# MATH 1210-90 Fall 2011

# Final Exam

INSTRUCTOR: H.-PING HUANG

**Hint: do NOT calculate any numerical value, unless specified otherwise.**

LAST NAME ______________________

FIRST NAME ______________________

ID NO. ______________________

**INSTRUCTION:** SHOW ALL OF YOUR WORK. MAKE SURE YOUR ANSWERS ARE CLEAR AND LEGIBLE. USE **SPECIFIED** METHOD TO SOLVE THE QUESTION. IT IS NOT NECESSARY TO SIMPLIFY YOUR FINAL ANSWERS.

| | | |
|---|---|---|
| PROBLEM 1 | 30 | ______ |
| PROBLEM 2 | 30 | ______ |
| PROBLEM 3 | 30 | ______ |
| PROBLEM 4 | 30 | ______ |
| PROBLEM 5 | 30 | ______ |
| PROBLEM 6 | 30 | ______ |
| PROBLEM 7 | 30 | ______ |
| PROBLEM 8 | 10 | ______ |
| TOTAL | 160 | ______ |

# PROBLEM 1

(30 pt) Evaluate the limit

$$\lim_{h\to 0} \frac{3(5+h)^2 + 3(5+h) - (3\cdot 5^2 + 3\cdot 5)}{h}$$

# PROBLEM 2

(30 pt) Find the equation of the tangent line to the curve $y = (x + 1)(x^2 - 1)$ at the point $(1, 0)$.

# PROBLEM 3

(30 pt) The function $f(x) = 4x^3 + 6x^2 - 72x$

is decreasing on the interval $(\_\_\_\_, \_\_\_\_)$. It is increasing on the interval $(-\infty, \_\_\_\_)$ and the interval $(\_\_\_\_, \infty)$.

The function has a local maximum at ____. Show using both the first and second derivative tests. I expect two separate responses, each with their own work.

# PROBLEM 4

(30 pt) Consider the parametric equation

$$x = \cos\theta + \theta\sin\theta \qquad y = \sin\theta - \theta\cos\theta$$

What is the length of the curve for $\theta = 0$ to $\theta = 7/2\pi$?

# PROBLEM 5

(30 pt) Set up the finite integral for the volume formed by rotating the region inside the first quadrant enclosed by

$$y = x^4 \qquad y = 8x$$

(a) about the $x$-axis.
(b) about the $y$-axis.
Please do not evaluate the values.

# PROBLEM 6

(30 pt) Given

$$f(x) = \int_0^x \frac{t^2 - 1}{1 + \cos^2 t}\, dt$$

At what value does the local **max** of $f(x)$ occur?
**Hint:** use the first derivative test .

# PROBLEM 7

(30 pt)

$$\lim_{n\to\infty} \frac{1}{(1+\frac{6}{n})^2} \cdot \frac{6}{n} + \frac{1}{(1+\frac{12}{n})^2} \cdot \frac{6}{n} + \frac{1}{(1+\frac{18}{n})^2} \cdot \frac{6}{n} + \cdots + \frac{1}{(1+\frac{6n}{n})^2} \cdot \frac{6}{n}$$

$$= \int_1^b f(x)\ dx.$$

Find out the upper limit $b$, and the integrand $f(x)$, and the finite integral $\int_1^b f(x)\ dx$.

# PROBLEM 8

(10 pt) Evaluate the definite integral

$$\int_3^5 (\frac{d}{dt}\sqrt{4+3t^4})\ dt$$