

Standard (Vertex) Form

What is standard (vertex) form of a quadratic function?

- Vertex form is a way to rewrite a quadratic function in a way that the vertex can be identified easily.
- The standard (vertex) form is as follows: $f(x) = a(x-h)^2 + k$, where (h, k) is the vertex of the function and a is the quadratic coefficient.

How can a quadratic function be rewritten in vertex form?

- A quadratic function can be rewritten in vertex form by completing the square.
- The following is an example:

$$f(x) = x^2 - 2x - 8$$

The given function is in the form $f(x) = ax^2 + bx + c$ form.

$$f(x) = (x^2 - 2x) - 8$$

First, group the x^2 and x terms.

$$f(x) = (x^2 - 2x + 1) - 8 - 1$$

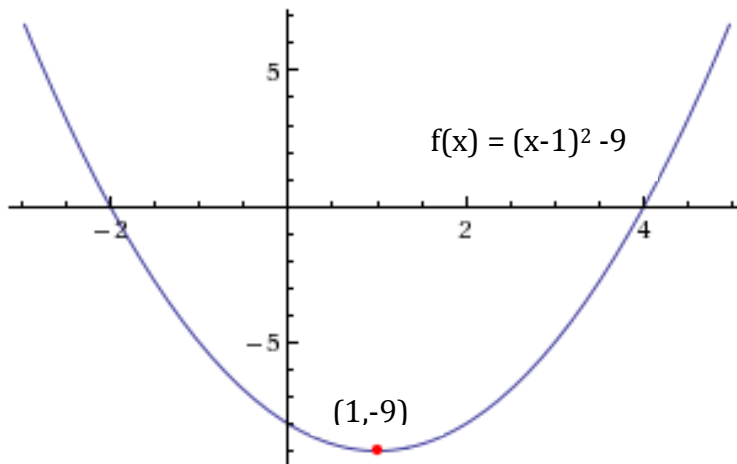
Then, add $(b/2)^2$ inside the parentheses and subtract the same value on the outside.

$$f(x) = (x-1)(x-1) - 9$$

Next, factor the expression in the parentheses and combine like terms.

$$f(x) = (x-1)^2 - 9$$

Finally, simplify. The vertex is $(1, -9)$.



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- Here is another example that is a bit more complicated:

$$f(x) = -2x^2 - 8x + 13$$

The given function is in the form $f(x) = ax^2 + bx + c$ form.

$$f(x) = (-2x^2 - 8x) + 13$$

First, group the x^2 and x terms.

$$f(x) = -2(x^2 + 4x) + 13$$

Factor out any common numbers.

$$f(x) = -2(x^2 + 4x + 4) + 13 - 4(-2)$$

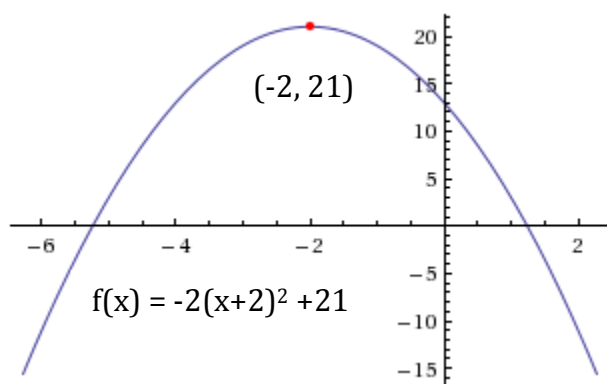
Then, add $(b/2)^2$ inside the parentheses and subtract the same value on the outside. This time, when subtracting by $(b/2)^2$ on the outside, multiply it by the number that was factored out.

$$f(x) = -2(x+2)(x+2) + 13 + 8$$

Next, factor the expression in the parentheses and multiply.

$$f(x) = -2(x+2)^2 + 21$$

Finally, simplify. The vertex is $(-2, 21)$.



You Try!

-Try rewriting the following functions in standard (vertex) form:

$$f(x) = 3x^2 - 12x - 3$$

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

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The following works were referred to during the creation of this handout: [Wolfram Alpha](#).



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