

Stony Brook University

MAT 132 - PRACTICE MIDTERM

Summer 2010

NAME (please print legibly): _____

Your University ID Number: _____

INSTRUCTOR: Caner Koca

DURATION: **2 HOURS** (9:30am-11:30am)

IMPORTANT INSTRUCTIONS:

- This exam is out of **130 points**. **100 points** will be regarded as a **perfect score**.
- **No calculators, notes or books** are allowed on this exam.
- Please **show all your work**. You may not receive full credit for a correct answer if there is no work shown.
- You may use back pages if necessary.

QUESTION	VALUE	SCORE
1	15	
2	15	
3	15	
4	15	
5	20	
6	20	
7	15	
8	15	
TOTAL	130	

1. (15 points) Find the following indefinite integrals:

(a) $\int \frac{(\ln x)^2}{x} dx$

(b) $\int \frac{\ln x}{x^2} dx$

(c) $\int \frac{1}{x^2 - 1} dx$

2. (15 points) Evaluate the following definite integrals:

(a) $\int_0^1 \frac{x}{e^{2x}} dx$

(b) $\int_0^{\pi^2} \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$

(c) $\int_{-2}^0 \frac{1}{(x+1)^3} dx$

3. (15 points) Determine whether the following improper integrals are convergent:

(a) [6pts] $\int_1^{\infty} \frac{\arctan x}{1+x^e} dx$ and $\int_0^{\infty} \frac{\arctan x}{1+x^e} dx$

(b) [9pts] $\int_1^{\infty} e^{-x} dx$ and $\int_{-\infty}^1 e^{-x} dx$ and $\int_{-\infty}^{\infty} e^{-x} dx$

4. **(15 points)** Compute the volume of a cap of a sphere with radius r and height h .
(Taken from Section 6.2, Exercise 33).

5. (20 points) A leaky 10kg bucket is lifted from the ground to a height of 12 m at a constant speed with a rope that weighs 0.8 kg/m. Initially the bucket contains 36kg of water, but the water leaks at a constant rate and finishes draining just as the bucket reaches the 12m-level. How much work is done? (Note: You can assume that the gravitational acceleration is $g = 10 \text{ m/s}^2$)

6. (20 points) (a) [10pts] The area bounded by the x -axis and the curve $y = x^2 - x^3$, is rotated about the x -axis. Calculate the volume swept out.

(b) [10pts] Same question, but now rotate about the y -axis.

7. (15 points) Suppose that 2J of work is needed to stretch a spring from its natural length of 30cm to a length of 42cm.

(a) How much work is needed to stretch the spring from 35cm to 40cm?

(b) Suppose the spring is hung vertically, and an object weighing 20N is attached at its lower end. How far will it be stretched? How much work will it take to lift the object back up to spring's resting position?

8. (15 points) (a) [7pts] Find the average value of the function $\frac{\sin x}{1 + \cos^2 x}$ on the interval $[0, \frac{\pi}{2}]$

(b) [8pts] If $f(x) = \int_{\tan(x)}^{e^{\sin(x)}} \frac{1}{1+t} dt$, compute $f'(0)$.