Topics: quadratic functions, standard equation for a quadratic, and vertex of a parabola

Student Learning Outcomes:

1. Students will be able to recognize quadratic functions graphically and algebraically.
2. Students will be able to write the standard equation for a quadratic function.
3. Students will be able to determine the vertex of a parabola.

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1 Standard Form of a Quadratic Function

Quadratic Formula. The roots of the equation $ax^2 + bx + c = 0$ are $\boxed{x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$

Standard Equation of a Parabola. The standard equation of a parabola is $y = a(x - h)^2 + k$. The point (h, k) is the vertex of the parabola.

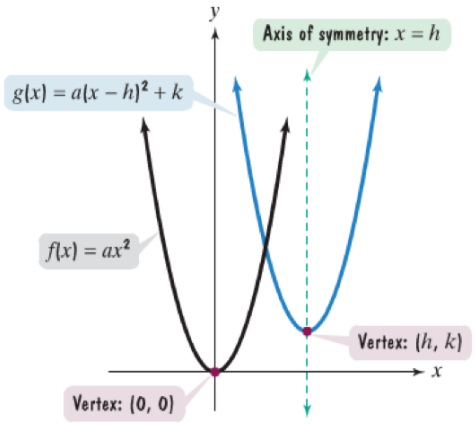


Figure 3.2(a) $a > 0$: Parabola opens upward.

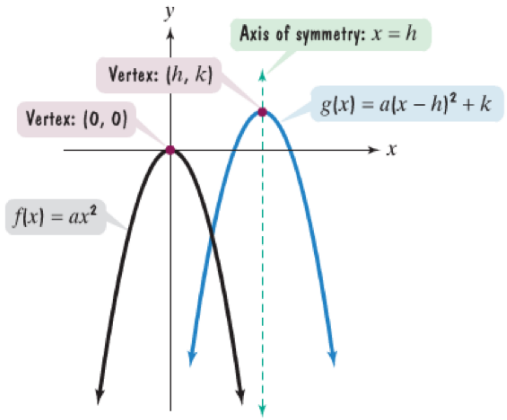
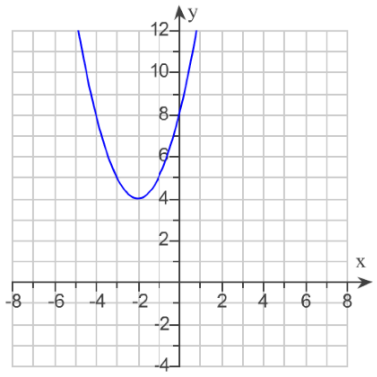


Figure 3.2(b) $a < 0$: Parabola opens downward.

1. The graph of a quadratic function is given. Select the function's equation.



A. $f(x) = (x - 2)^2 + 4$
B. $f(x) = (x + 2)^2 + 4$
C. $f(x) = (x + 2)^2 - 4$
D. $f(x) = (x - 2)^2 - 4$

2 Graphing a Quadratic Function in Standard Form

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

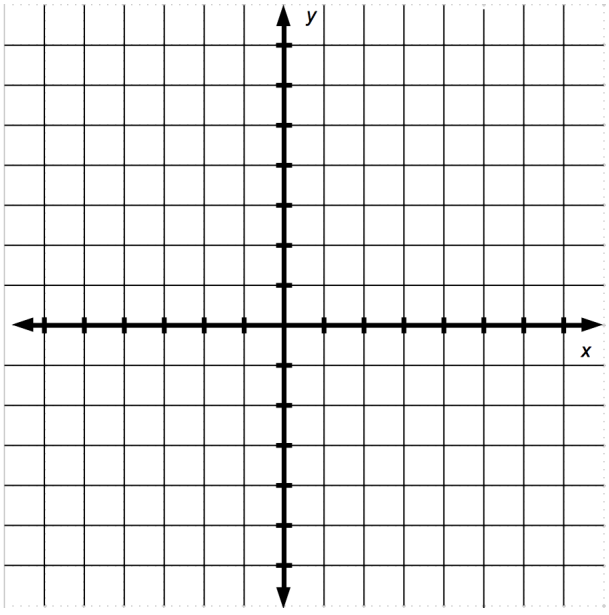
   (a) Determine whether the graph of the parabola opens upward or downward.

   (b) Identify the vertex.

   (c) Determine the x-intercept(s).

   (d) Determine the y-intercept.

   (e) Sketch the function.



   (f) Determine the axis of symmetry.

3 Determining the Standard Form of Quadratic Function

To determine the standard form of a quadratic function written in the form $y = ax^2 + bx + c$, we use a process called **Completing the Square**.

3. Determine the standard equation of the parabola $y = 3x^2 + 12x + 5$. Then determine the vertex.

The Vertex of a Parabola Whose Equation Is $f(x) = ax^2 + bx + c$

Consider the parabola defined by the quadratic function $f(x) = ax^2 + bx + c$. The parabola's vertex is $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$. The x-coordinate is $-\frac{b}{2a}$. The y-coordinate is found by substituting the x-coordinate into the parabola's equation and evaluating the function at this value of x.

Student Learning Outcomes Check

1. Are you able to recognize quadratic functions graphically and algebraically?
2. Can you write the standard equation for a quadratic function?
3. Are you able to determine the vertex of a parabola?

If any of your answers were no, please ask about these topics in class.