College of the Holy Cross, Fall 2007
Math 131, Midterm 3 (All Sections)
Wednesday, November 28, 6 PM

Your Name: _____

Your Section:

Little (8:00am) ____ Ballantine (9:00am) ____
DeStefano (10:00am) ____ DeStefano (noon) ____

Instructions: For full credit, you must show *all work* on the test pages. Use the back of the preceding page if you need more space for scratch work. The numbers next to each part of the questions are their point values.

Please do not write in the space below

Problem	Points/Poss
I	/ 25
II	/ 15
III	/ 20
IV	/ 10
V	/ 15
VI	/ 15
Total	/100

I. For each of the following functions find the derivative and simplify.

A. (4) $f(x) = \sin(2x)\cos(4x)$ $\qquad f'(x) =$

B. (4) $g(x) = \dfrac{1 + \ln x}{1 - x}$ $\qquad g'(x) =$

C. (4) $h(x) = \arctan(4x^2 + x)$ $\qquad h'(x) =$

D. (4) $k(x) = x^{\tan x}$ $\quad k'(x) =$

E. (4) Use logarithmic differentiation to find y' if $y = \sqrt[3]{\dfrac{x^2+2x}{x^2-2x}}$.

$y' =$

F. (5) Find the equation of the tangent line to the curve $x^2y^3 + 2y = 3x$ at the point $(2, 1)$. Tangent line:

II. (15) A rocket is launched vertically and is tracked by a ground station 4 miles from the launch pad. What is the vertical speed of the rocket when its height above the ground is 5 miles and its distance to the ground station is increasing at 3600 miles per hour?

Answer:

III. All parts of this question refer to the function $f(x) = \dfrac{x}{(2x+1)^2}$.

A. (5) Find all critical numbers and determine where $f(x)$ is increasing and decreasing.

Critical numbers: ____

Increasing: ____

Decreasing: ____

B. (2) Find all local maximum and minimum values of $f(x)$.

Local maximum values: ____

Local minimum values: ____

C. (3) Determine the concavity of $f(x)$, and find any inflection points given that

$$f''(x) = \frac{8(x-1)}{(2x+1)^4}.$$

Concave up: ____

Concave down: ____

Inflection points: ____

(problem continues on following page)

D. (2) Find all asymptotes for the graph of $f(x)$. Hint: You may use the following facts if necessary:

$$\lim_{x \to -0.5^+} f(x) = -\infty, \text{ and } \lim_{x \to -0.5^-} f(x) = -\infty$$

Asymptotes:

F. (8) Sketch the graph of $f(x)$ using the information above. Label any maximum and minimum values, inflection points, asymptotes, and any other points which help you to give a clear and accurate picture.

IV. All parts of this question refer to the function $f(x) = x^3 - 12x - 7$.

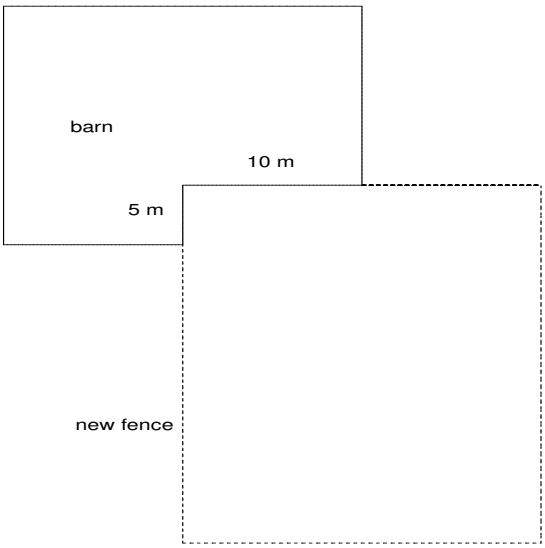
A. (5) Find the critical numbers of $f(x)$.

Critical numbers: [ ]

B. (5) What does the Second Derivative Test tell you about the behavior of f at these critical numbers?

Answer: [ ]

V. (15) A rectangular outdoor pen is to be added to a barn with a 5 meter by 10 meter corner notch as shown in the diagram below. If 85 meters of new fencing is available, what is the maximum area that can be enclosed? No fencing is needed along the walls of the barn. Be sure to say how you know your solution gives the maximum area.



Answer:

VI. Find the following limits. (Just an answer is not sufficient; you must show work for full credit.)

A. (3) $\lim_{x\to 0} \dfrac{x^3 + 2\sqrt{x}}{5x^3 + 2}$ Limit: $\boxed{}$

B. (4) $\lim_{x\to 2} \dfrac{e^{x^2} - e^4}{x - 4}$ Limit: $\boxed{}$

C. (4) $\lim_{x\to 0} \dfrac{e^x - x + 1}{\cos x - 1}$ Limit: $\boxed{}$

D. (4) $\lim_{x\to \infty} \dfrac{\ln x}{\sqrt[4]{x}}$ Limit: $\boxed{}$