

MAT125, Paper Homework 7

1. A water tank holds 5000 gallons of water. If a tap is opened at the bottom of the tank, it will drain within 40 minutes. Torricelli's law tells us that the volume of water remaining in the tank after t minutes is given by

$$V(t) = 5000 \left(1 - \frac{t}{40}\right)^2 \quad 0 \leq t \leq 40$$

Find the rate at which the water is draining from the tank at

- (a) 5 minutes
- (b) 20 minutes
- (c) 40 minutes

Also, when is the water draining out of the tank the fastest? The slowest?

2. Using differentials, estimate the amount of paint required to apply a coat of paint 0.05 cm thick to a hemispherical dome with diameter 50 meters.

You may find it useful to remember that the volume of a sphere of radius r is $\frac{4}{3}\pi r^3$, or maybe that Thelonious Monk's middle name was Sphere. There are 100 centimeters in a meter.