

MATH 1500 D01 Fall 2016 Assignment 3

SHOW ALL WORK to get full marks. Leave answers as exact answers. For example, leave it as fractions such as $1/7$ as opposed to decimals such as 0.142857. Word problems should have sentence answers with units. Fractions should be lowest terms.

All assignments must be handed in on UMLearn as **one PDF file**. Late assignments will not be accepted. Failure to follow the instructions will result in a mark of 0.

Techniques from this course must be used to solve the questions, not more advanced techniques. For example L'Hopital's Rule for solving limits is not permitted.

The assignment covers sections 3.6, 4.1–4.3 and 4.5 in the textbook.

1. Compute the derivative of the following functions:

[5] (a) $f(x) = 5^{47 \csc x}$

[5] (b) $f(x) = \ln |\cot(\pi - t^3)|$

[5] (c) $f(x) = \log_5(\sin 5x + \ln x)$

[6] (d) $f(x) = x^2 + (\ln x)^{x^2}$

- [7] 2. Use logarithmic differentiation to compute the derivative of

$$f(x) = \frac{\sqrt{4x+3} e^{6x} (x-5)^7}{x^3}.$$

3. Compute the critical numbers of the following functions. Show complete reasoning.

[3] (a) $f(x) = x^3 - 6x^2 - 63x + 5$

[3] (b) $f(x) = |4x - 3|$

- [6] 4. Compute the absolute maximum and minimum values of $f(x) = \sqrt[3]{x}(4-x)$ on the interval $[-1, 8]$. Explain all reasoning.

- [6] 5. Verify that the following function satisfies the conditions of the Mean Value Theorem on the interval $[-2, 1]$, and then compute c which satisfies the conclusion of the Mean Value Theorem.

$$f(x) = \frac{x+5}{x+3}$$

- [14] 6. Let

$$f(x) = \frac{9(x^2-3)}{x^3} \quad f'(x) = \frac{-9(x^2-9)}{x^4} \quad f''(x) = \frac{18(x^2-18)}{x^5}.$$

Determine the following. Show all work.

- (a) Domain of f :
- (b) Symmetry of f :
- (c) Equation(s) of any vertical asymptotes:

- (d) Equation(s) of any horizontal asymptotes:
- (e) Coordinates of any critical point(s):
- (f) Open intervals where f is increasing:
- (g) Open intervals where f is decreasing:
- (h) Coordinates of any local maxima:
- (i) Coordinates of any local minima:
- (j) Open intervals where f is concave up:
- (k) Open intervals where f is concave down:
- (l) Coordinates of any inflection point(s):
- (m) Sketch the graph of f , labelling all points of interest.

[15] 7. Let

$$f(x) = \frac{x^3}{x^2 - 4} \quad f'(x) = \frac{x^2(x^2 - 12)}{(x^2 - 4)^2} \quad f''(x) = \frac{8x(x^2 + 12)}{(x^2 - 4)^3}$$

Determine the following. Show all work.

- (a) Domain of f :
- (b) Symmetry of f :
- (c) Equation(s) of any vertical asymptotes:
- (d) Equation(s) of any horizontal asymptotes:
- (e) Coordinates of any critical point(s):
- (f) Open intervals where f is increasing:
- (g) Open intervals where f is decreasing:
- (h) Coordinates of any local maxima:
- (i) Coordinates of any local minima:
- (j) Open intervals where f is concave up:
- (k) Open intervals where f is concave down:
- (l) Coordinates of any inflection point(s):
- (m) Sketch the graph of f , labelling all points of interest.

This assignment is out of 75 points.