Math 112 Final Exam
December 19, 2016

Time: 2 hour and 30 minutes
Instructions: Show all work for full credit. No outside materials or calculators allowed.
Extra Space: Use the backs of each sheet for extra space. Clearly label when doing so.

Name: _____

ID #: _____

Instructor/Section: _____

"I pledge by my honor that I have abided by the NJIT Academic Integrity Code."

_____ (Signature)

Problem(s)	Score	Total

1. Consider the function $f(x) = \frac{1}{x}$.
    a. Find the full Taylor series representation of f(x) centered around x=2 **(6 points)**

b. (continued from page 1): Find the radius and interval of convergence of the Taylor Series found in part (a) **(6 points)**

2. Determine if the following series converge or diverge. Show all work including stating any tests for convergence. **(10 points)**

$a)$ $\sum_{n=0}^{\infty} \frac{n10^n}{(2n)!}$

$b)$ $\sum_{n=1}^{\infty} \frac{\ln(n)+n}{n^2+4}$

3. Suppose the curve y=x^2, $0 \leq x \leq 2\ meters$ is revolved around the y-axis to create a tank. Find the work done in filling this tank with a liquid with density 3000 N/m^3 pumped up from the x-axis. **(7 points)**

4. Find the volume of the figure formed by rotating the region bound by $y=\sin x$, $x=0$, $x=\pi$ and $y=0$ about the y-axis. **(7 points)**

5. Integrate the following **(10 points):**
   a. $\int \frac{x^2}{(1-x^2)^{3/2}} dx$

   b. $\int sin^3(x)cos^2(x)dx$

6. Integrate the following **(10 points):**
   a. $\int x^2 sinh(2x^3) dx$

   b. $\int \frac{x+4}{x(x+2)^2} dx$

7. Integrate the following **(10 points)**:
   a. $\int x tan^{-1}(x) dx$

   b. $\int_0^1 \frac{1}{\sqrt{x^3}} dx$

8. For each of the following, circle **<u>ALL VALUES</u>** of k for which the following converge (note, there may be multiple answers circled). For this problem, only your answers will be graded, not the quality of your scratch work if needed **(6 points)**.

$a)\ \sum_{n=1}^{\infty} \frac{(-1)^n}{(k+2)n^k}$

a) k = 3
b) k = 1
c) k = ½
d) k = 0
e) k = –1
f) none of these

$b)\ \sum_{n=1}^{\infty} \frac{k}{n^k}$

a) k = 3
b) k = 1
c) k = ½
d) k = 0
e) k = –1
f) none of these

$c)\ the\ sequence\ \left\{\frac{1}{n^k}\right\}_{n=1}^{n=\infty}$

g) k = 3
h) k = 1
i) k = ½
j) k = 0
k) k = –1
l) none of these

9. Consider the parametric equation given by x(t) = cos(2t), y(t) = sin(2t).
    a. Find the length of this curve on the range $0 \leq t \leq \frac{\pi}{2}$ **(4 points)**

    b. Find the equation of the tangent line to the curve when t = $\pi/8$ **(4 points)**

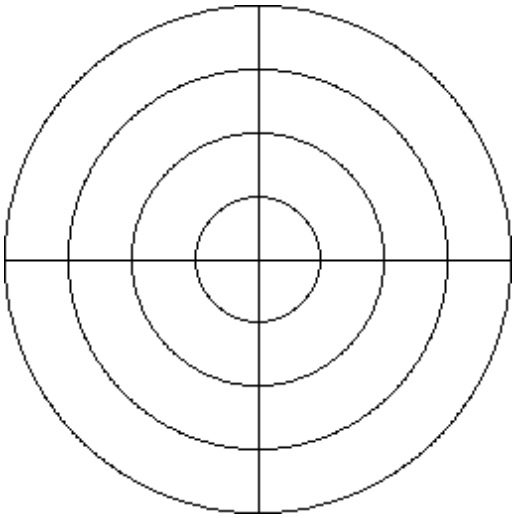
    c. Graph the portion of the parametric curve that you found arc length for in part (a) and the tangent line found in part (b) **(3 points)**

10. Consider the function $f(x) = \frac{3}{4}x^{4/3}$ **(8 points)**

a. Find $P_2(x)$, the 2nd degree Taylor Polynomial centered around x=8 for f(x)

b. Suppose f(x) is approximated by the Taylor Polynomial from part (a). Use Taylor's Theorem to bound the error when $1 \leq x \leq 8$.

11. Graph the polar curves $r = 1 + \cos(\theta)$ and $r = 3\cos(\theta)$ on the axis below **(3 points)**:



b) Find the area inside $r = 3\cos(\theta)$ but outside $r = 1 + \cos(\theta)$ **(7 points)**: