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 \( g(x) = \frac{x^2 + x + 1}{x^3 - x} \). 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 \( f(x) = 1 + \frac{x}{1 - x} \), and note that \( f'(x) = \frac{2}{(1 - x)^2} \) and \( f''(x) = \frac{4}{(1 - x)^3} \).
(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 \( f(x) = x^{\frac{7}{5}} \). 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.