LEBANESE AMERICA UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND MATHEMATICS
MTH 201 - CALCULUS 3
SAMPLE EXAM 3 – SPRING FALL 2013

1.
   a. Find the MacLaurin series for the function $f(x) = xe^x$. Does this series converge to $f(x)$? If so, over which interval?
   b. Conclude a value for the sum $\sum_{n=0}^{\infty} \frac{n+1}{n!}$.

2. Let $f(x) = \frac{x}{1+2x}$.
   a. Find its Maclaurin series.
   b. Conclude a value for $f^{(7)}(0)$

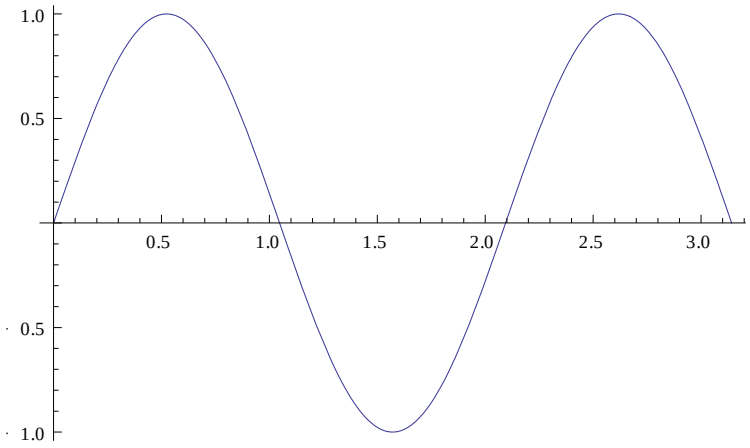
3.
   a. Use a known Maclaurin series to evaluate $\lim_{x\to 0} \frac{1-\cos x}{1+x-e^x}$.
   b. Write the indefinite integral $\int \sin\left(x^2\right)dx$ as an infinite series.

4.
   a. Find the domain of the function $f(x,y) = \sqrt{16-x^2-y^2}$
   b. Identify the level curves of this function.

5. Turn the following polar equations into Cartesian equations and then identify them:
   a. $r = 2Sin(\theta)$
   b. $r\cos\theta\cot\theta = 1$

6. Consider the cardioid $r = 1+\sin\theta$.
   a. Find a formula for $\frac{dy}{dx}$.
   b. 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. Discuss the symmetries of this cardioid then plot it.

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



8. Use polar coordinates to show that $\lim_{(x,y)\to(0,0)} \dfrac{3y}{\left(x^2+y^2\right)^2 + xy + y}$ exists.

9. Show that $\lim_{(x,y)\to(-1,1)} \dfrac{x^2-1}{y-1}$ **does not exist** by using the following two paths: $y = x^2$ and $y = -x$.