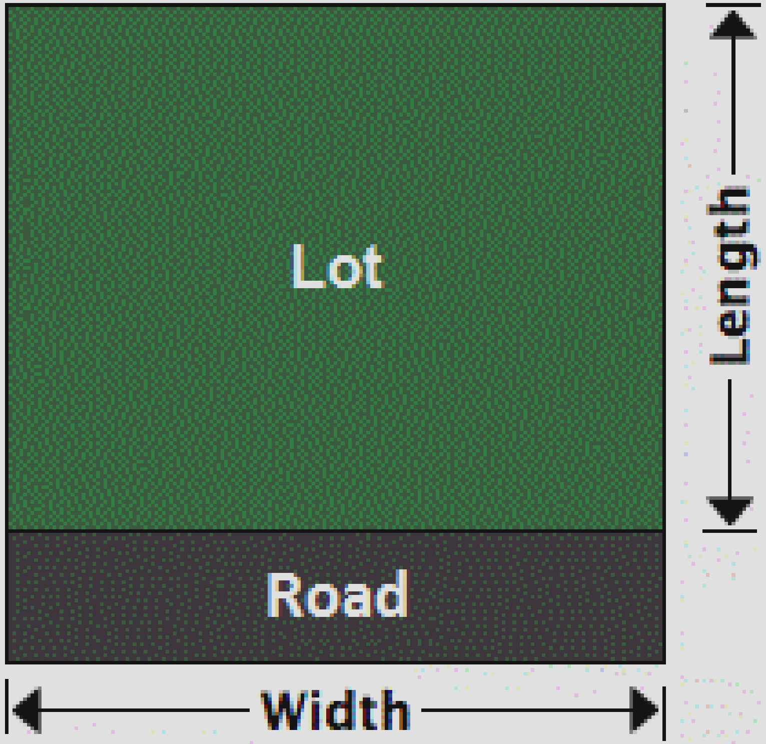
Write a function for the area of the lot.



We are dividing a square tract of land into rectangular lots for houses. We know that each lot will have a road across the front which will make the length 32 feet shorter than the width of the lot.

You can model the motion of a pumpkin released from a catapult using a vertical motion model. A **vertical motion model** is a quadratic equation that models the height of an object at a given time. The equation is of the form shown.

$$y = -16t^2 + v_0 t + h_0$$

In this equation, y represents the height of the object in feet, t represents the time in seconds that the object has been moving, v_0 represents the initial vertical velocity (speed) of the object in feet per second, and h_0 represents the initial height of the object in feet.

1. What characteristics of this situation indicate that it can be modeled by a quadratic function?

Suppose that a catapult hurls a pumpkin from a height of 68 feet at an initial vertical velocity of 128 feet per second.

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2. Write a function for the height of the pumpkin, $h(t)$, in terms of time, t.

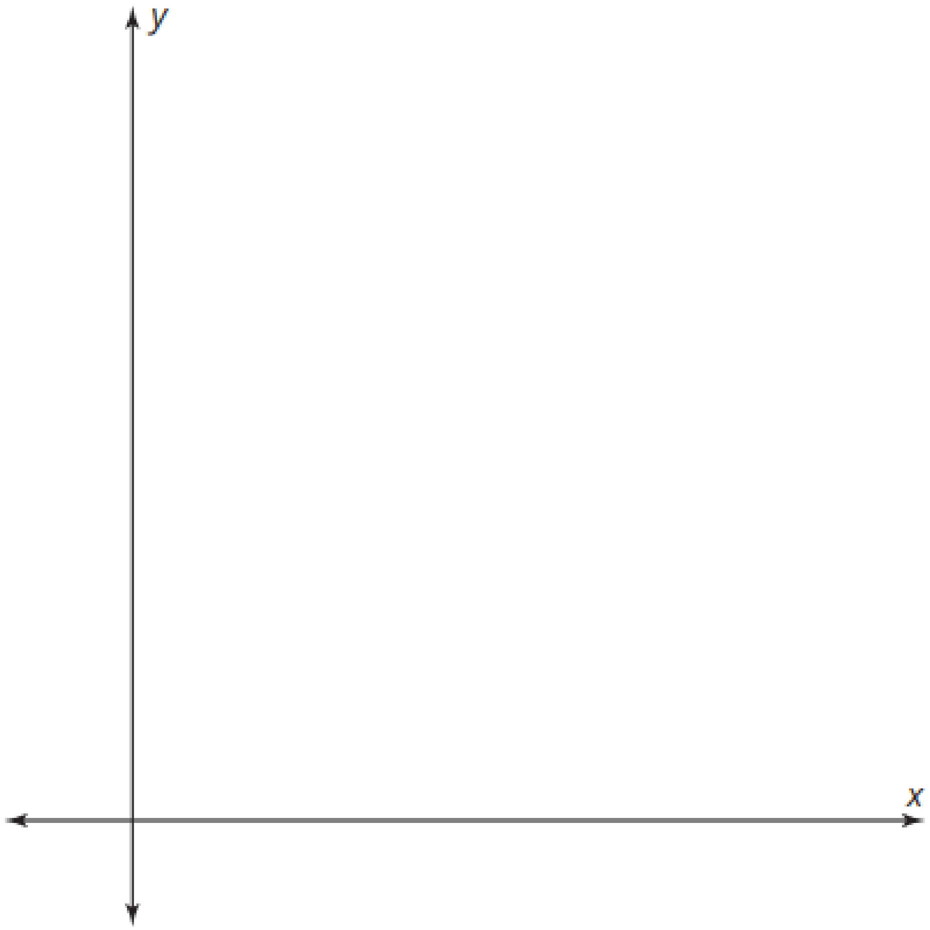
$$h(t) = -16t^2 + 128t + 68$$

3. Does the function you wrote have a minimum or maximum? How can you tell from the form of the function?

a is negative which causes a reflection over the *x*-axis, the parabola opens down making it a maximum.

4. Use technology to graph the function. Sketch your graph and label the axes.

Punkin' Chunkin'



Ask yourself:

What do all the points on this graph represent?

5. **Use technology to determine the maximum or minimum and label it on the graph. Explain what it means in terms of the problem situation.**

6. **Determine the *y*-intercept and label it on the graph. Explain what it means in terms of the problem situation.**

7. **Use a horizontal line to determine when the pumpkin reaches each height after being catapulted. Label the points on the graph.**

   a. **128 feet**

   b. **260 feet**

   c. **55 feet**

8. **Explain why the *x*- and *y*-coordinates of the points where the graph and each horizontal line intersects are solutions.**

9. When does the catapulted pumpkin hit the ground? Label this point on the graph. Explain how you determined your answer.

Remember:

The zeros of a function are the *x*-values when the function equals 0.

The time when the pumpkin hits the ground is one of the *x*-intercepts, (x, 0). When an equation is used to model a situation, the *x*-coordinate of the *x*-intercept is referred to as a root. The **root** of an equation indicates where the graph of the equation crosses the *x*-axis.