

Name: \_\_\_\_\_

There are 25 points possible on this quiz. This is a closed book quiz. Calculators and notes are not allowed. **Please show all of your work!** If you have any questions, please raise your hand.

*Exercise 1.* (12 pts.) Evaluate the limits below. Use L'Hospital's Rule where appropriate. **Indicate when you are using L'Hospital's Rule and state explicitly the indeterminate form.**

(a.)  $\lim_{x \rightarrow \infty} x^3 e^{-x^2}$

(b.)  $\lim_{\theta \rightarrow \pi/2} \frac{\cos \theta}{\sin(8\theta)}$

(c.)  $\lim_{x \rightarrow 0} (1 - 4x)^{1/x}$

Exercise 2. (3 pts.) Given  $f(x) = 6 + xe^{-x}$ ,  $f'(x) = -(x - 1)e^{-x}$ , and  $f''(x) = (x - 2)e^{-x}$ , use the Second Derivative Test to identify the local minimum and maximum values of  $f$  or explain why the test is inconclusive.

Exercise 3. (10 pts.) Use the information below to answer questions about the function  $f(x)$ . Make sure you answer the question! If something doesn't exist, you must explicitly state this.

$$f(x) = \frac{1}{x^2 + 9}, \quad f'(x) = \frac{-2x}{(x^2 + 9)^2}, \quad f''(x) = \frac{6(x^2 - 3)}{(x^2 + 9)^3}.$$

(a.) Find the interval(s) where the function is increasing and the interval(s) where the function is decreasing.

(b.) Find the local maximum and minimum values of  $f$  and where they occur.

(c.) Find the intervals of concavity and any inflection points.