

Show all work.

1. **(6 points)** A spherical balloon is being filled by a compressor which moves 600 cubic centimeters of air (at the balloon's internal pressure) per second. The balloon currently has a radius of 50cm (i.e. a diameter of 1 meter). How quickly is the balloon's radius growing right now? For reference, the volume of a sphere of radius r is $\frac{4}{3}\pi r^3$.

2. **(9 points)** You are using a radargun to track the speed of a car which is currently 0.8 miles to the west of your monitoring position on an east-west racetrack; for safety, you are standing 0.6 miles south of the track. Your radargun reports that the car is approaching you at 160 miles per hour.
 - (a) **(5 points)** How quickly is the car actually moving?

 - (b) **(4 points)** If you want to continue tracking the car, how quickly should you be swiveling the radar at this moment?

3. **(5 points)** Use linear (a.k.a. differential) approximations to determine good rational estimates for the following values.
 - (a) $\sqrt{35.91}$.

 - (b) $(-3.02)^4$.