

Math 221 Spring 2014
Professor Reznikoff

Midterm Exam 2
March 4, 2014

Your name: _____

Rec. Instr.: _____

Rec. Time: _____

Instructions: Show all your work in the space provided under each question. Please write neatly and present your answers in an organized way. You should leave answers in terms of the constants

g = acceleration due to gravity (in m/s^2) and

ρ = mass density of water (in kg/m^3).

Also leave values such as π or $\sqrt{3}$ or $\sqrt{2}$ as part of your answers. In the word problems, assume the units of the x and y axes are in meters.

Problem	1	2	3	4
Points	/10	/10	/15	/10
Problem	5	6	7	Total
Points	/10	/10	/5	/70

Note: all midterms will have the same weight.

1. Calculate the limit, or indicate why it does not exist.

(a) $\lim_{x \rightarrow 0} \frac{\tan x}{e^{2x} - 1}$

(b) $\lim_{x \rightarrow 0} \frac{\sqrt{x}}{e^x}$

(c) $\lim_{x \rightarrow 1} (1 + \ln x)^{\frac{2}{x-1}}$

2. Integrate

$$\int \frac{3x^3 + 2x^2 + x + 1}{x^2(x^2 + 1)} dx$$

3. Calculate the integral or indicate why it diverges.

(a) $\int_0^{\infty} x e^{-x^2} dx$

(b) $\int_2^\infty \frac{5}{\sqrt[3]{x}} \mathrm{d}x$

(c) $\int_0^1 \frac{2x}{x-1} \mathrm{d}x$

4. A solid object is to be built in the shape of the frustum formed by rotating the line segment

$$y = x - 2 \quad 2 \leq x \leq 3$$

about the y -axis. (The base is formed by rotating the segment $0 \leq x \leq 2$.)

How much work (in Joules) is needed to build this object if the material used has density δ ?

5. A plate in the shape of the area bounded by the x -axis and the curve $y = x^2 - 1$ is submerged vertically underwater, so that its top edge (the x -axis edge) is 3 meters below the surface of the water. Find the fluid force on the plate, in Newtons.

6. Find the arclength of the curve $y = \ln x - \frac{x^2}{8}$, $1 \leq x \leq e$.

7. Write down—but do not attempt to evaluate—an integral for the surface area obtained by rotating the same curve about the x -axis.