1. Chain Rule
(a) Let \( h(t) = \sin(\cos(\tan(t))) \). Find the derivative with respect to \( t \)
(b) Let \( s(x) = \sqrt{x} \) where \( x(t) = \ln(f(t)) \) and \( f(t) \) is a differentiable function. Find \( \frac{ds}{dt} \).

2. Parameterized curves
(a) Describe and sketch the curve given parametrically by
\[
\begin{align*}
x &= 5 \sin(3t) \\
y &= 3 \cos(3t)
\end{align*}
\], when \( 0 \leq t < \frac{2\pi}{3} \).
What happens if we allow \( t \) to vary between 0 and \( 2\pi \)?
(b) Set up, but do not evaluate an integral that calculates the arc length of the curve described in part (a).
(c) Consider the equation \( x^2 + y^2 = 16 \). Graph this equation in \( \mathbb{R}^2 \) and find a parameterization of the curve that traverses the curve once in a counterclockwise direction.

3. The 1st and 2nd Derivative Tests
(a) Use the 2nd Derivative Test to classify the critical numbers of the function
\( f(x) = x^4 - 8x^2 + 10 \).
(b) Use the 1st Derivative Test and find the extrema of \( h(s) = s^4 + 4s^3 - 1 \).
(c) Explain why the 2nd Derivative test is unable to classify all the critical numbers of \( h(s) = s^4 + 4s^3 - 1 \).

4. Consider the function \( f(x) = x^2 e^{-x} \).
(a) Find the best linear approximation to \( f \) at \( x = 0 \).
(b) Compute the second-order Taylor polynomial at \( x = 0 \).
(c) Explain how the second-order Taylor polynomial at \( x = 0 \) demonstrates that \( f \) must have a minimum at \( x = 0 \).

5. Consider the integral \( \int_0^{\sqrt{3\pi}} 2x \cos(x^2) \, dx \).
(a) Sketch the area in the \( xy \)-plane that is implicitly defined by this integral.
(b) To evaluate, you will need to perform a substitution. Choose a proper \( u = f(x) \) and rewrite the integral in terms of \( u \). Sketch the area in the \( uv \)-plane that is implicitly defined by this integral.
(c) Evaluate the integral \( \int_0^{\sqrt{3\pi}} 2x \cos(x^2) \, dx \).