Think It Through
December 4

1. Find the equation of a parabola for each of the following circumstances:
   (a) The parabola goes through the points $(-2, 0)$, $(0, -4)$, and $(-5, -9)$.

   (b) The parabola has a vertex of $(-4, 2)$, that goes through the point $(-2, 6)$.

   (c) The parabola that has an axis of symmetry of $x = 2$, a maximum of $y = 5$, and passes through the x-axis at $(5, 0)$.

2. Consider the parabola equation of parabola below:

$$y = x^2 + ax + 4$$

   Find a so that the parabola has a vertex $(3, -5)$.

3. Derive the quadratic formula:

4. Solve $x^2 + 3x + x(x + 2) = x(x + 4) + 3x^2$.

5. If a toy rocket is launched vertically upward from the ground level with an initial velocity of 128 feet per second, then its height h after t seconds is given by the equation $h(t) = -16t^2 + 128t$ (if air resistance is neglected).

   (a) How long will it take for the rocket to return to the ground?

   (b) After how many seconds will the rocket be 112 feet above the ground?

   (c) How long will it take the rocket to hit its maximum height?

   (d) What is the maximum height?