Your Name: ________________________________

On this exam, you may use a calculator.

It is not sufficient to just write down the answers. You
must explain how you arrived at your answers and how you know they are correct.

1   (10) ________
2   (15) ________
3   (15) ________
4   (15) ________
5   (15) ________
6   (15) ________
7   (15) ________
Total (100) ________
1. **(10 points)** Draw the graph of a function $f$ if you know that $f'(0)$ is undefined, $f$ is decreasing on $(-\infty, 0)$, $f$ is concave downward on $(0, 3)$, and $f$ has an inflection point at $x = 3$.

2. **(15 points)** You are given two functions and one is the derivative of the other. Identify each function.

3. **(15 points)** For the function $f(x) = \frac{x^2}{x-1}$ find the intervals where the function is increasing and decreasing, find the relative extrema, find the intervals where the function is concave upward and concave downward and the inflection points, if any.

4. **(15 points)** Obtain as much information about the function $f(x) = x - \frac{1}{x}$ and then sketch the graph of the function.

5. **(15 points)** Find the absolute maxima and minima of the function $f(x) = \frac{1}{3}x^3 - x^2 + x + 1$ on the closed interval $[0, 2]$. 
6. (15 points) The weekly demand for video discs manufactured by the Herald Record Company is given by

\[ p = -0.0005x^2 + 60 \]

where \( p \) denotes the unit price in dollars and \( x \) denotes the quantity demanded. The weekly total cost function associated with producing this discs is given by

\[ C(x) = -0.001x^2 + 18x + 4000 \]

where \( C(x) \) denotes the total cost incurred in pressing \( x \) discs. Find the production level that will yield a maximum profit for the manufacturer.

7. (15 points) Find the horizontal and vertical asymptotes of the function \( f(x) = \frac{x^2 - 4}{x^2 - 1} \).