MATH 1272 Name:_____

Midterm II

Professor Bramson T.A.:_____

October 23, 2008

INSTRUCTIONS: There are 100 points possible on the exam. Do as many problems as you can. Answers must be in the boxes provided to be counted. Show your work in the space provided below each problem - outside the boxes. If you need extra space, state where the work is being done. Also, be sure to justify your answers. Note that some formulas are given on page 7. Page 6 is provided as scratch; be sure your exam has all 7 pages. **NO CALCULATORS** are permitted. GOOD LUCK!

1. (10 pts) At what values of t does the graph of the parametric equations

$$x = t(t+2)(t+5) \quad \text{and } y = t^2 - 2$$

pass through the point $(0, 2)$? Show your work.

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2.(a)(20 pts) What is the solution of $x^2y' = y - y'$ with $y(0) = -2$? Write the answer as a function of x. Show your work.

(b)(10 pts) What is the general solution of $y' = \sin x + x^2$? Show your work.

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3. (15 pts) What can you say about $\int_1^4 \frac{x+1}{x^2-2x}\,dx$? For instance, is it finite? infinite? undefined? Can you compute it? Be explicit.

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4. (15 pts) What is the centroid of the region lying between $g(y) = y^2 + 3y + 2$, $h(y) = y + 2$, $y = 1$, and $y = 4$? You can write your answer in terms of integrals. Write down any formulas you are using.

5. (7 pts) Suppose that a tank initially contains 30 lbs. of salt dissolved in 2,000 gallons of water. Brine that contains 1 lb. of salt for each 2 gallons of water enters the tank at a rate of 40 gallons per minute. The solution is kept thoroughly mixed and drains from the tank at 25 gallons per minute. If $y(t)$ denotes the amount of salt in pounds in the tank at time t, which differential equation does $y(t)$ satisfy?

(A) $y' = 40 - \frac{y}{80}$
(B) $y' = 40 - 25y$
(C) $y' = 30 - \frac{y}{80}$
(D) $y' = 30 - 25y$
(E) $y' = 20 - \frac{y}{80}$
(F) $y' = 20 - 25y$
(G) $y' = 40y - \frac{1}{80}$
(H) $y' = 40y - 25$

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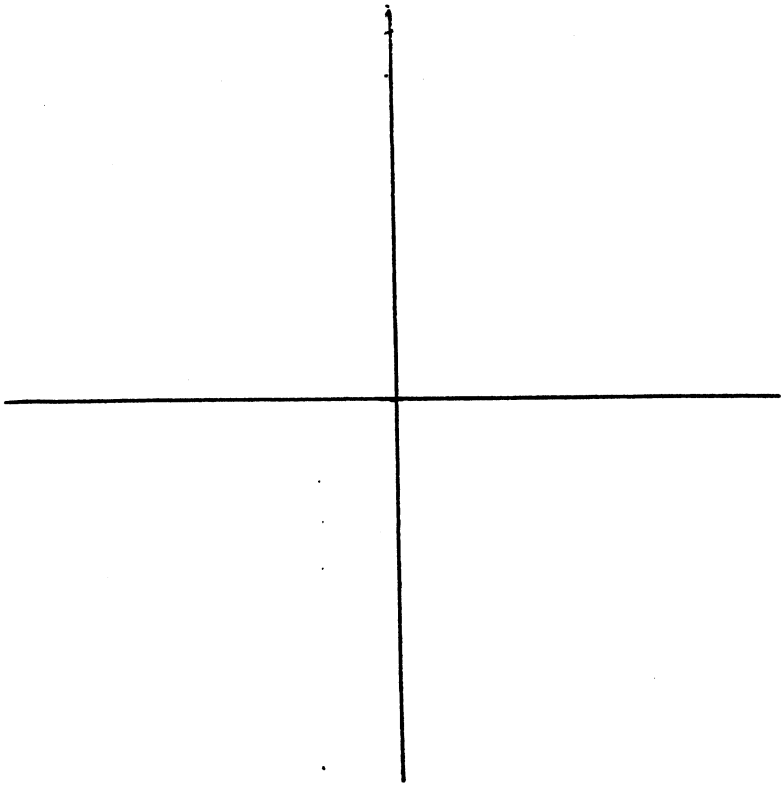
6. (23 pts) Find the area of the region that lies inside $r = 1 - \sin\theta$ and outside $r = 1$. Make a sketch of both curves on the graph provided below. Show any formulas you are using.



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