In the following,

a) Differentiate and simplify
b) Find all critical numbers.
c) Use the first derivative test to find all local extremes.
d) Find absolute extremes.

Let \( f(x) = x^3(x - 1)^2 \) on \([-1, 2]\).
1) Differentiate and simplify.
2) Find all critical numbers.
3) Find all absolute extremes.

Let \( f(x) = x(\ln x)^2 \) on \([e^{-3}, e^3]\).
1) Differentiate and simplify.
2) Find all critical numbers.
3) Use the first derivative to find all local extremes.
4) Find all absolute extremes.

Let \( f(x) = x^2e^{-x^2} \) on \([-2, 2]\).
1) Differentiate and simplify.
2) Find all critical numbers.
3) Use the first derivative to find all local extremes.
4) Find all absolute extremes.

In the following,

a) Differentiate and simplify
b) Find all critical numbers.
c) Use the first derivative test to find all local extremes.
d) Find absolute extremes.

\[
f(x) = xe^{-x^2} \text{ on } [-1, 1] \quad f(x) = x \ln x \text{ on } [1, e^2] \\
f(x) = \sin x \cos x \text{ on } [0, \pi] \quad f(x) = x^2\sqrt{1 - x^2} \text{ on } [-1, 1]
\]