

HW 9: Section 5.5 and 5.6

Due: Monday, October 7th in SQRC by 9pm

Learning Goals:

- Reason about problems involving projectile motion.
- Use integrals to compute work done.

Questions:

1. I'm standing at the foot of a hill with slope 1, (i.e. it follows the line $y = x$). If I throw a ball from a height of 2 meters, at an angle of $\pi/6$, with a velocity of 10 meters per second, where does it hit the hillside?
2. Just as in problem 1, I throw a ball with initial height of 2 meters at a speed of 10m/s. At what angle should I throw to maximize the distance I throw it up the hill?
3. Compute the mass and center of mass of an object with density $\rho(x) = 3 - \frac{x}{6}$ kg/m, $0 \leq x \leq 6$. Briefly explain in terms of the density function why the center of mass is not at $x = 3$.
4. A force of 10 pounds stretches a spring 2 inches. Find the work done in stretching this spring 3 inches beyond its natural length.
5. A bucket is lifted a distance of 80 feet at the rate of 4ft/s. The bucket initially contains 100 pounds of sand but leaks at a rate of 2 lbs/s. Compute the work done.
6. A water tank is in the shape of a right circular cone of altitude 10 feet and base radius 5 feet, with its vertex at the ground (think ice cream cone). If the tank is full of water, find the work done in pumping all of the water out the top of the tank.