Assignment 2B-2: Quadratic Models

1. Suppose that the *orcs* are attacking The castle at Ministereth with their catapults that launch rocks from a height of 20 feet. The initial vertical velocity is 40 ft. per second and an initial horizontal velocity of 80 ft. per second.

   a. Write a function to model the h as a function of time t.

   b. Graph the equation on your calculator and sketch it here.

   c. What is the amount of time at it will take the projectile to reach its maximum height? How do you find this?

   d. What is the maximum height of the projectile?

   e. At what time will the rock hit the ground? Explain how does this show up in the graph.

   f. The wall of the castle is 50 feet tall and it is 800 feet from the base of the catapult. Use the answers in parts a-d and your graphing calculator to decide if the boulder (which has a diameter of 4 feet) will fall short, hit the wall, or go over the wall.

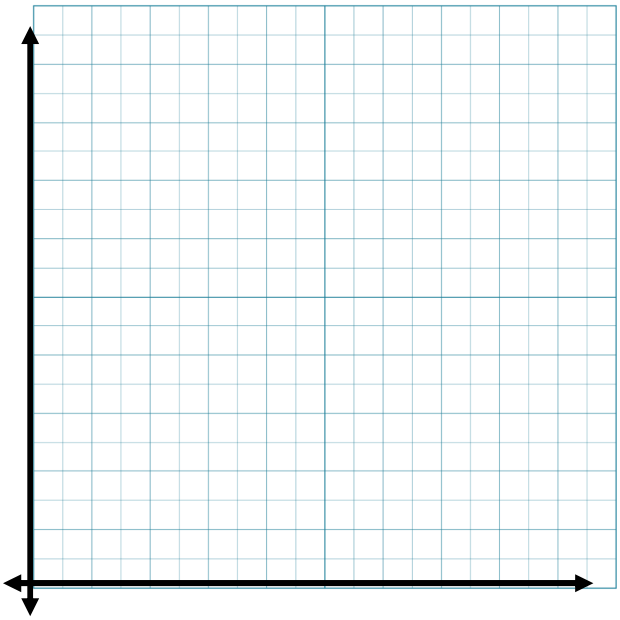
Business Models

When computing revenue (the amount of money that a business brings in) we often get a quadratic model based on a linear relationship between price and the number of units sold.

2. The Swedish Sister's coffee stand would "sell" 2400 Lattes in a week if they gave them away for free (because that's all they can make). After collecting some data over several months, their marketing department has found that they sell 400 fewer Lattes for every dollar that they raise the price.

   a. Write an equation for the number of lattes, n , as a function of the price p in dollars.

   b. Graph the function $n(p)$ here (including the scale).



   c. At what price will $n = 0$?

      Explain what this means for the Swedish Sister's business?

   d. Revenue is calculated by multiplying the number of lattes sold, n , by the price p . By substituting your equation from part (a), write an equation for revenue as a function of the price p .

$$revenue\colon\ r = p \cdot n = p(\qquad\qquad)$$

      Simplify this equation to get a quadratic equation for r.

   e. Graph the function and sketch it here.

   f. What is the price that will maximize the revenue?

   g. What is the maximum revenue?