Math 111 Fall 2009 Exam 2 Practice Problems

Instructor: Dr. O'Donnol

Instructions: This is a closed book, closed notes exam. Use of calculators is not permitted. You have **fifty minutes**. Do all the problems. Please do all your work on the paper provided. You must show your work to receive full credit on a problem. An answer with no supporting work or explanation will receive little to no credit.

The actual exam will be **five** problems, not seven. Solutions without details are on the last page.

1. (a) Give the definition of the derivative as a function $f'(x)$.
   (b) From the text book: Chapter 2 review page 168, problems 47 and 48.

2. Find the limits:

(a)

$$\lim_{x\to\infty} \frac{4x^5 + 7x^3 - 2}{3x^5 - 8x - 300} =$$

(b)

$$\lim_{x\to-\infty} \frac{1 - e^x}{1 + 2e^{2x}} =$$

(c)

$$\lim_{x\to 0} \frac{\sin(4x) + \tan x}{x} =$$

3. Find the derivatives:

(a)

$$y = x^2 \cos x \sin x$$

(b)

$$f(x) = \frac{\ln(x^2)}{x^9 - 3x}$$

(c)

$$g(x) = \ln(\frac{\tan 2x + \sec x}{(x^4 + 4)^7})$$

4. Find the tangent line to the curve $y = x^{\sin x}$ at the point $(\pi, 1)$.

5. Find the derivative of $y = \arctan x$. Show all of your steps carefully.

6. Show that there exists a c such that $f(c) = 50$ where $f(x) = x + e^{2x} + \sin x$.

7. The length of a rectangle is increasing at a rate of 8 cm/s and the width is increasing at a rate of 3 cm/s. When the length is 20 cm and the width is 10 cm, how fast is the area of the rectangle increasing?

Solutions These are not complete solutions, you must show your work to get full credit. This is only so that you may check your work.

1. See book page 154.
2. (a) $\frac{4}{3}$
   (b) 1
   (c) 5
3. (a)
   $$y' = 2x \sin x \cos x + x^2(\cos^2 x - \sin^2 x)$$
   (b)
   $$f'(x) = \frac{2(x^8 - 3) - (9x^8 - 3)\ln(x^2)}{(x^9 - 3x)^2}$$
   (c)
   $$g'(x) = \frac{2\sec^2(2x) + \sec x \tan x}{\tan(2x) + \sec x} - \frac{7(4x^3)}{x^4 + 4}$$
4. The tangent line is $y - 1 = -\ln \pi(x - \pi)$.
5. The function f is the sum of continuous functions so it is continuous. In particular f is continuous on $[0, 10\pi]$.
   $$f(0) = 1 < 50.$$
   $$f(10\pi) = 10\pi + e^{20\pi} + 0 > 50.$$
   Thus, by the Intermediate Value Theorem there is a $c \in (0, 10\pi)$ such that $f(c) = 50$.
6. $140 cm^2/s$