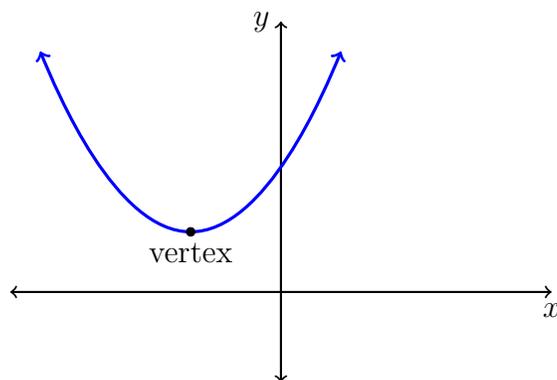


The graph of a quadratic polynomial  $y = ax^2 + bx + c$  is always a **parabola**.



### Things to Know

1. The coefficient  $a$  on the  $x^2$  term tells you if the parabola is right-side up like the one in the picture (when  $a > 0$ ) or if the parabola is upside down (when  $a$  is negative).
2. If you can't factor a quadratic, then use the **quadratic formula** to find its roots.

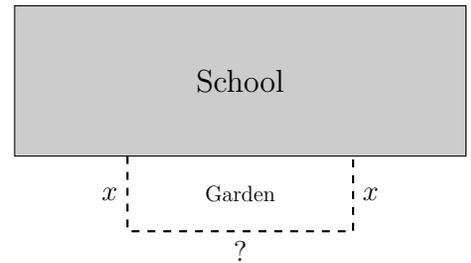
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

3. A **tangent line** is a line that intersects the parabola at one and only one point. If a tangent line intersects the parabola at  $x$ , then the slope of the tangent line is  $m = 2ax + b$ .
  4. The **vertex** of a quadratic function is the point where the slope of the tangent line is zero.
- 

### Practice

1. For each of the following parabolas, find the coordinates of the vertex and then decide based the position of the vertex if the parabola has zero, one, or two roots.
  - (a)  $y = x^2 - 6x - 2$
  - (b)  $f(x) = -4x^2 - 3x - 2$
  - (c)  $f(x) = 2x^2 - 12x + 18$
2. Find the  $x$ -values where the line  $y = 2x + 5$  intersects the parabola  $y = x^2 - 3$ .

3. A local elementary school wants to make a rectangular flower garden along the side of the school building. One side of the garden will be along the wall of the school, but the other three sides will be fenced off. If you have 60 feet of fencing material, what is the largest area possible for the flower garden? (Hint: if the garden is  $x$  feet wide, then how long is the other side?)



4. If a gas station sets the price of gas  $p$  at \$2 per gallon, they will sell 18,000 gallons of gas. Assume that the quantity of gas sold is a linear function and for every dollar the price increases, the quantity sold decreases by 9,000 gallons. Find formulas for the quantity sold  $Q$  and the revenue  $R$  as a function of the price  $p$ . Recall that revenue is price times quantity sold. Then sketch a graph of the revenue function, and find the price where revenue is maximized.
5. The height of a ball thrown in the air is given by  $h(x) = -\frac{1}{12}x^2 + 6x + 3$ . Draw a sketch of the path this ball takes, including the highest point it reaches. How far from the thrower is the ball when it lands?
6. A quadratic function is completely determined by three points its graph passes through. Find the equation for the parabola shown below.

