Lab Time: Your Name:

GOAL: This quiz is designed to illuminate your understanding of how to analyze the graphical behavior of functions in terms of extrema, concavity and derivatives.

1. (12 points) **Multiple Choice**. Indicate your answer to the following multiple choice questions (1 point) by selecting the appropriate box. Your explanation of your answer is worth 2 points.

(a). Which of the following statements is always true?

(A) □ All local extrema are also global extrema.

(B) □ All global extrema are also local extrema.

(C) □ Some global extrema are local extrema.

(D) □ No local extrema are global extrema.

(E) □ None of the above statements is true.

(b). Consider an unknown function $g(x)$ where $g'(x) = x^2(x - 2)$. It has

(A) □ no inflection points.

(B) □ one inflection point.

(C) □ two inflection points.

(D) □ three inflection points.

(E) □ an unknowable number of inflection points.

(c). Consider an unknown function $g(x)$ where $g'(x) = x^2(x - 2)$. It has

(A) □ no critical points.

(B) □ one critical point.

(C) □ two critical points.

(D) □ three critical points.

(E) □ an unknowable number of inflection points.

(d). Consider an unknown function $M(x)$ where all you know is that $M(x)$ is decreasing at every point in the interval $[0, 3]$. Which of the following must be true?

(A) □ $M(x)$ has a local minimum at $x = 2$.

(B) □ $M(x)$ has a global minimum at $x = 2$.

(C) □ $M(x)$ has a local maximum at $x = 2$.

(D) □ $M(x)$ has a global maximum at $x = 2$.

(E) □ More than one of the above statements must be true.
2. (8 points) Consider the graph of the function $f(x) = e^{-0.2x} \sin(x)$ on $[0, 5]$. Label all local maxima with $\text{LMax}$; similarly, label all local minima with $\text{LMin}$. Then, label all global maxima with $\text{GMax}$; similarly, label all global minima with $\text{GMin}$.

BONUS (5 points) Consider the function $F(x) = x^2 e^{-x}$. Sketch a graph of the function $F(x)$ on its domain after clearly identifying the locations of all extrema and inflection points.