

**Second Exam**

- Do not open this exam booklet until you are directed to do so.
- You have 120 minutes to earn 93 points.
- Write your solutions in the space provided. If you need more space, write on the back of the sheet containing the problem. Do not put part of the answer to one problem on the back of the sheet for another problem.
- Do not spend too much time on any problem. Read them all through first and attack them in the order that allows you to make the most progress.
- Show your work, as partial credit will be given. You will be graded not only on the correctness of your answer, but also on the clarity with which you express it. Be neat. By the same token, be sure to justify your solutions, so we can follow your reasoning.
- Good luck!

| Problem      | Points    | Grade       |
|--------------|-----------|-------------|
| 1            | 18        |             |
| 2            | 15        |             |
| 3            | 10        |             |
| 4            | 10        | Not covered |
| 5            | 15        |             |
| 6            | 15        |             |
| 7            | 10        |             |
| <b>Total</b> | <b>93</b> |             |

covered on technique test (b only)

covered on technique test  
 - just mem. form. for S.A. -  
 for us mem. arc length is amp

Please circle your section:

MWF 10:00    MWF 10:00    MWF 10:00    MWF 11:00    MWF 11:00    MWF 12:00  
 Brian        Andy        Eric        Noam        Robert        Andy  
 Conrad       Engelward    Towne       Elkies       Pollack       Engelward

TTh 10:00    TTh 10:00    TTh 10:00    TTh 11:30    TTh 11:30  
 Tomas        Joel        Eric        Heather        Nadia  
 Klenke        Rosenberg    Towne        Russell        Lapusta

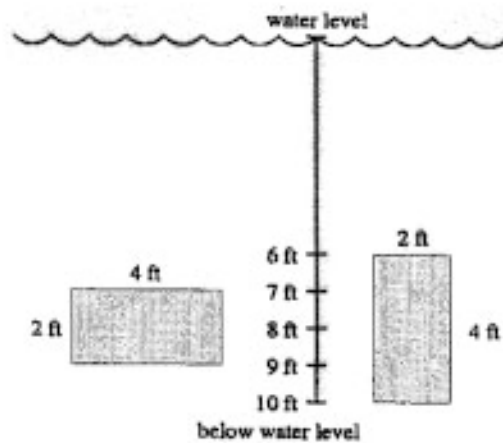
1. (18 pts) Evaluate the following integrals.

a.  $\int_0^2 \frac{3x}{(1+x^2)^2} dx$

b.  $\int_0^{\frac{\pi}{2}} \frac{\cos t}{\sqrt{\sin t}} dt$

c.  $\int e^{\sqrt{x}} dx$

2. (15 pts) The owner of a sight-seeing tour boat is going to install a 2 foot by 4 foot glass window under the water level on her boat so that people can look at the fish as the boat moves. She is considering orienting the window in one of the two configurations shown.



Calculate the fluid force on the window in each orientation and show whether one has a lower total fluid force on it. (Assume the sea water's density is  $\rho = 64 \frac{\text{lb}}{\text{ft}^3}$ ).

3. (10 pts) Evaluate the following integral.

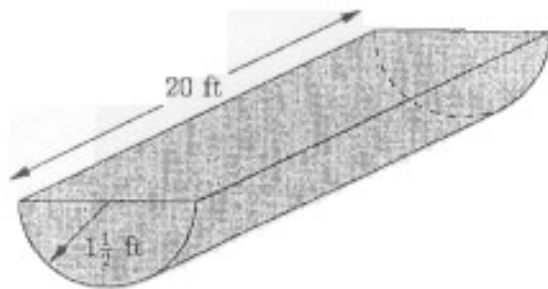
$$\int \frac{7x+1}{(2x-1)(x+1)} dx$$

4. (10 pts) Find the area of the surface generated by revolving the curve given by the equation  $y = \frac{x^4}{4} + \frac{1}{8x^2}$  on the interval  $[1, 2]$  about the  $y$ -axis.

5. (15 pts) Let  $R$  be the region in the plane consisting of points whose  $(x, y)$  coordinates satisfy  $x \geq 0$  and  $0 \leq y \leq xe^{-x}$ .

- What is the area of  $R$ ?
- What is the volume of the solid obtained by rotating  $R$  about the  $x$ -axis?

6. (15 pts) A wading pool has the shape of a half-cylinder of radius  $1\frac{1}{2}$  feet and length 20 feet. That is, the surface is a  $20\text{ft} \times 3\text{ft}$  rectangle, and the pool has maximal depth  $1\frac{1}{2}$  feet. The pool is full of water. Set up, but *do not evaluate*, an integral which computes the amount of work it would take to pump all the water to the level of the top of the tank. Use  $\rho = 62.4 \frac{\text{lb}}{\text{ft}^3}$  for the density of the water. pool



7. (10 pts) If we rotate the curve given by  $y = \sqrt{x(x-1)(x+1)}$  on the interval from  $x = -1$  to  $x = 0$  around the  $x$ -axis, what is the volume of the egg-shape we obtain?