Math 221 Calculus 2 — Final Exam
Professor John Maginnis — December 18, 2013

Your name: _____

Rec. Instr.: _____

Rec. Time: _____

Instructions:

Show all your work in the space provided under each question. Please write neatly and present your answers in an organized way. You may use your one sheet of notes, but no books or calculators.

For each test of convergence that you use, either give the name of the test, or briefly describe what the test says.

This exam is worth 120 points. The chart below indicates how many points each problem is worth.

Problem	1	2	3	4	5
Points	/10	/10	/10	/10	/10
Problem	6	7	8	9	10
Points	/10	/10	/10	/10	/10
Problem	11	12			Total
Points	/10	/10			/120

1. Determine whether the series converges or diverges. Explain.

$$\sum_{n=0}^{\infty} \frac{n!}{e^{n^2}}$$

2. Evaluate the indefinite integral.

$$\int \frac{3x-2}{x^3+x}\,dx$$

3. Determine whether the series converges or diverges. Explain.

$$\sum_{n=1}^{\infty} \frac{n}{\sqrt{n^4+1}}$$

4. Given the following equation in polar coordinates, convert to an equation in rectangular coordinates.

$$r = \frac{1}{1 + \cos(\theta)}$$

5. Find the Taylor series at $c = 2$ for the function. You need to find a formula for the general term.

$$f(x) = \frac{1}{x}$$

6. A chain 20 meters long is hanging from the roof of a building. The chain has a density of 5 kilograms per meter. Find the work required to lift the chain to the top of the building. Recall that $g = 9.8\ \frac{m}{sec^2}$ is the acceleration of gravity.

7. Evaluate the indefinite integral.

$$\int \sin^3(x)\cos^3(x)\ dx$$

8. Find the arc length of the curve described by the parametrization.

$x = 3t^2 + 5, \;\; y = 2t^3, \;\;$ for $\; 0 \leq \mathrm{t} \leq 1.$

9. Find an equation of the tangent line to the curve given by the parametrization

$$x = t\cos(\frac{\pi}{t}), \quad y = \frac{t^2}{t^2+1} \quad \text{when t} = 1.$$

10. Find the volume of revolution if the region below the curve $y = e^{3x}$ between $x = 0$ and $x = 1$ is revolved around the y-axis.

11. Determine whether the series converges or diverges. Explain.

$$\sum_{n=1}^{\infty} \frac{n}{2n-1}$$

12. Find the total area inside the four loops of

$$r^2 = \sin(4\theta).$$