Name: _____

TA's Name: _

Instructions: You must show supporting work as much as possible to receive full and partial credits. No text book, notes, formula sheets allowed.

1(16pts) Find the following limits. (Calculator read-off answers receive no credit.)

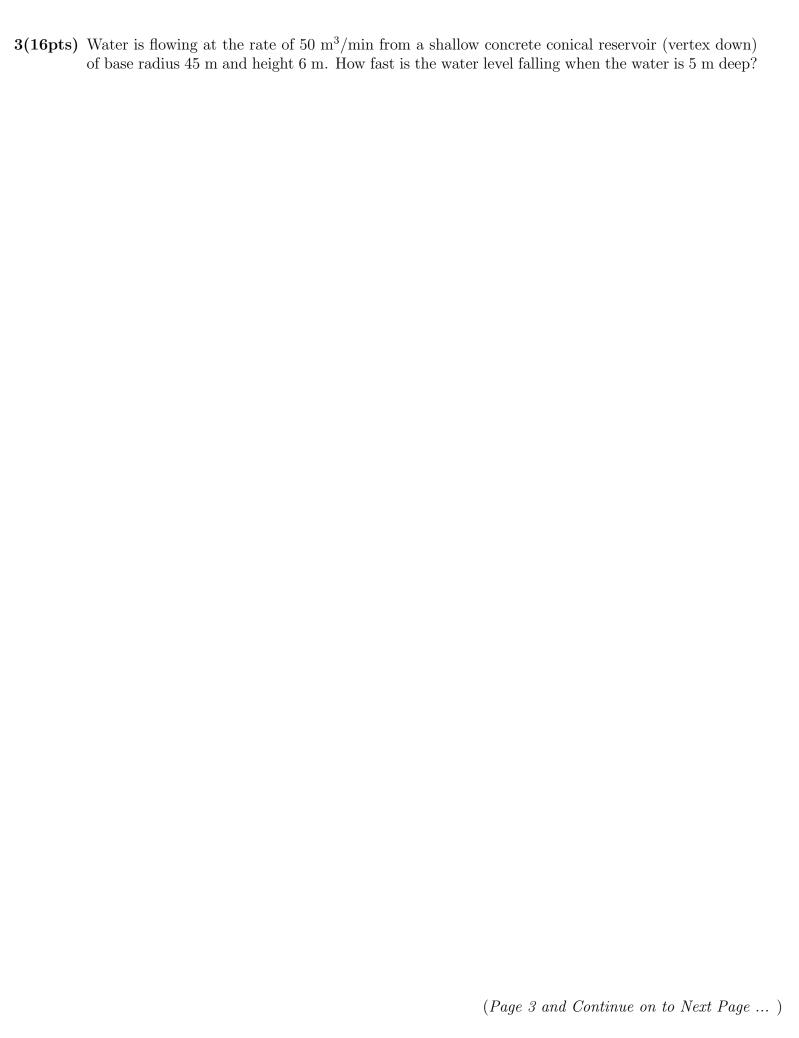
(a)
$$\lim_{x \to 0} \frac{\sin x - x}{x^3}$$

(a)
$$\lim_{x \to 1} \frac{\ln x}{x - 1}$$

- **2(18pts)** Let $y = f(x) = x^5 + 37x$.
 - (a) Find an equation for the tangent line of the function y = f(x) at x = 1.

(b) Find the value of dy when x = 1 and $\Delta x = 0.2$.

(c) It is given that for a function y = g(x), g(3) = 1, g'(3) = 0.2. Approximate the value g(3.1) and justify your answer.







6(18pts) The first and second derivatives of the function $y = x^2 e^{1/x}$ are given as

$$y' = (2x - 1)e^{1/x},$$
 $y'' = \left(\frac{2x^2 - 2x + 1}{x^2}\right)e^{1/x}$

Sketch the graph of the function, including these information: intercept points, horizontal and vertical asymptotes, extrema and intervals of monotonicity, inflection points and intervals of concavity. (Calculator read-off answers receive no credit.)