MATH 127
MIDTERM II
Wed. April 2, 2008

NAME (please print legibly): _____________________________________________
Your University ID Number: _____________________________________________

- No calculators are allowed on this exam.
- Please show all of your work. You may use backs of pages if necessary. You
  might not receive full credit for a correct answer if there is no work shown.
- You do not need to simplify all the way (but please evaluate trig functions
  when possible).

Unacceptable answer: $4x^2 - x|_1^2$.
Acceptable answer: $(4(2^2) - 2) - (4 - 1)$.

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<th>QUESTION</th>
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1. (20 pts) Consider the following plate, submerged vertically under water.

(a) Write down an integral representing the length of the curve. Do not evaluate the integral.

(b) Which of the following integrals integral represents the total force \( F \) (in Newtons) on the plate? (Distance above is measured in meters. You do not need to show any work.)

A. \[ \int_{-2}^{0} (1000)(9.8)(-y) \sqrt{y+2} \, dy \]

B. \[ \int_{-\sqrt{2}}^{\sqrt{2}} (1000)(9.8)2x(x^2-2) \, dx \]

C. \[ \int_{-2}^{0} (1000)(9.8)y \sqrt{y+2} \, dy \]

D. \[ -(1000)(9.8)2 \int_{-\sqrt{2}}^{\sqrt{2}} (x^2-2) \, dx \]

ANSWER: __________________________
2. (20 pts) Compute \[ \int \frac{1}{\sqrt{x^2 + 4}} \, dx \]
3. (22 pts)

(a) (12 pts) Compute the following improper integral. Give the value if convergent, or show that it diverges. For full credit, you must use the correct definition of the integral. (In particular, your answer must involve taking a limit.)

\[ \int_{2}^{\infty} e^{-5x} \, dx \]

(b) (10 pts) Compute \( \int \sin^2(x) \, dx \)
4. (20 pts) Use Partial Fractions to compute:

\[ \int \frac{y + 2}{y^2 + y} \, dy \]
5. (18 pts) Find a solution $y = y(x)$ to the following IVP:

$$\frac{dy}{dx} = \frac{\cos x}{2y} \quad (y(0) = 4).$$