problems	1 − 4	5 − 7	8 − 10	11 − 14	15 − 17	18 − 20	21 − 23	total
scores								

Final Exam, December 11, Calculus II (109), Fall, 2009, W. Stephen Wilson

I agree to complete this exam without unauthorized assistance from any person, materials or device.

Name: ______________________________ Date: ______________

NO CALCULATORS, NO PAPERS, SHOW WORK. For most of this exam there is no partial credit. You are required to show your work. If you have the correct answer but have no work, then you get no credit. If you have a lot of good work, but don't have the correct answer, then you will get no credit. Be sure to clearly mark your answers. (89 points total)

In case you need them: $\cos(2x) = 2\cos^2(x) - 1 = 1 - 2\sin^2(x)$.

1. (1 point) TA Name and section: ______________________

2. (3 points)

$$\int_{\pi/6}^{\pi/2} \cot^2(x)dx$$

3. (3 points) Write in terms of partial fractions:

$$\frac{x^2 - 3x + 7}{(x^2 - 4x + 6)^2}$$

4. (3 points) Answer is very nice and simple.

$$\int_{1/2}^{1} \frac{e^{1/x}}{x^3} dx$$

5. (3 points) Solve

$$y' = -y^2 \text{ when } y(0) = .5$$

6. (3 points) Use Euler's method with step size .1 to estimate $y(.2)$ where $y(x)$ is the solution of the initial-value problem

$$y' = y + xy, \text{ with } y(0) = 1$$

7. (3 points) Solve (Partial credit on this one.)

$$y' = 1/y$$

8. (5 points) Let $K = 8 \times 10^7$ and $k = ln(3)$. If $y(0) = 2 \times 10^7$, what is t when $y(t) = 4 \times 10^7$ and

$$\frac{dy}{dt} = ky(1 - \frac{y}{K})$$

A second pages is available for work.

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9. (4 points) If $v(0) = 5$, solve for v in

$$\frac{dv}{dt} - 2tv = 3t^2 e^{t^2}$$

10. (3 points) (Partial credit on this one.) Sketch the curve given by

$$x = t^2 - 2 \text{ and } y = 5 - 2t \text{ when } -3 \le t \le 4.$$

11. (3 points) Set up the integral for the length of the curve. Do not integrate. Although you do not need to integrate, you must expand and simplify the anwer you get so it looks nice.

$$x = t - t^2 \text{ and } y = \frac{4}{3}t^{\frac{3}{2}} \text{ when } 1 \leq t \leq 2.$$

12. (3 points) (Partial credit on this one.) Sketch the curve with polar equation:

$$r = 4\sin(3\theta)$$

13. (6 points) (Partial credit on this one.) Find all points of intersection of

$$r = 1 + \sin(\theta) \text{ and } r = 3\sin(\theta).$$

14. (3 points) Find the length of the polar curve:

$$r = \theta^2 \text{ when } 0 \leq \theta \leq 2\pi$$

15. (3 points) Find the area between the origin and the polar curve:

$$r = \theta^2 \text{ when } 0 \leq \theta \leq 2\pi$$

16. (5 points) Compute and then round off $\cos(.2)$ to the 4-th decimal place.

17. (5 points) Compute $e^{1/2}$ using the third Taylor polynomial and 4 decimal places.

18. (5 points) Estimate the error in the previous computation, again keeping track of 4 decimal places. There is an extra page for this problem

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19. (6 points) (Partial credit on this one.) If you want to compute $\sin(x)$ using only the first two terms of the Taylor series and you want to have your error less than .0001, does this work for $c > |x|$ where c=1/2? (2 points) where c = 2/5? (2 points) and where c = 1/3? (2 points) There is an extra page for this problem.

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20. (6 points) Ignore the constant of integration and compute the first 4 non-zero terms of the power series for this integral around a=0. There are several ways to work this problem. Any will do but you must show your work.

$$\int x \ln(1+x)dx$$

21. (5 points) Keeping careful track of four (4) decimal places (so your numbers will mean something to 3 decimal places), use the power series you found in the previous problem to approximate the integral below (this gives you a check on the next problem). Trap your answer between the sum of the first 3 terms and the sum of the first 4 terms. Round off your upper and lower bounds to the third decimal place. (You will get the correct answer this way no matter how you rounded to the fourth decimal.) Your upper and lower bound must be arithmetically correct to 3 decimals. (Your actual upper and lower bounds will only agree in the first decimal place, but two decimals will be enough to tell you if you are consistent with the next problem's answer.)

$$\int_0^1 x \ln(1+x)dx$$

22. (4 points) This is a particularly difficult integral and could take up a lot of time. The answer is just a simple number. You can do a partial check on the answer using the previous problem.

$$\int_0^1 x \ln(1 + x)dx$$

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23. (4 points) This, unfortunately, is another really hard problem. The answer is really simple and doesn't have any numbers bigger than 3 although there might be a sign and a natural log. If your answer doesn't simplify dramatically then it is wrong.

$$\int_{-1}^{0} \frac{x}{\sqrt{x^2+x+1}}dx$$

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This is an extra page for the previous problem.

This is scrap paper if you need it on the exam.