

# MAT132 Midterm II

Spring 2010

Print your name, ID number and section number on your answer sheet.

Do each of the following 5 problems. Show some work or give an explanation when you are asked to do so. It is not necessary to “simplify” your answers.

Please do not use calculators or any other electronic devices, notes or books during the exam time.

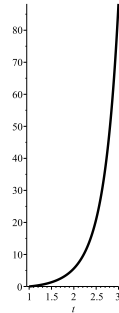
Each problem is worth 20 points.

1. If 50 foot-pounds of work is needed to stretch a spring from its natural length of 10 feet to a length of 12 feet, then how much work will be needed to stretch the spring from a length of 11 feet to a length of 15 feet? **Show work.**

2. Find the length of the curve given by

$$y = \int_1^x \sqrt{u^2 e^{u^2} - 1} du \quad 1 \leq x \leq 3.$$

**Show work.**



3. Let  $R$  denote the region in the plane bounded by the curves  $x = 2$ ,  $x = 9$ ,  $y = \sin(x)$ , and  $y = 3^x$ .
  - (a) Express the area of  $R$  as a definite integral
  - (b) Let  $S_1$  be the solid obtained by rotating the region  $R$  about the line  $y = -2$ . Express the volume of  $S_1$  as a definite integral.
  - (c) Let  $S_2$  be the solid obtained by rotating the region  $R$  about the line  $y$ -axis. Express the volume of  $S_2$  as a definite integral.
4. A spherical tank of radius 3 meters is buried in the ground so that the top of the tank is 4 meters beneath ground level. The tank is filled with liquid which has a density of 1500 kilograms/meter<sup>3</sup>. How much work does it take to pump all of the liquid to ground level? (Recall that gravitational acceleration is 9.8 meters/second<sup>2</sup>. **Show Work.**)
5. A question on center of mass and stuff that I don't want to type up. This will not be on the Fall 2011 exam; instead, we'll have questions on infinite series.