

Math 1133

Derive Assignment #2

Name(s) _____

Due: _____

You may do this assignment by yourself or with up to two of your classmates.

Solve each of these problems using DERIVE. Your presentation of solutions must be neat, clear, and concise. You may report answers only, with no justification unless otherwise indicated. In most problems you are asked to hand in either a graph or a printed screen showing your results. Label graphs by indicating the function that has been graphed. Use text if you feel that words will enhance your display. Please staple your papers and do NOT use paper torn from a spiral notebook. Sloppy papers will not be graded.

1. (a) Use DERIVE to find each of the following limits or derivatives. Hand in your printout with your answers.

(i) $\lim_{x \rightarrow 0} (1 + 2x)^{1/(3x)}$

(ii) $\lim_{x \rightarrow \infty} \frac{\ln x}{\sqrt[3]{x}}$

(iii) $\lim_{x \rightarrow \frac{\pi}{2}^-} (\sec x - \tan x)$

- (b) Show how to evaluate the limits (i) - (iii) without the use of DERIVE or a calculator.

2. In this problem we'll investigate the behavior of the function

$$f(x) = \frac{10 \ln(\ln x)}{\ln x}.$$

- (a) Use DERIVE to find the first and second derivatives of f .
(b) Use the formula for f' given by DERIVE to **algebraically** find the relative extreme points on the graph of f . Show your work.
(c) Find any inflection points on the graph of f . This does not need to be done algebraically, but you must clearly explain the process you use to find the inflection points.
(d) Use DERIVE to help you evaluate a limit in order to find the location of any horizontal asymptotes of the function f . Explain what limit you used to find the horizontal asymptotes.
(e) Use DERIVE to graph the functions f , f' , and f'' on the same screen. Clearly indicate which function is which.

3. Given the function $f(x) = \sqrt{1+x^3}$ on the interval $[0, 2]$, find the ordered pair for which $f''(x)$ has an absolute maximum on the specified interval. Use DERIVE equation solving capabilities to solve for the x coordinate of the absolute maximum. Use DERIVE's substitution capabilities to find the corresponding y coordinate. Print a screen which shows all of the algebraic work and also a screen which shows the graph of the second derivative with its absolute maximum value on the interval $[0, 2]$.

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

- Find $f'(x)$ using DERIVE.
- Draw a complete graph of $f(x)$ & $f'(x)$ on the interval $[-6, 6]$ in the same window using DERIVE.
- Find all values on the interval $[-6, 6]$ where $f'(x) = 0$. (round to 3 d.p.) using DERIVE.
- What observations do you make about the graph of $f(x)$ at these values?

Hand in a printout including the graph and the algebra window showing results.

5. If $f(x) = \sin^2 x \cos^3 x$, find

- $f^4(x)$
- $|f^4(x)|$
- The graph of $|f^4(x)|$ showing a clear view on the interval $[0, 2]$.
- Find the critical numbers of $|f^4(x)|$ using DERIVE.
- Find the ordered pair at which the absolute maximum value of $|f^4(x)|$ occurs on the interval $[0, 2]$. Use the equation solving command and the substitute command when finding the absolute max, rather than zooming.

Hand in a printout including the graph and the algebra window showing results.