(1) Give the critical points of the function $f(x) = x^3 e^{-x}$ in the interval $[0, 5]$, indicating whether the point is a local maximum, minimum, or neither.

(2) Find the local maxima and minima of the function $f(x) = x^3 - 2x^2 + 2x$. Sketch the graph.

(3) Find the local maxima and minima of the function $s(t) = \ln(t^2 + t + 1)$. Sketch the graph.

(4) It costs \$1 apiece to make gidgets. The number n of gidgets that you can sell is related to the price x by $n = 400 - .05x^2$. What price should you charge to maximize your profit?

(5) The spawner-recruit function for chameleons is $f(S) = 1.4S - .01S^2$. Find the maximum sustainable harvest for Steve the cat.

(6) An Ichthyosaurus is defecating in a conical pile with a fixed height of 10 inches. If the beast is eliminating 60 cubic inches per minute, how fast is the radius growing when it reaches a 4 inch radius?

(7) The gas law (for constant temperature) is $PV^{1.4} = C$, where P is pressure, V is volume, and C is a constant. Find the relation between $\frac{\frac{dP}{dt}}{P}$ and $\frac{\frac{dV}{dt}}{V}$.

(8) The average daily metabolic rate for rodents can be approximated by

$$m = 90w^{0.55}$$

where w is the weight in kg and m is the metabolic rate in kcal/day. Determine $\frac{dm}{dt}$ for a 2-kg rodent that is gaining 0.1 kg/day.

(9) Using the method of differentials (tangent lines), approximate $34^{\frac{1}{5}}$.

(10) Using series, estimate $\cos 1$.

(11) Using series, estimate $e^{\frac{1}{3}}$.

(12) State the mean value theorem.