Mathematics 1823-010
Examination II Form A
March 16, 2001

Name (please print) _____

Student Number _____

Discussion Section (please circle day and time):

We 2:30 We 3:30 Th 9:00 Th 10:30 Th 12:00 Th 1:30

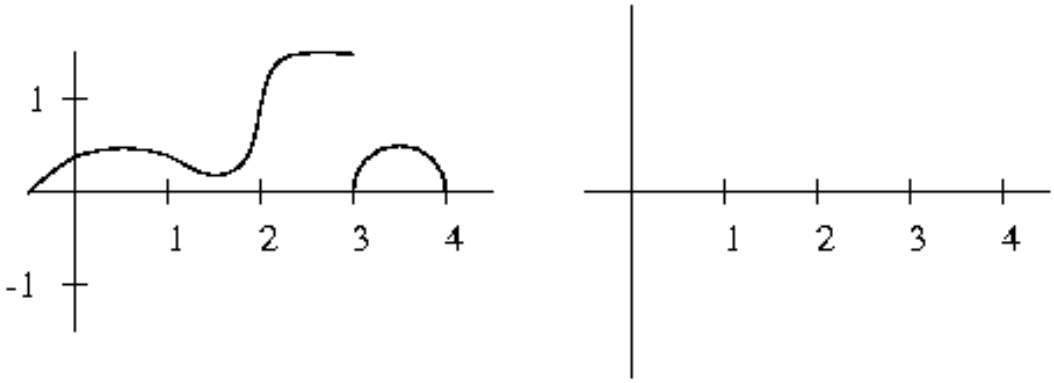
I. Determine the following derivatives.

(12)

1. $\frac{d}{d\theta}(\sec(\theta) + \cot(\theta) + \csc(\theta) + \tan(\theta))$ (do not calculate, give derivatives from memory)

2. $\frac{dy}{dx}$ if $\cos(y^2) = \sqrt{x}$ (use implicit differentiation)

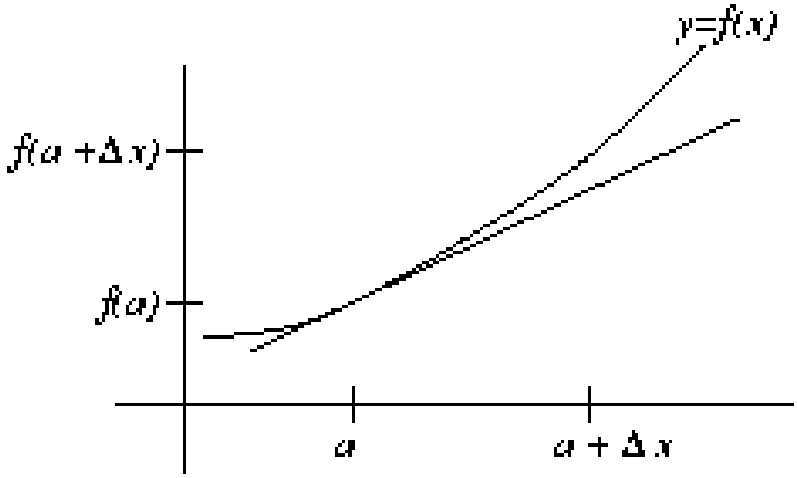
II. (5) The first coordinate system shows the graph of a function $f(x)$. On the second coordinate system, sketch the graph of its derivative $f'(x)$.



III. (8) The figure below shows the tangent line to $f(x)$ at $x = a$.

1. On the figure, draw the linear part of the change of $f(x)$ between a and $a + \Delta x$. Give the expression for it in terms of f'.

2. Let $\epsilon(\Delta x)$ denote the nonlinear part of the change of $f(x)$ between a and $a + \Delta x$. On the figure below, indicate where $\epsilon(\Delta x)$ would be. In the box below the diagram, finish writing down an equation that expresses the idea that "the nonlinear part of the change is small relative to Δx".



$$\lim_{\Delta x \to 0}$$

IV. Calculate the following things.
(20)

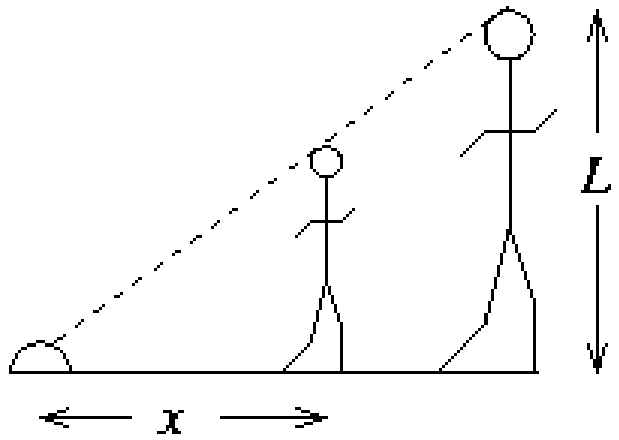
1. $\dfrac{dy}{du}$ if $y = \dfrac{Bu + D}{Au + C}$

2. $(\text{blue} \circ \text{green})'(\text{orange})$ if $\text{green}(\text{orange}) = \text{violet}$, $\text{green}'(\text{orange}) = \text{turquoise}$, $\text{blue}'(\text{violet}) = \text{red}$, $\text{green}'(\text{blue}(\text{orange})) = \text{yellow}$, and $\text{blue}'(\text{orange}) = \text{teal}$.

3. $\dfrac{dy}{dx}$ if $y = \sqrt{x + \sqrt{x}}$

4. $f^{(2)}(x)$ if $f(x) = \sin(x)\cos(x)$

V. (9) As shown in this figure, a spotlight on the ground shines on a wall 15 m away. A man 2 m tall walks from the spotlight toward the wall at a speed of 1.5 m/sec.



1. Let L be the length of the man's shadow and let x be his distance from the spotlight. Use similar triangles to write an equation that relates L to x.

2. Use the equation to calculate an equation that contains $\frac{dL}{dt}$.

3. At the moment when the man is 10 feet from the spotlight, how fast is the length of his shadow changing?