1. (8 points) If \( f(x) = x^3 - 6x^2 + 1 \) answer the following questions:

   a. Where is the function increasing and decreasing? \( f'(x) = 3x^2 - 12x = 3x(x - 4) \) thus the split points are 0 and 4 so \( f \) is increasing on \((-\infty, 0)\) and \((4, \infty)\) and decreasing on \((0, 4)\).

   b. Where are the local maximums and minimums? Local maximum at \((0, 1)\) and local minimum at \((4, -31)\).

   c. Where is the function concave up and concave down? \( f''(x) = 6x - 12 = 6(x - 2) \) so we have one split point at 2 thus \( f \) is concave down on \((-\infty, 2)\) and concave up on \((2, \infty)\).

   d. Where are the inflection points? Inflection point at \((2, -15)\).

2. (6 points) Find the absolute maximum and minimum of \( f(x) = \frac{x^2}{x - 1} \) on \([-1, \frac{1}{2}]\).

   \( f'(x) = \frac{x(x - 2)}{(x - 1)^2} \) so we have critical points at -1, 0 and 1/2 since all of the other potential critical points are not in our interval. \( f(-1) = -1/2, f(0) = 0 \) and \( f(1/2) = -1/8 \) so our absolute minimum is -1/2 and absolute maximum is 0.

3. (6 points) If the edge of a cube is increasing at the constant rate of 2 centimeters per second, how fast is the volume changing when the length of the edges are 5 centimeters?

   Let the edges of the cube be labeled by \( x \), then the volume of the cube is \( V = x^3 \). We also know \( \frac{dx}{dt} = 2 \) and want to find \( \frac{dV}{dt} \) when \( x = 5 \). Differentiating \( V = x^3 \) with respect to \( t \) we get 

   \[ \frac{dV}{dt} = 3x^2 \frac{dx}{dt} \] 

   thus \( \frac{dV}{dt} = 3(5^2)(2) = 150 \text{ cm}^3 \) per second.

6. (1 point extra credit) There have been 5 X-Men movies since 2000, name as many as you can including subtitles.