LEBANESE AMERICA UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND MATHEMATICS

MTH 201 - CALCULUS 3

EXAM 3 – FALL 2009

Instructor: Dr. Samer Habre
Duration: 75 mns

Name: **ID#:**

☐ **CHECK THIS BOX IF YOU WANT YOUR EXAM GRADED BY THURSDAY, JANUARY 14, 2010**

- **This exam consists of 8 pages and 8 problems.**
- **Answer the questions below on the space provided. You can use the back pages for scratch or for more space for your answers. Please specify.**
- **Make sure you justify all your answers.**

Question Number	Grade
1. 8%	
2. 16%	
3. 10%	
4. 14%	
5. 14%	
6. 12%	
7. 16%	
8. 10%	
Total	

1. (8%) Determine the values of x for which the series $\sum_{n=0}^{\infty} \frac{(-3)^n x^n}{\sqrt{n+1}}$ converges.

2.

a. (8%) Find the MacLaurin series for the function $f(x) = xe^x$. Does this series converge to $f(x)$? If so, over which interval?

b. (8%) Find a value for the sum $\sum_{n=0}^{\infty} \frac{n+1}{n}$.

3. (8%) Let $f(x) = \frac{x}{1+2x}$. Using a known MacLaurin series, find $f^{(7)}(0)$.

4.

a. (7%) Let $f(x) = 2x^3 + x^2 - x + 3$. Find its Taylor polynomial of order 3 around $a = 1$.

b. (7%) Use the known geometric series $\frac{1}{1-r} = 1 + r^2 + r^3 + r^4 + \ldots \text{for} -1 < r < 1 \text{to}$ express $f(x) = \frac{1}{7-2x}$ as a Taylor series around a=3.

5. a. (8%) Use a known MacLaurin series to evaluate $\lim_{x\to 0}\frac{1-\cos x}{1+x-e^x}$.

b. (6%) Evaluate the indefinite integral $\int \sin\left(x^2\right)dx$ as an infinite series.

6. Turn the following polar equations into Cartesian equations and then identify them:

a. (6%) $r = 2Sin(\theta)$

b. (6%) $r\cos\theta\cot\theta = 1$

7. Consider the cardioid $r = 1+\sin\theta$.

a. (4%) Find a formula for $\frac{dy}{dx}$.

b. (4%) Find the slope of the tangent lines to this cardioid for:

$$\theta = \frac{\pi}{3}; \theta = \frac{\pi}{2}; \theta = \frac{5\pi}{6}; \theta = \frac{7\pi}{6}$$

c. (8%) Discuss the symmetries of this cardioid then plot it.

8. (10%) Here is the graph of the function $y = \cos(3x)$ over the interval $[0, \pi]$; use it to plot the polar curve $r = \sin(3\vartheta)$