KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 101 - EXAM II

Wednesday – April 25, 2007 Duration 90 Minutes

Student's Name: ……

ID #: …….. **Section #: ……**

Important Instructions:

1. All TYPES OF CALCULATORS, PAGERS, OR MOBILES ARE NOT ALLOWED TO BE WITH YOU DURING THE EXAMINATION.

2. Check that the exam paper has 6 different pages other than the cover page, with 10 different problems.

3. Write neatly and legibly. You may loose credits for missy work.

Problem	Grade
1	/28
2	/5
3	/8
4	/5
5	/6
6	/12
7	/5
8	/15
9	/12
10	/4
Total	/100

1. (28 Points) Find $\frac{dy}{dx}$. (DO NOT SIMPLIFY THE ANSWER)

(a) $y = \sqrt[4]{x + \sqrt[3]{x}}$

(b) $y = e^{(e^{\sec x})} . \tan(\cos x)$

(c) $y = \tan^{-1}\left(x - \sqrt{1+x^2}\right)$

(d) $y = \left(\frac{x}{1+\ln x}\right)^3$

(e) $y = \coth^{-1}\sqrt{1+x^2}$

(f) $y = 7^{\cosh x} + \log_5(\operatorname{sech} x)$

(g) $y = (\sin x)^x$

2. (5 Points) Find all points on the graph of $y = \frac{1}{x+1}$ where the tangent line is parallel to the line $y = -x$.

3. (8 Points) The position function of a particle is given by
$s(t) = \frac{t^3}{3} - 2t^2 + 3t - 1;\ t \geq 0.$

(a) Find the velocity of the particle at time *t*.

(b) Sketch a diagram to represent the motion of the particle.

(c) Find the distance traveled by the particle while moving backward (i.e. in the negative direction)

4. (5 Points) Find the equation of the line tangent to the graph of $y = e^x$ and passes through the origin.

5. (6 Points) Find a second degree polynomial P such that $P(2) = 3, P'(2) = 5$ and $P''(2) = 4$.

6. (12 Points) If $f(2)=4,\ f'(2)=3,\ g(2)=2$ and $g'(2)=5$, find

   a. $\left.\dfrac{d}{dx}\left(\sqrt{f(x)}\right)\right|_{x=2}$

   b. $\left.\dfrac{d}{dx}\left(f\circ g(x)\right)\right|_{x=2}$

   c. $\left.\dfrac{d}{dx}\left(\dfrac{f+g}{x}\right)\right|_{x=2}$

7. (5 Points) Use the definition of the derivative to prove that $\dfrac{d}{dx}(\cos x)=-\sin x$.

8. (15 Points) Find the value of the limit if it exists.

(a) $\lim_{\theta \to 0} \dfrac{\sin(\cos\theta)}{\sec\theta}$

(b) $\lim_{t \to 0} \dfrac{\sin^2 3t}{t^2}$

(c) $\lim_{x \to 1} \dfrac{e^x - e}{x - 1}$

9. (12 Points)

(a) If $e^{y} + \sin xy = 1$, use implicit differentiation to find y' .

(b) If $x^{4} + y^{4} = 2$, use implicit differentiation to find y'' at the point (1, 1).

10. (4 points) Find $D^{50}(\cos 2x)$