

1. (4 points) Approximate the two following values with well-chosen linear approximations:

(a)  $\sqrt[3]{997}$ .

(b)  $(3.04)^4$ .

2. (10 points) Let  $f(x) = 2 + 3x^2 - x^3$ . Answer the following questions about this function.

(a) (4 points) Where is it increasing? Where is it decreasing?

(b) (3 points) Where are its local maxima and minima?

(c) (3 points) Where is it concave up, where is it concave down, and what are its points of inflection?

3. (6 points) Calculate the following limits:

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

(b)  $\lim_{t \rightarrow 3} \frac{t^2 - 2t - 3}{t^2 + 2t + 2}$ .

4. (2 point bonus) Find an example of the equation of a continuous function with infinitely many local maxima, infinitely many global minima on  $(-\infty, \infty)$ , and only one global maximum.