Solving Related Rates Problems:

• Find an **equation** that ties your variables together.

•You may now plug in any **constant** value. Do not plug in any value that changes.

• **Differentiate** your equation with respect to time.

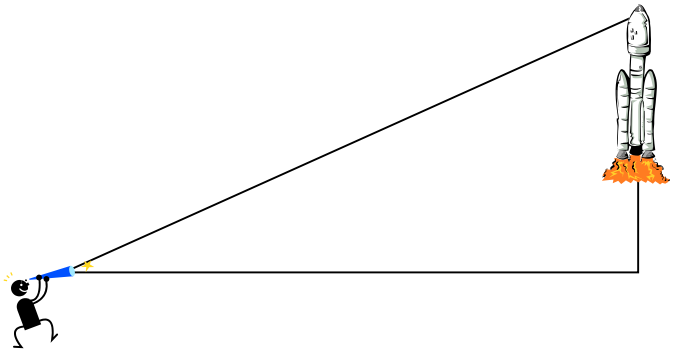
• **Plug in** all variables. If you have more than one unknown, you will most likely use your original equation to find the missing value.

• **Label** your answers in terms of the correct units and be sure that you answered the question asked!

1. A spherical bubble is being blown up. The volume is increasing at the rate of 9 mm^3 per second. At what rate is the radius increasing when the radius is 3 mm?

2. A cylindrical tumbler with a radius of 3 cm has its height increasing at a rate of 2.5 cm/sec. Find the rate of change of the volume of the cylinder when the height is 12.56 cm.

3. Tracking a rocket: A spy tracks a rocket through a telescope to determine its velocity. The rocket is traveling vertically from a launching pad located 10 km away, as in the figure. At a certain moment, the spy's instruments show that the angle between the telescope and the ground is equal to $\frac{\pi}{3}$ and is changing at a rate of 0.5 rad/min. What is the rocket's velocity at that moment?



4. A spherical hot air balloon is being inflated. If air is blown into the balloon at the rate of 2 ft^3/sec,
   a. Find how fast the radius of the balloon is changing when the radius is 3 ft.
   b. Find how fast the surface area is increasing at the same time.

5. You are looking at the New York ball drop on New Year's Eve at a distance of 100 m away from the base of the structure. If the ball drops at a constant rate of 2 m/s, what is the rate of change of the angle between you and the ball when the angle is $\frac{\pi}{4}$?