

MATH 180 – Hour Exam 2

NAME _____

TA _____

Calculators are NOT allowed on this exam.

To receive full credit, you must show all of your work and write legibly.

1. (24 points) Find the derivatives of the following functions: (do not simplify your answers)

(a) $f(x) = x^2 \cos(x + 1)$

(b) $g(x) = \sin(x \ln x)$

(c) $h(x) = \tan^{-1}(2x^2 + 1)$

(d) $k(x) = (x + x^3)^{1776}$

2. (24 points) Let $f(x) = x^3 + 3x^2 - 9x - 11$.

(a) Find the critical points of f .

(b) Find the intervals on which f is increasing and the intervals on which f is decreasing.

(c) Find the local minima and maxima of f . Compute x and $f(x)$ for each local extremum x .

(d) Determine the intervals on which f is concave up and the intervals on which f is concave down.

(e) Find the points of inflection of f .

(f) Sketch the graph of f .

3. (10 points) Find an equation for the tangent line to the curve defined by the equation $x^2y^2 + xy + y = 1$ at the point $(2, -1)$.

4. (15 points) Find the minimum and the maximum values on the interval $[0, 5]$ for the function

$$f(x) = x^3 - 9x^2 + 24x + 1.$$

5. (15 points) You are designing a closed cardboard box (with a top, a bottom and four sides). The length of the box must be twice its width, and the volume of the box must be 72 cubic inches.

(a) Express the surface area of the box as a function of its width.

(b) Determine the dimensions of the box that will use the least amount of cardboard.

6. (12 points) Use L' Hôpital's rule to compute the limit:

$$\lim_{x \rightarrow 0} \frac{\sin(3x^2)}{1 - e^{x^2}}$$

Hand this sheet in with your exam booklet.