

4.2

Graph Quadratic Functions in Vertex or Intercept Form

Goal • Graph quadratic functions in vertex form or intercept form.

Your Notes

VOCABULARY

Vertex form

Intercept form

GRAPH OF VERTEX FORM $y = a(x - h)^2 + k$

The graph of $y = a(x - h)^2 + k$ is the parabola $y = ax^2$ translated _____ h units and _____ k units.

- The vertex is (____, ____).
- The axis of symmetry is $x =$ ____.
- The graph opens up if a ____ 0 and down if a ____ 0.

Example 1 Graph a quadratic function in vertex form

Graph $y = \frac{1}{2}(x + 1)^2 - 2$.

1. Identify the constants $a =$ _____, $h =$ _____ and $k =$ _____. Because $a > 0$, the parabola opens _____.

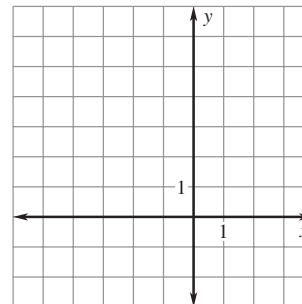
2. Plot the vertex $(h, k) =$ (_____, _____) and draw the axis of symmetry at $x =$ _____.

3. Evaluate the function for two values of x .

$$x = 1: y = 0$$

$$x = 3: y = 6$$

Plot the points $(1, \underline{\quad})$ and $(3, \underline{\quad})$ and their reflections in the axis of symmetry.



4. Draw a parabola through the plotted points.

Your Notes

GRAPH OF INTERCEPT FORM $y = a(x - p)(x - q)$

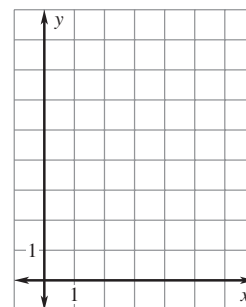
Characteristics of the graph $y = a(x - p)(x - q)$:

- The x-intercepts are ___ and ___.
- The axis of symmetry is halfway between (___, 0) and (___, 0). It has equation $x = \frac{\boxed{}}{2}$.
- The graph opens up if a ___ 0 and opens down if a ___ 0.

Example 2 Graph a quadratic function in intercept form

Graph $y = -2(x - 1)(x - 5)$.

1. Identify the x-intercepts. Because $p = \underline{\hspace{1cm}}$ and $q = \underline{\hspace{1cm}}$, the x-intercepts occur at the points (___, 0) and (___, 0).



2. Find the coordinates of the vertex.

$$x = \frac{p + q}{2} = \frac{\boxed{}}{2} = \underline{\hspace{1cm}}$$

$$y = \underline{\hspace{2cm}} = \underline{\hspace{1cm}}$$

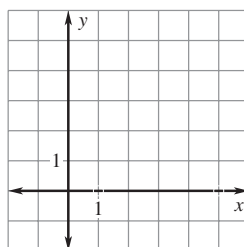
So, the vertex is (___, ___).

3. Draw a parabola through the vertex and the points where the x-intercepts occur.

✓ Checkpoint Complete the following exercises.

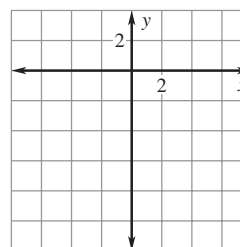
1. Graph the function. Label the vertex and the axis of symmetry.

$$y = -(x - 3)^2 + 4$$



2. Graph the function. Label the vertex, axis of symmetry, and the x-intercepts.

$$y = (x - 4)(x + 2)$$



Your Notes

FOIL METHOD

Words To multiply two expressions that each contain two terms, add the products of the _____ terms, the _____ terms, the _____ terms, and the _____ terms.

Example F O I L

$$(x + 4)(x + 7) = x^2 + 7x + 4x + 28 = x^2 + 11x + 28$$

Example 3 *Change from intercept form to standard form*

Write $y = 3(x + 2)(x - 5)$ in standard form.

$$y = 3(x + 2)(x - 5)$$

Original function

$$= 3 \underline{\hspace{2cm}}$$

Multiply using FOIL.

$$= 3 \underline{\hspace{2cm}}$$

Combine like terms.

$$= \underline{\hspace{2cm}}$$

Distributive property

Example 4 *Change from vertex form to standard form*

Write $f(x) = -5(x + 2)^2 + 8$ in standard form.

$$f(x) = -5(x + 2)^2 + 8$$

Original function

$$= -5(\underline{\hspace{1cm}})(\underline{\hspace{1cm}}) + 8$$

Rewrite $(x + 2)^2$.

$$= -5(\underline{\hspace{2cm}}) + 8$$

Multiply using FOIL.

$$= -5(\underline{\hspace{2cm}}) + 8$$

Combine like terms.

$$= \underline{\hspace{2cm}} + 8$$

Distributive property

$$= \underline{\hspace{2cm}}$$

Combine like terms.

✓ **Checkpoint** Write the quadratic function in standard form.

Homework

3. $y = 4(x - 3)^2 - 10$

4. $y = -3(x - 7)(x + 6)$