Mathematics 121-A

Spring 2000

Exam 7

April 28, 2000

_____
Name

Technology used: _____

Textbook/Notes used: _____

Directions: Be sure to include in-line citations, including page numbers if appropriate, every time you use a text or notes or technology. Include a careful sketch of any graph obtained by technology in solving a problem. **Only write on one side of each page.**

The Problems

1. (5 points each) Find the following indefinite integrals.

   (a) $\int \left(x^3 + 5 - x^{-1/3}\right)\, dx$

   (b) $\int y\left(y^2 - 5y + 2\right)\, dy$

   (c) $\int \frac{\sqrt{1-x^2}+1}{\sqrt{1-x^2}}\, dx$

   (d) $\int 8\sec^2(4x)\, dx$

2. ($10, 5$ points) The acceleration due to gravity on the moon is approximately .8 m/s^2. If a rock is hurled vertically upward from the surface of the moon with an initial velocity of 24 m/s,

   (a) What is the maximum height it will reach?

   (b) How long does it take to reach half of the maximum height?

3. (15 points each) Do **two** of the following.

   (a) One side of a rectangular field is bounded by a straight river. The other three sides are bounded by straight fences. The total length of the fence is 800 feet. Each side of the field is at least 220 feet. Determine the dimensions of the field given that its area is a maximum.

   (b) An 1125 cubic foot open-top rectangular tank with a square base x feet on a side and y feet deep is to be built with its top flush with the ground to catch runoff water. The steel for the tank costs \$5.00 per square foot and the cost of excavating the hole is $10xy$ dollars. What are the values of x and y that minimize the cost of constructing the tank?

   (c) A rectangular sheet of perimeter 36 cm and dimensions x cm by y cm is to be revolved about one of the sides of length y to sweep out the cylinder in the figure. What values of x and y give the largest volume? See the picture on the board.

4. (25 points) Sketch the graph of a function $f(x)$ that satisfies all of the following.

Points on the graph of f	$(-4,-1),(-3,1),(-1,-2),(0,0),(3,2),(4,3)$
Inputs where $f'(x)$ Does Not Exist	$x=-4,\ x=-1$
Inputs where $f'(x)=0$	$x=-3,\ x=3$
Intervals where $f'(x)>0$	$(-\infty,-3),\quad (-1,3),(3,\infty)$
Intervals where $f'(x)<0$	$(-3,-1)$
Intervals where $f''(x)>0$	$(-\infty,-4),\quad (3,4)$
Intervals where $f''(x)<0$	$(-4,-1),(-1,3),\quad (4,\infty)$
Limit information	$\lim_{x\to -4} f'(x)=\infty$
	$\lim_{x\to -1^-} f'(x)=-\infty$
	$\lim_{x\to -1^+} f'(x)=3$
	$\lim_{x\to -\infty} f(x)=-3$
	$\lim_{x\to \infty} f(x)=4$