King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
Math 101- Calculus I
Exam I
2007-2008 (073)

Tuesday, July 22, 2008   **Allowed Time: 2 hours**

Name: _____

ID Number: _____

Section Number: _____   **Serial Number:** _____

Instructions:

1. Write neatly and eligibly. You may lose points for messy work.
2. **Show all your work.** No points for answers without justification.
3. **Calculators and Mobiles are not allowed.**
4. Make sure that you have 8 different problems (6 pages + cover page)

Problem No	Grade	Maximum Points
1		33
2		7
3		7
4		8
5		8
6		13
7		8
8		16
Total		100

MATH 101, EXAM-I (Term 073)

1. Evaluate the limit if it exists. Justify your answer

(a) $\displaystyle\lim_{x\to 0^+} \frac{x-1}{x^2+2x}$. (4 pts.)

(b) $\displaystyle\lim_{x\to 1} \frac{\sqrt{x}-x^2}{1-\sqrt{x}}$. (8 pts.)

(c) $\displaystyle\lim_{x\to 0^-} x\sin\left(\frac{\sqrt{x+2}}{x}\right)$. (6 pts.)

MATH 101, EXAM-I (Term 073)

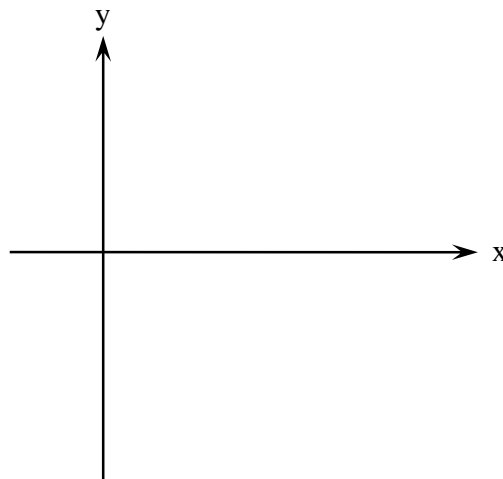(d) $\lim\limits_{x \to 1} arc\sin\left(\dfrac{1-x}{1-x^2}\right).$ (4 pts.)

(e) $\lim\limits_{x \to -\infty} \dfrac{x^3 - 2x + 7}{-2x^2 + x - 3}.$ (4 pts.)

(f) $\lim\limits_{x \to +\infty} \left(\sqrt{9x^2 + x} - 3x\right).$ (7 pts.)

MATH 101, EXAM-I (Term 073)

2. Use the graph of $f(x) = \sqrt{x-1}$ to find a number δ such that   (7 pts.)

$$\left|\sqrt{x-1}-1\right| < 0.1 \text{ whenever } |x-2| < \delta.$$

3. Where is the function $f(x) = \dfrac{1}{1-e^{\frac{x+1}{x}}}$ continuous?   (7 pts.)

MATH 101, EXAM-I (Term 073)

4. Find the constant k that makes the function   (8 pts.)

$$f(x) = \begin{cases} x^2 - k^2 & \text{if} \quad x \le 2 \\ kx + 5 & \text{if} \quad x > 2 \end{cases}$$

continuous on $(-\infty, +\infty)$.

5. Show that the equation $x \ln x = \sin x$ has a root in the interval $(1, e)$.   (8 pts.)

MATH 101, EXAM-I (Term 073)

6. (a) How many horizontal asymptotes can a function have?   (6 pts.)
   Illustrate your answer graphically.

   (b) Does the graph of $f(x) = \ln\left(9 - x^2\right)$ have a vertical asymptote   (7 pts.)

   (i)   at $x = 3$. Justify.

   (ii)   at $x = -1$. Justify.

7. The position function of a particle moving in a straight line is given by the equation of motion $s(t) = \dfrac{1-t}{1+t}$, where t is measured in seconds and s in meters. Find the instantaneous velocity of the particle when $t = 1$.   (8 pts.)

MATH 101, EXAM-I (Term 073)

8. (a) **TRUE** or **FALSE**. Justify: If $f'(a)$ exists, then $\lim\limits_{x \to a} f(x) = f(a)$. (4 pts.)

    (b) Is $f(x) = x|x|$ differentiable at $x = 0$. Justify. (6 pts.)

    (c) Graph the derivative of the function whose graph is given below. (6 pts.)