

Homework 8

Math 232 section 006

Due: Thursday, November 29th

Since this is our first assignment with real word problems on it, I'll include some directions:

- Since the problem is posed sententially, please give your answer in sentence form.
- You should draw a picture, and clearly label variables, axes, and any given distances, weight, etc.
- Units are critical. Your answer should always involve units. Sometimes you will need to make conversions in your units to get the correct answer (ie if you are given distances in centimeters and asked for force in Newtons ($kg\ m/s^2$), you will have to convert the distance in centimeters to meters).
- You make make assumptions about problems if you are not given specific information (if you are finding work, and not given a force, you can probably assume it's a gravitational force; If you are not given other information, you can probably assume it is some constant).

1. Answer the following questions for the function: $f(x) = \frac{1}{x+1}$
- (a) Find the average value (f_{ave}) of the function between $x = 0$ and $x = 2$
 - (b) Find the value of c so that $f_{ave} = f(c)$ as stated by the Mean Value Theorem for integrals (again, between $x = 0$ and $x = 2$).

2. A 100 pound crate needs to be lifted to the second story balcony of a building. The movers tie a rope, weighing one quarter of a pound per foot, to the crate. They go to the roof forty feet above the ground, and lift the rope and crate up fifteen feet to the desired balcony. How much work was done lifting the rope and crate?

3. A force of 20 Newtons is required to maintain a spring with a natural length of 10 centimeters, stretched to 20 centimeters. Answer the following questions about the spring.
- (a) How much work is done stretching the spring from a length of 15 centimeters to a length of 20 centimeters?
 - (b) How far past its natural length will a force of 18 Newtons stretch the spring?

4. Answer the following questions, given the function: $y = c \cos(ax)$

(a) Show that y is a solution to the differential equation

$$y'' + a^2y = 0$$

(b) Find the particular solution when $y(0) = 5$ and $y''(0) = -7$

Bonus: Suppose a rectangular dam has a height of L (in meters). What is the total force applied on the dam due to hydrostatic pressure, assuming the water level is at the top of the dam?