

Math 161, Fall 2003  
**Exam 3**

Name:

Answer all questions.

1. Prove from the definitions that if  $f'(a) > 0$  then  $f$  does not have a local maximum at  $a$ . (15 Points)
2. Prove that if  $f'(x) = g'(x)$  on  $(a, b)$  then  $f(x) - g(x)$  is constant on  $(a, b)$ . (You may quote, rather than proving, the relevant corollary to the Mean Value Theorem from class.) (10 Points)
3. Find the maximum and minimum of

$$g(x) = x^2 - |x|$$

on  $[-1, 2]$  (15 Points)

4. You are given a circular piece of plastic with radius 10 cm. How do you make a conical drinking cup from it with maximum volume? (15 Points)
5. Find the function to be minimized and the interval on which to minimize it for the following situation: What are the proportions of the pyramid with a square base with a given volume which lead to least total surface area? (10 Points)
6. Where is  $f(x) = \frac{(x-2)(x-4)}{x^2-1}$  increasing? (10 Points)
7. Where is  $h(x) = \frac{x^3}{x^2+1}$  concave up? (10 Points)

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8. Sketch a graph using the following information:

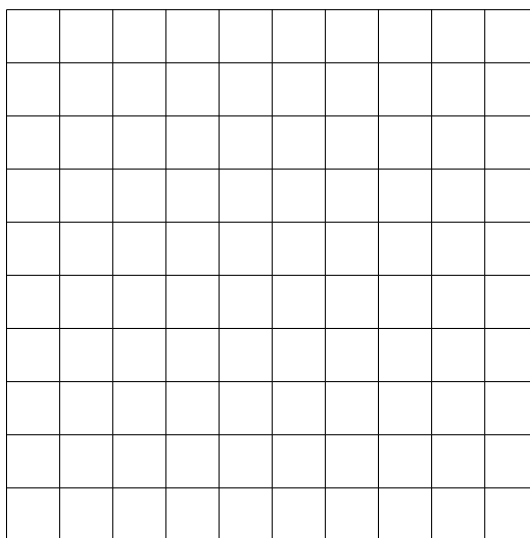
(15 Points)

Asymptotes:  $y = -1$  (to left),  $y = 1$  (to right)  $x = 1$

Values and signs:

$$f(-2) = -3, f(-3) = -2$$

$f(x)$	-		-		-		+		+
$f'(x)$	-		-		+		+		-
$f''(x)$	-		+		+		+		+
$x$		-3		-2		0		1	



Draw your graph here: