Math 140, Jeffrey Adams
Test III, November 6, 1998

IMPORTANT INSTRUCTIONS
1. Write your name, section number, and TA's name on each answer sheet.
2. Number the sheets 1-4. Do all of the work for problem 1 on sheet 1. You may use the back if necessary – write "*see back of sheet*". Similarly for problems 2-4.
3. For full credit you must **show your work**.

Question 1. (30 points)

(a) Let $f(x) = x^3 - 6x^2 + 9x - 1$. Find the maximum value and minimum value of f on the interval $[0, 2]$.

(b) Let $g(x) = \dfrac{x^2 + x + 1}{x^3 - x}$. Find all vertical asymptotes and horizontal asymptotes of g.

(c) Find a function $h(x)$ such that $h(0) = 0$ and $h'(x) = e^{-x}$.

Question 2. (30 points)

Let $f(x) = \dfrac{1+x}{1-x}$, and note that $f'(x) = \dfrac{2}{(1-x)^2}$ and $f''(x) = \dfrac{4}{(1-x)^3}$.

(a) Find all x and y intercepts of f.

(b) Find all relative maximum values and relative minimum values of f.

(c) Determine where the graph of f is concave upward and where it is concave downward.

(d) Find all inflection points of f.

(e) Find all horizontal asymptotes and vertical asymptotes of f.

(f) Sketch the graph of f, and include all pertinent labels on the graph.

Question 3. (20 points)

An isosceles triangle has base 4 and height 10. Find the maximum possible area of a rectangle that can be placed inside the triangle with one side on the base of the triangle.

Question 4. (20 points)

(a) Let $f(x) = x^{\frac{7}{3}}$. Find a point c such that $f'(c) = f''(c) = 0$. Show that f does *not* have a relative maximum or relative minimum at c.

(b) Suppose $g(x)$ is a function defined for $x \geq 0$, such that $g'(x)$ has the graph given below. Determine the intervals on which the graph of g is concave up, and those on which it is concave down.

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