^2 = a(x^2 + dx + \left(\frac{d}{2}\right)^2)$$

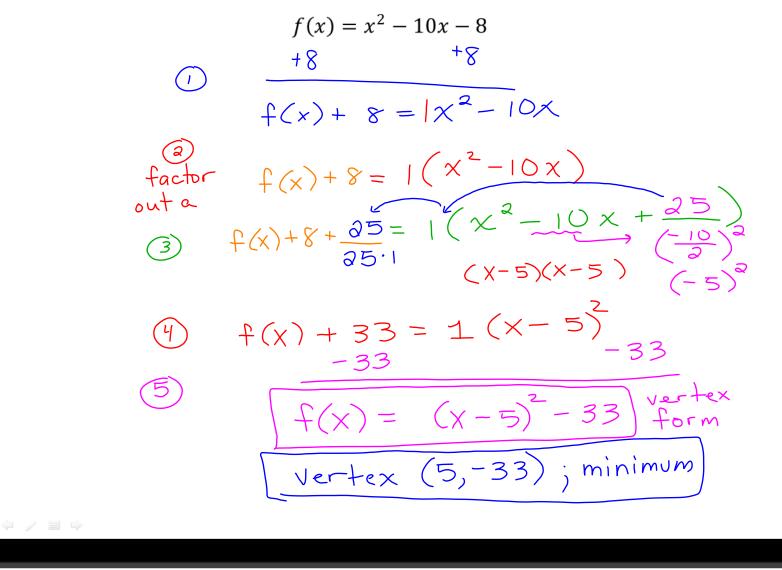
4. Simplify the left side and write the perfect square trinomial as a binomial squared: $f(x) - k = a(x - h)^2$

5. Write the function in vertex form: $f(x) = a(x - h)^2 + k$



Objective: Write a quadratic function in vertex form by completing the square. Ex) Write each quadratic function in vertex form. Then identify the vertex and if it is a maximum or minimum. $f(x) = 3x^2 + 24x - 3$ $\frac{+3}{f(x)+3} = \frac{+3}{3x^2+24x}$ (a) factor $f(x)+3 = 3(x^2 + 8x)$ out a () out a $f(x) + 3 + \frac{48}{16 \cdot 3} = 3(x^2 + 8x + \frac{16}{5})$ $(\mathbf{3})$ (4)f(x) + 51 = 3(x + 4)- 51 (5) 5 vertex form vertex ((-4,-51); minimum

Ex) Write each quadratic function in vertex form. Then identify the vertex and if it is a maximum or minimum.



<u>Closure</u>

Michelle rewrote the standard form of a quadratic function in vertex form. Her work is shown. What error did Michelle make? If you fix her mistake, what is the correct vertex form?

standard form: $f(x) = 2x^2 - 16x - 8$ step 1: $f(x) + 8 = 2x^2 - 16x$ step 2: $f(x) + 8 = 2(x^2 - 16x)$ step 3: $f(x) + 8 + 128 = 2(x^2 - 16x + 64)$ step 4: $f(x) + 136 = 2(x - 8)^2$ vertex form: $f(x) = 2(x - 8)^2 - 136$

Michelle's error is that she forgot to factor 2 out of 16, making the new number an 8. If I fix her mistake, the correct vertex form is $f(x) = 2(x - 4)^2 - 40$.