Mathematics 1823-010
Examination II Form B
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. Calculate the following things.

(20)

1. $\dfrac{dy}{du}$ if $y = \dfrac{Cu + D}{Au + B}$

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

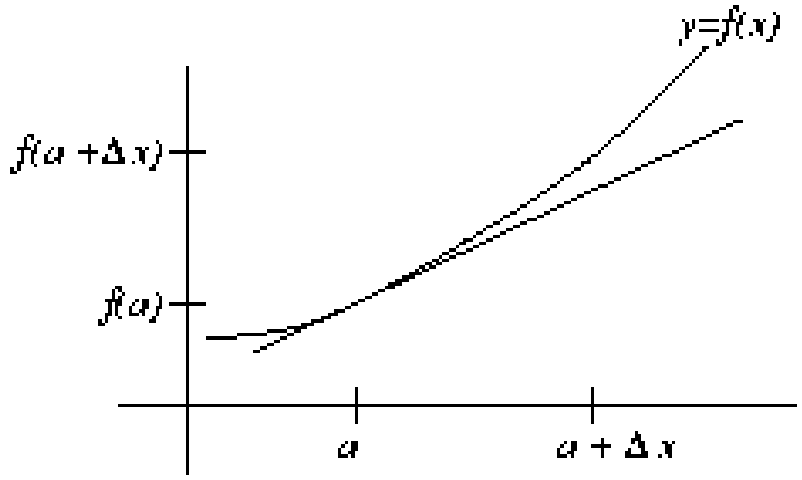
3. $f^{(2)}(x)$ if $f(x) = \cos(x)\sin(x)$

4. (blue $\circ$ green)$'$(violet) if green(violet) = orange, green$'$(violet) = turquoise, blue$'$(orange) = yellow, green$'$(blue(violet)) = red, and blue$'$(violet) = teal.

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

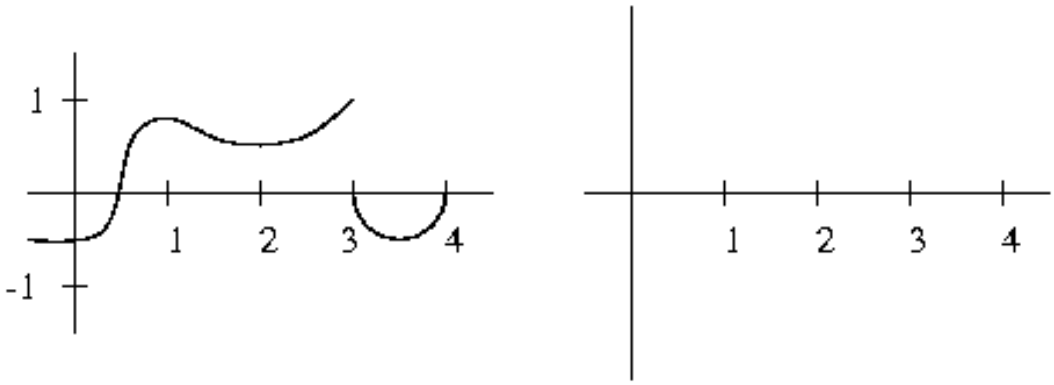
1. On the figure, draw the linear part of the change of $f(x)$ between a and $a + \Delta x$. Give the expression for it in terms of f'.

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".

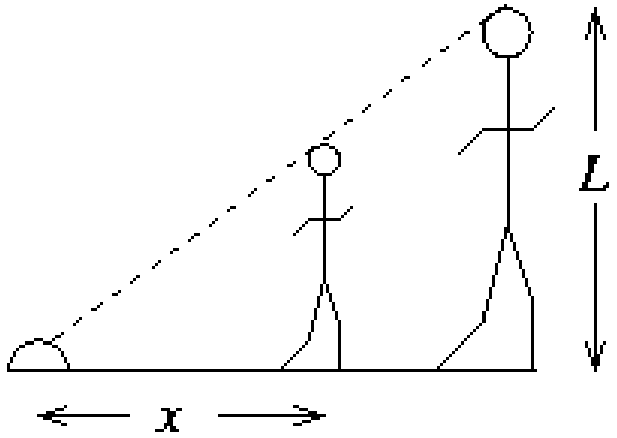


$$\lim_{\Delta x \to 0}$$

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



IV. (9) As shown in this figure, a spotlight on the ground shines on a wall 20 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?

V. Determine the following derivatives.

(12)

1. $\dfrac{dy}{dx}$ if $\sin(y^2) = \sqrt{x}$ (use implicit differentiation)

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