(1) (15 pts.)
(a) Find the linearization $L(x)$ of the function $f(x) = x^{5/6}$ at $a = 64$.
(b) Use part (a) to approximate $(62)^{5/6}$ using differentials.

(2) (15 pts.) Find the absolute maximum and minimum values on the interval $[0, \pi]$ for the function $f(x) = x - 2\sin x$. 
(3) (15 pts.) For the function \( f(x) = 4x^3 - x^4 \), do the following.
(a) Find the intervals of increase, decrease.
(b) Find the local maximum and minimum values.
(c) Find the intervals of concavity.
(d) Find the inflection points.
(e) Sketch the graph of \( y = f(x) \), clearly showing the information obtained in parts (a) – (d).
(4) (15 pts.) For the function $f(x) = x - 1 + \frac{2}{x}$, on the domain $D = (0, \infty)$, do the following.
(a) Find the vertical asymptote and the slant asymptote.
(b) Find the critical points. Apply the first derivative test to find the intervals of increase or decrease and the local extrema.
(c) Sketch the graph of $y = f(x)$, clearly showing the information obtained in parts (a) and (b).
(5) (15 pts.) A rectangular poster is to have an area of 300 square inches with two-inch margins at the bottom and sides and a three-inch margin at the top. What dimensions will maximize the printed area?
(6) Find the limits.

(a) (7 pts.) \( \lim_{x \to \infty} \frac{x^2 + 1}{e^x} \)

(b) (8 pts.) \( \lim_{x \to 1} \frac{\ln x}{1 - x} \)

(c) (10 pts.) \( \lim_{x \to 0} \left(1 + \frac{x}{2}\right)^{\frac{1}{x}} \)