Name: _____

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page. SHOW ALL YOUR WORK. WRITE NEATLY AND LARGE. CIRCLE FINAL ANSWER.

1. (10 points) Find the linearization $L(x)$ of $g(x) = 2^x$ at $a = 0$.

2. (15 points) Fuel is being pumped into a cylindrical tank that is 100 ft tall and 50 ft in diameter. If the fuel level is rising by 2 ft/min, find the rate at which the fuel is being pumped in.

3. (10 points) Find the critical number(s) of the function $f(x) = x^2e^x$.

4. (15 points) Find the absolute minimum value of f on the given interval.

$$f(s) = s^3 - 6s^2 + 9s - 1, \qquad [0, 2]$$

5. (15 points) Find all local maximum and minimum values (and classify each) for

$$k(y) = y \ln y$$

6. (10 points) Find the limit. Use L'Hospital's Rule where appropriate. If L'Hospital's Rule can not be applied, explain why.

$$\lim_{x\to\infty}\left(xe^{1/x}-x\right)$$

7. (15 points) Find the dimensions of the rectangle of largest area that can be inscribed in an equilateral triangle which has sides of length one.

8. (10 points) Find an initial guess x_1 that would cause Newton's method to fail when applied to

$$x^3 - 3x + 7 = 0.$$

Explain why.

9. **Bonus:** (10 Points) Explain why Newton's method fails when applied to $\sqrt[3]{x} = 0$ for any initial guess $x_1 \neq 0$.