

Name (print) \_\_\_\_\_ Tu/Th Discussion (circle) 8 9 10

(1) *Return* this exam copy with your exam booklet. (2) *Write* your solutions in your exam booklet. (3) *Show* your work. (4) There are *six questions* on this exam. (5) If you use a calculator it must be *your own*. (6) Round decimal answers to *four decimal places*. (7) *You are expected to abide by the University's rules concerning academic honesty.*

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1. (20 points) Find the derivative of the following functions, do NOT simplify answers:

a)  $7x^3 + (6/x^2) + \pi$ ;

b)  $(x^2 - 7)^{200}(x^4 - 7x + 1)$ ;

c)  $(\sin x + x^{10} - 3)/(3^x + 1)$ ;

d)  $e^{\cosh x} + \ln(\cos x)$ .

2. (15 points) Let  $y = f(x)$  be differentiable and satisfy the equation  $x^3y^4 + 4y^5 + 2x^7 = 1$ .

a) Find  $dy/dx$  in terms of  $x$  and  $y$ .

b) Find an equation of the line tangent to the graph of  $y = f(x)$  at the point  $(-1, 1)$ .

3. (18 points) Let  $f(x) = x^4 - 8x^2$ . Note that  $f(x)$  is an even function.

a) Find the critical points of  $y = f(x)$ .

b) Find the intervals on which  $f(x)$  is increasing, on which  $f(x)$  is decreasing.

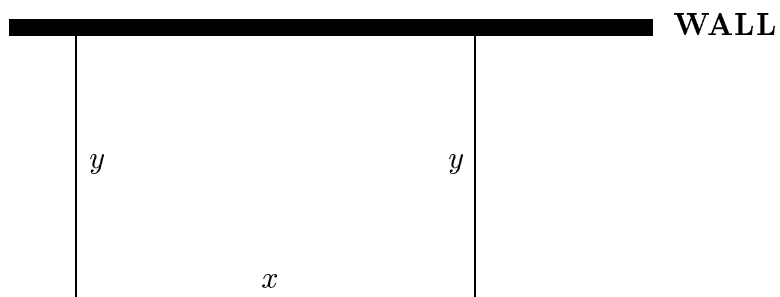
c) Find where the graph of  $f(x)$  is concave up, where the graph of  $f(x)$  is concave down.

d) Find the inflection points on the graph of  $y = f(x)$ .

e) Using the information derived from parts a)–d), sketch the graph of  $y = f(x)$ . Plot the inflection points, the points corresponding to local maxima and local minima, specifying their coordinates, and where the graph crosses the  $x$ -axis.

\*\*\* OVER FOR PROBLEMS 4–6 \*\*\*

4. (17 points) A rectangular garden covering 500 square feet is to be constructed as follows: one side is against a straight wall and shrubs are to border the other three sides with costs of \$25 per foot for the sides of length  $y$  and \$10 per foot for the side of length  $x$ .



- a) Find the total cost of the shrubs  $C$  in terms of the side length  $x$  and find the domain of  $C = C(x)$ .
- b) Find the dimensions ( $x$  and  $y$ ) of the garden which *minimize* the total cost of the shrubs; you must justify your answer.
5. (15 points) Use L'Hopital's rule to find the following limits:
- a)  $\lim_{x \rightarrow \infty} (7x^2 + 3x - 1)/(2x^2 + 4)$ ;
- b)  $\lim_{x \rightarrow 0} (\sin 3x)/4x$ .
6. (15 points) Let  $f(x) = \sqrt{x^2 + 5}$ .
- a) Find the line tangent approximation for  $f(x)$  near  $x = 2$ .
- b) Use this tangent line approximation to estimate  $f(2.1)$ .