Name _____ Rec. Instr._____
Signature _____ Rec. Time_____

Math 220
Exam 3
April 7, 2016

No books, calculators, or notes are allowed. Please make sure that your cell phone is turned off. You will have 75 minutes to complete the exam. Unless instructed otherwise, **show your work** on each problem.

Problem	Points	Points Possible	Problem	Points	Points Possible
1		16	6		12
2		10	7		4
3		9	8		10
4		10	9		5
5		12	10		12

Total Score: _____ out of 100

1. The function $f(x)$ and its first and second derivatives are:

$$f(x) = \frac{x^2 - 1}{x^2 + 3} \qquad f'(x) = \frac{8x}{(x^2 + 3)^2} \qquad f''(x) = \frac{-24(x^2 - 1)}{(x^2 + 3)^3}.$$

Find the information below about $f(x)$, and use it to sketch the graph of $f(x)$. When appropriate, write NONE. No work needs to be shown on this problem.

A. (1 point) Domain of $f(x)$: _____

B. (1 point) y-intercept: _____

C. (1 point) x-intercept(s): _____

D. (1 point) Horizontal asymptote(s): _____

E. (1 point) Interval(s) $f(x)$ is increasing: _____

F. (1 point) Interval(s) $f(x)$ is decreasing: _____

G. (1 point) Local maximum(s) (x, y): _____

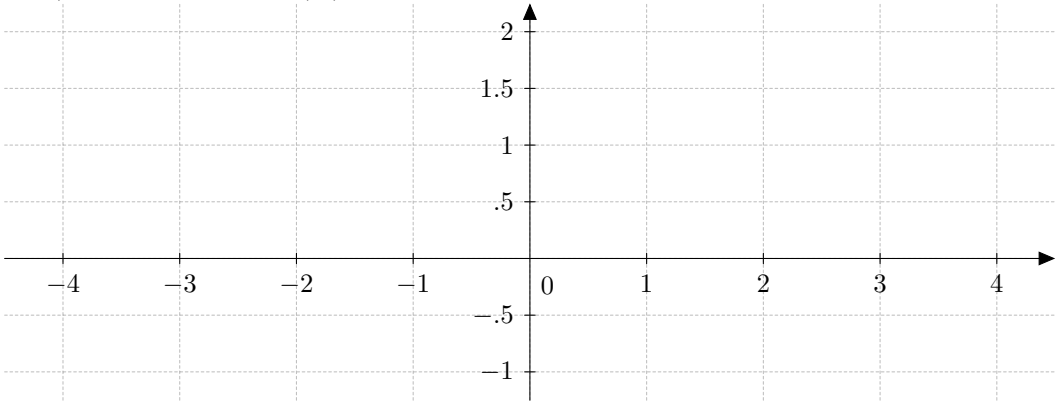
H. (1 point) Local minimum(s) (x, y): _____

I. (1 point) Interval(s) $f(x)$ is concave up: _____

J. (1 point) Interval(s) $f(x)$ is concave down: _____

K. (1 point) Inflection point(s) (x, y): _____

L. (5 points) Sketch $y = f(x)$ on the graph below.



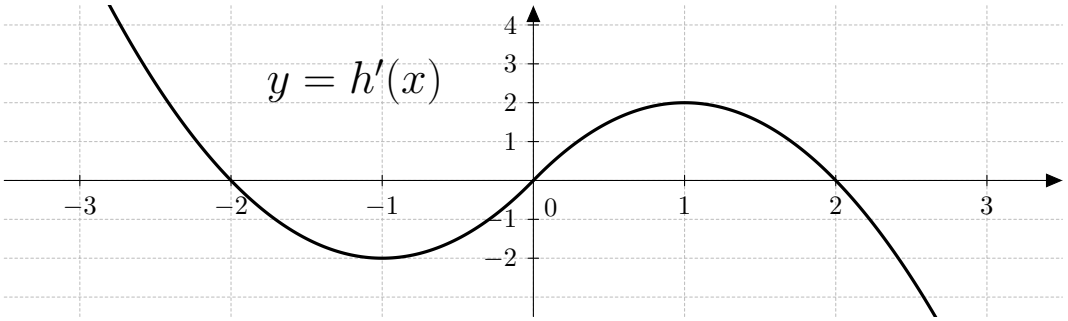
2. (10 points) Find the absolute maximum and absolute minimum of $g(x) = x^3 - 3x^2 + 4$ on $[-1, 1]$.

3. A. (6 points) Find the linearization of $w(x) = \sqrt{x}$ at $x = 9$.

B. (3 points) Use your answer from Part **A** to estimate $\sqrt{9.6}$.

4. (10 points) Find the function $v(x)$ satisfying $v''(x) = 2$, $v'(0) = -3$, and $v(0) = 5$.

5. (12 points) A farmer has 24 feet of fencing and wants to fence off a rectangular area that borders a straight river. The farmer needs no fencing along the river. What dimensions will maximize the fenced-in area? (Make sure to justify why your answer corresponds to the absolute maximum.)



6. (3 points each) $y = h'(x)$ is plotted above. Find:

A. Interval(s) where $h(x)$ is increasing: _____ decreasing: _____

B. x-coordinate(s) where $h(x)$ has a local max: _____ local min: _____

C. Interval(s) where $h(x)$ is concave up: _____ concave down: _____

D. x-coordinate(s) where $h(x)$ has an inflection point: _____

7. (2 points each) In each of the following blanks, fill in "**max**" or "**min**".

A. If $l'(5) = 0$ and $l''(5) = 14$, then $l(x)$ has a local _____ at $x = 5$.

B. If $l'(2) = 0$ and $l''(2) = -3$, then $l(x)$ has a local _____ at $x = 2$.

8. (5 points each) Find the following most general antiderivatives. (I hope that you 'C' what I mean.)

A. $\int \left(\sec^2(x) + 4\right)\, dx =$

B. $\int \left(\sqrt{x} + 5e^x\right)\, dx =$

9. (5 points) Find the differential dy if $y = \cos(4x^2)$.

10. (12 points) A rectangular open-topped aquarium is to have a square base and volume 8 m^3. The material for the base costs \$2 per m^2, and the material for the sides costs \$1 per m^2. What dimensions minimize the cost of the aquarium? (Make sure to justify why your answer corresponds to an absolute minimum.)