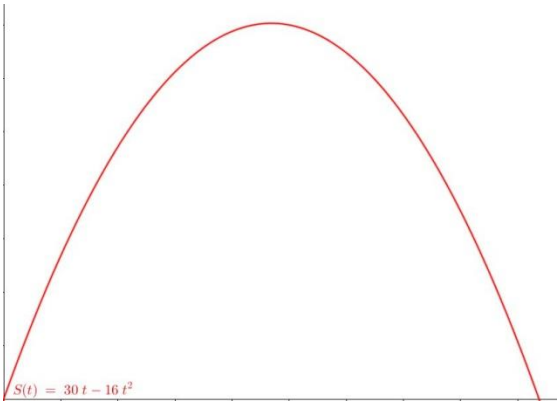
**Math 1311**
**Section 6.1**
**Velocity**

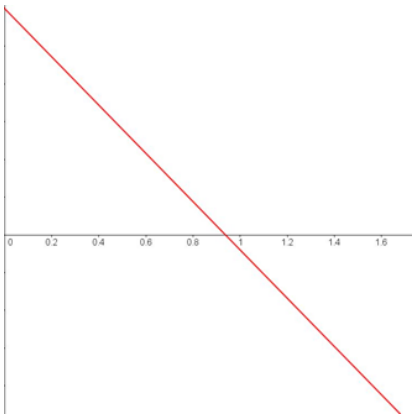
**Example 1:** If from ground level we toss a rock upward with a velocity of 30 feet per second, we can use elementary physics to show that the height in feet of the rock above the ground $t$ second after the toss is given by $S = 30t - 16t^2$.

Below we see a graph of distance up versus time and a graph of velocity versus time.

The velocity of rock is the rate of change in the distance up from the ground.

The velocity measures how fast the rock is rising of falling.




a) Use your calculator to plot the graph of $S$ versus $t$.
b) How high does the rock go?
c) When does it strike the ground?

**Velocity vs Speed**

$$Velocity = \frac{change\ in\ directed\ distance}{change\ in\ time} \qquad Speed = \frac{length\ of\ the\ trajectory}{change\ in\ time}$$

- Speed is always a positive number.
- Velocity has a sign (positive or negative)

**Example 2:** An airplane leaves Kennedy Airport in New York and flies to Miami, where it is serviced and receives new passengers before returning to New York. Assume that the trip is uneventful and that after each takeoff the airplane accelerates to its standard cruising speed, which it maintains until it decelerates prior to landing.

1) Describe what the graph of distance south of New York looks like during the period
    a) when airplane is maintaining its standard cruising speed on the way to Miami.

    b) when airplane is serviced and receives new passengers in Miami.

    c) when airplane is maintaining its standard cruising speed on the way to New York.

2) Sketch the graph of airplane's distance south of New York versus time.
    a) Locate and mark the places on the graph where the directed distance is zero and where it reaches its extremes
    b) Label the regions of increase and decrease of directed distance.
    c) Complete the graph, using any additional information known about directed distance

3) Make possible graph of the velocity of airplane versus time.
    a) Locate and label points on the graph where the velocity is zero.
    b) Label the regions where the velocity is positive and where it is negative.
    c) Complete the graph, incorporating any other knows features of the graph.

**Summary**

1. Velocity is the rate of change in directed distance.
2. When directed distance is increasing, velocity is positive. (The graph of velocity is above the horizontal axis.)
3. When directed distance is decreasing, velocity is negative. (The graph of velocity is below the horizontal axis.)
4. When directed distance is not changing, velocity is zero. (The graph of velocity is on the horizontal axis.)
5. When velocity is constant, the rate of change in directed distance is constant.(The directed distance is a linear function with a slope equal to the constant velocity, so its graph is a straight line)