Name:_____

Student ID:_____

Section:_____

Instructor:_____

Math 113 (Calculus II)
Final Exam
Form A

December 15, 2009, 7-10p.m.

Instructions:

- Work on scratch paper will not be graded.
- For questions 10 to 17, show **all** your work in the space provided. Full credit will be given only if the necessary work is shown justifying your answer. Please write neatly.
- Should you have need for more space than is allotted to answer a question, use the back of the page the problem is on and indicate this fact.
- Simplify your answers. Expressions such as $\ln(1)$, e^0, $\sin(\pi/2)$, etc. must be simplified for full credit.
- Calculators are not allowed.

For Instructor use only.

#	Possible	Earned
MC	36	
10	7	
11	7	
12	7	
13	8	
Sub	65	

#	Possible	Earned
14	7	
15	12	
16	8	
17	8	
Sub	35	
Total	100	

Multiple Choice. Fill in the answer to each problem on your computer-scored answer sheet. Make sure your name, section and instructor are on that sheet.

1. Find the area of the region bounded by $y = e^{2x}$, $y = e^x$, and $x = \ln 3$.

   a) 6 b) 2 c) 0 d) $\frac{1}{2}$

   e) $\frac{3}{2} - \frac{1}{2}e^2 + e$ f) $\frac{3}{2}$ g) 13 h) 4

   i) None of these.

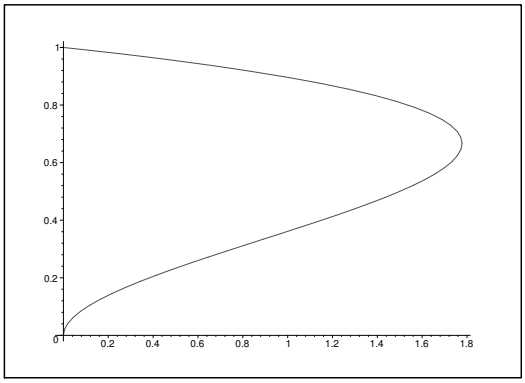
2. Find the volume of the solid obtained by rotating about the x-axis the region in the first quadrant that is enclosed by the curves $y = \cos x$, $y = \sin x$, and $x = 0$.

   a) $\frac{1}{2}$ b) $\frac{\pi}{4}$ c) $\frac{\sqrt{2}\pi}{4}$ d) π

   e) $\frac{\pi}{2}$ f) 2π g) 2 h) 0

   i) None of these.

3. The curve $x = 12(y^2 - y^3)$ and the y-axis enclose a region in the first quadrant (see figure). Find the volume of the solid obtained by rotating this region about the x-axis.



   a) $\frac{3\pi}{5}$ b) 2π c) $\frac{6\pi}{5}$ d) $\frac{\pi}{20}$

   e) 24π f) 12π g) $\frac{\pi}{10}$ h) $\frac{9\pi}{5}$

   i) None of the above

4. What is the value of the integral $\int_0^2 \frac{dx}{(1-x)^2}$?

   a) -2 b) -1 c) 2

   d) $\tan^{-1} 2$ e) $\ln 2$ f) 0

   g) $\frac{1}{2}\ln 3$ h) The integral diverges. i) None of these

5. Find the radius of convergence of the series $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^{n+1}(x+2)^n}{n2^n}$.

a) 1 b) 0 c) 4 d) ∞

e) $\frac{1}{2}$ f) 2 g) 6 h) None of these.

6. What is the third non-zero term in the Maclaurin series of $f(x) = \dfrac{1}{\sqrt{x+4}}$?

a) $\frac{x^2}{4}$ b) $\frac{3x^2}{128}$ c) $-\frac{x^2}{64}$ d) $12x^2$

e) $\frac{3x^2}{256}$ f) $40x^2$ g) $\frac{15x^2}{128}$ h) None of these.

7. Find the area of the region enclosed by one loop of the curve $r = 4 + 2\cos\theta$.

a) 16π b) 9π c) 18π d) 36π

e) 11π f) 32π g) 8π h) None of these

8. Find a power series representation for $f(x) = \dfrac{1}{(1+2x)^2}$.

a) $\displaystyle\sum_{n=0}^{\infty}(-1)^n 2^n x^n$ b) $\displaystyle\sum_{n=0}^{\infty}(n+1)2^n x^n$ c) $\displaystyle\sum_{n=0}^{\infty} 2^{2n}x^{2n}$

d) $\displaystyle\sum_{n=0}^{\infty}(-1)^{n+1}2^{n-1}x^n$ e) $\displaystyle\sum_{n=1}^{\infty}(-1)^n n 2^n x^{n-1}$ f) $\displaystyle\sum_{n=0}^{\infty}(-1)^n(n+1)2^n x^n$

g) None of the above

9. Approximate $x^2\cos 3x$ near $x = 0$ with a sixth degree Taylor polynomial.

a) $1 - \frac{9x^2}{2} + \frac{81x^4}{24} - \frac{729x^6}{720}$ b) $1 + \frac{9x^2}{2} + \frac{81x^4}{24} + \frac{729x^6}{720}$ c) $x^2 - \frac{9x^4}{2} + \frac{81x^6}{4}$

d) $x^2 + \frac{9x^4}{2} + \frac{81x^6}{4}$ e) $x^2 - \frac{9x^4}{2} + \frac{81x^6}{24}$ f) $3x^2 - \frac{9x^5}{2}$

g) $1 - 3x^2 + \frac{9x^5}{2}$ h) None of the above

Free response: Write your answer in the space provided.

In problems 10 to 12, evaluate the following indefinite or definite integrals.

10. (7 points) $\displaystyle\int \frac{x^2}{(4x^2+9)^2}\,dx.$

11. (7 points) $\displaystyle\int_0^{\pi} x\sin x\,dx$

12. (7 points) $\displaystyle\int \frac{dx}{(x+1)(x^2+1)}$

13. (8 points) Set up but *do not evaluate* the integrals.

(a) Set up the integral used to determine the arc length of the curve defined by the equation $y^2 + 2y = 2x + 1$ from $(-1, -1)$ to $(7, 3)$.

(b) Set up the integral used to find the length of the curve defined by the parametric equations

$$x = e^t - t$$
$$y = 4e^{t/2} \quad 0 \leq t \leq 1.$$

14. (7 points) Find the sum of the series, or show that the series diverges. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{4^n}$

15. (12 points) For each of the following series, use an appropriate test to prove that the series converges, or to prove that it diverges. If the series is alternating and convergent, show whether it is absolutely or conditionally convergent.

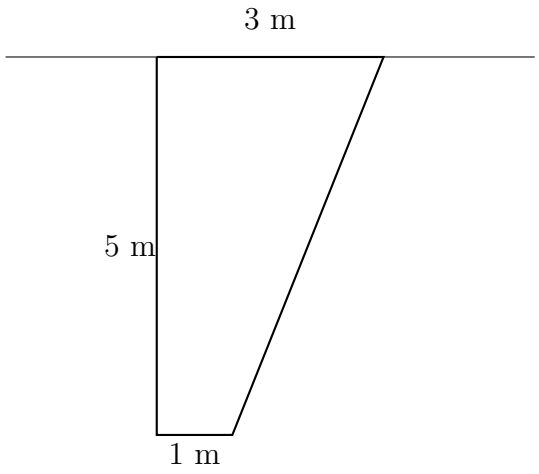
(a) $\displaystyle\sum_{n=2}^{\infty} \frac{1}{n \ln^2 n}$

(b) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n n}{n^2 + 5}$

(c) $\displaystyle\sum_{n=1}^{\infty} \frac{1}{1 + \ln n}$

16. (8 points) A bag of sand originally weighing 144 lb is lifted 18 ft at a constant rate. As it rises, the sand leaks out at a constant rate, and the sand is half gone by the time it had been lifted the 18 ft. How much work was done in lifting the bag of sand? (Neglect the weight of the bag and the lifting equipment).

17. (8 points) Find the force due to fluid pressure on the pictured plate that is submerged vertically in water until the top of the plate is at the top of the water. (Remember the density of water is 1000 kg/m^3.)



END OF EXAM