

- A ball is thrown upward with a velocity of 48 feet per second from the top of a 144-foot building. What is the maximum height of the ball? How long until the ball hits the ground?

$$h(t) = -16t^2 + 48t + 144$$

SINCE  $h$  IS A QUADRATIC FUNCTION ITS GRAPH IS A PARABOLA. THE PARABOLA OPENS DOWN BECAUSE THE LEADING COEFFICIENT IS NEGATIVE,  $-16$ .

THE MAX HEIGHT OCCURS AT THE VERTEX.

$$t\text{-COORD OF VERTEX} = \frac{-b}{2a} = \frac{-48}{2(-16)} = \frac{48}{32} = 1.5$$

$$\begin{aligned} h(1.5) &= -16(1.5)^2 + 48(1.5) + 144 \\ &= 180 \end{aligned}$$

MAX HEIGHT IS 180 FT AFTER 1.5 SECONDS

BALL HITS THE GROUND WHEN  $h(t) = 0$

$$-16t^2 + 48t + 144 = 0$$

THIS DOES NOT FACTOR NICELY SO WE USE THE QUAD. FORMULA.

$$t = \frac{-48 \pm \sqrt{(48)^2 - 4(-16)(144)}}{2(-16)} = \frac{-48 \pm \sqrt{11520}}{-32}$$

$$\approx \boxed{4.854 \text{ SECONDS}} \text{ OR } -1.854 \text{ SECONDS}$$