MATH 225: EXAM 2 (FINAL EXAM)

Spring 2016

READ THE INSTRUCTIONS BELOW, BUT DO NOT OPEN THE TEST UNTIL YOU ARE TOLD TO DO SO!

Problem	1	2	3	4	5	6	7	Total	Course Points
Points	18	12	12	15	10	15	18	100	300
Score									

Name:

Student Signature: _____

Turn off any electronic devices that might be disruptive.

You are NOT allowed access to ANY such devices during the exam.

Show all necessary work for all but short answer problems. Use of L'Hôpital's Rule to evaluate limits on this exam is not permitted.

This test is single-sided, with problems only on the front of each page. Use the back of the pages as scrap paper. If you need additional scrap paper, ask one of the exam proctors. You cannot use your own paper as scrap. Any work done on scrap paper will be disregarded unless you direct the grader to look at it. All scrap paper should be handed in with your exam.

Use of calculators is not permitted on this exam.

Be sure to keep your eyes on your own test. If you are caught looking at another student's test, the penalty will be severe, involving failure of this exam and, by extension, likely the course.

When you are finished with your exam, hand it in to YOUR instructor and leave quietly. Have a nice break!

1. (18 points) Evaluate each of the following integrals.

a)

$$\int_0^2 \frac{x}{(x^2+1)^2}\,dx$$

b)

$$\int (3x^3 - 6x)(x^2 + x)dx$$

c)

$$\int x^2 \sin x\, dx$$

2. (12 points) Find the area of the region bounded by the graphs of $f(x) = 3x^2 - 6x + 3$ and $g(x) = 6x - 6$. Show all work.

3. (12 points) Suppose $v(t) = t^2 - 6t + 8$, where $t \geq 0$, represents the velocity of a particle where t is in seconds and $v(t)$ is in feet/second.

a) Find the average velocity of the particle in the time interval from $t = 1$ to $t = 7$.

b) Find the total distance traveled by the particle in the time interval from $t = 1$ to $t = 7$.

4. (15 points) Find the derivatives specified. You do not need to simplify your answers.

a)

$$\frac{d}{dx}\left[\int_x^5 \frac{t^3+t}{\sqrt{\sin t+2}}\,dt\right]$$

b)

$$\frac{d}{dx}\left[\int_0^{\sin x} \tan\left(\sqrt{t}\right)\,dt\right]$$

c)

$$\frac{d}{dx}\left[\int_{\sqrt{2}}^{\pi} \frac{\sqrt[3]{t}}{t^2+1}\,dt\right]$$

5. (10 points) Use calculus to find two nonnegative numbers whose sum is 18 such that the product of one number and the square of the other number is a maximum.

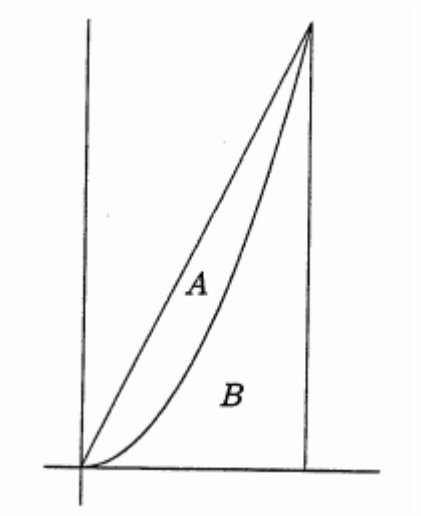
6. (15 points) Suppose $f(x) = \sin x$

a) Use a Riemann Sum with four rectangles and right endpoints to estimate the area between $f(x)$ and the x-axis on the interval from $x = 0$ to $x = \pi$.

b) Write a limit of sums that gives the exact area under $f(x)$ on $x = 0$ to $x = \pi$. Do not compute (or attempt to compute!) the limit.

c) Use the Fundamental Theorem of Calculus to find the exact area.

7. (18 points) Suppose region A is bounded by the curves $y = \frac{x^2}{3}$ and $y = 2x$, and region B is bounded by the curve $y = \frac{x^2}{3}$, the vertical line shown, and the x-axis, as indicated in the graph below:



Set up, but DO NOT EVALUATE, definite integrals for each of the following. Be sure that your answers have the correct limits of integration.

a) The volume of the solid obtained by rotating region B about the x-axis, using disks.

b) The volume of the solid obtained by rotating region A about the y-axis, using cylindrical shells.

c) The volume of the solid obtained by rotating region B about the y-axis, using washers.