

Name: \_\_\_\_\_

Please show all work. Supply brief narration with your solutions and draw conclusions.

1. Find  $y'$  where

(a)  $y = \frac{\sin(3x)}{x^2}$       (b)  $y = x^{x^3}$       (c)  $\sin(5y) + \exp(4y) = x^3$

2. You have 30 meters of fence and want to build a rectangular enclosure for your lab animals against an existing wall, which will form one side of the enclosure. What should the dimensions of the enclosure be to maximize the enclosed area? What is that area?

3. Evaluate the following limits using l'Hôpital's rule. Specify which case you are using.

(a)  $\lim_{x \rightarrow 0} \frac{e^x - 1}{\sin x}$       (b)  $\lim_{x \rightarrow 0^+} x^2 \ln x$       (c)  $\lim_{x \rightarrow 0^+} \left( \frac{1}{x} - \frac{1}{\sqrt{x}} \right)$

4. Find antiderivatives for the following functions

(a)  $\frac{1}{1 + 25x^2}$       (b)  $x \sin(3x^2)$       (c)  $x^2 \sin(3x)$

5. After an initial bolus injection of 25 mg of a drug, a patient is placed on a drip delivering 1.5 mg per hour. If the drug is cleared by the patient at a rate of  $0.7 - 0.1t^3$  mg/h as a function of time, what is the amount of drug in the patient 4 hours later?

1	2	3	4	5	total (50)	%

Prelim. course grade:                      %