Practice Midterm Exam I
Math 101 Summer General Session 2010

Instructions: This is a **105**-minute exam. You may not consult any notes or books during the exam, and no calculators are allowed. Show all of your work on each problem. Attach extra paper if you need more space.

Write your name:

Write out the Honor Pledge: "On my honor, I have neither given nor received any unauthorized aid on this exam."

Signature:

Problem	Score
1	
2	
3	
4	
5	
6	
7	
8	
Total	

Some useful identities

$$\sin^2 \theta + \cos^2 \theta = 1$$

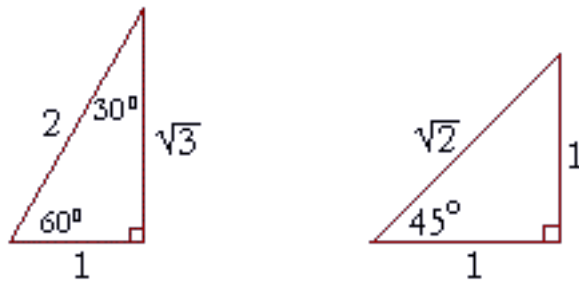$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\pi \text{ radians} = 180°$$

$$a^2 - b^2 = (a+b)(a-b)$$

$$\log(ab) = \log a + \log b$$

$$\log(a^b) = b \log a$$

$$\log\left(\frac{a}{b}\right) = \log a - \log b$$

$$\ln(x) = \log_e(x)$$

You may use the above triangles to recall certain values of $\sin, \cos$, and $\tan$.

1. (20 points) Consider the polynomial function $f(x) = x^3 + 3x^2 - 2x - 6$.

   (a) Calculate $f(2)$ and $f\left(-\frac{1}{3}\right)$.

   (b) Find the derivative $f'(x)$.

   (c) Find the equation of the tangent line of $y = f(x)$ when $x = 1$.

   (d) Show that $f(x) = 0$ for some x between $x = 1$ and $x = 2$.

2. (10 points) Calculate the following limits:

(a)
$$\lim_{x \to 0} \left(\frac{1}{x^2} - \frac{\cos x}{x^2} \right).$$

(b)
$$\lim_{x \to 0} x^2 \sin \left(\frac{\sqrt[3]{x+3}}{x} \right).$$

3. (5 points) What is the largest possible domain of the function

$$f(x) = \frac{\sqrt{x+1}}{|x|}?$$

4. (15 points) Find the derivative $\dfrac{dy}{dx}$ when

(a) $y = x^2 + 1$.

(b) $y = x^2 \sin(x)$.

(c) $y = \cos(2x + 3)$.

5. (15 points) Find the derivative $f'(x)$ when

(a) $f(x) = \ln(x \cos x)$.

(b) $f(x) = e^{\sqrt{x}}$.

(c) $f(x) = \dfrac{e^x}{\sqrt[3]{x}}$.

6. (5 points) Find the absolute maximum and absolute minimum values for $f(x) = x^2 + 6x + 11$ in the interval $[-4, -1]$.

7. (10 points) A rectangle has perimeter of 100 meters. What is its largest possible area?

8. (5 points) The sides of a square are all increasing at a rate of 0.5 centimeters per second at the moment that they have length 10cm. How quickly is the area of the square increasing at that time?