HOMEWORK 9 - MATH 160
DUE DATE: Tuesday, November 1
INSTRUCTOR: George Voutsadakis

Read each problem **very carefully** before starting to solve it. Two out of the ten problems will be chosen at random and graded for a total of 20 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Graph on the same system of axes the functions $f(x) = \log_2 x$ and $g(x) = \log_{\frac{1}{3}} x$.
2. Find the derivatives of the following functions:
   (a) $f(x) = 2e^x - x^2$
   (b) $f(x) = \frac{e^x}{e^x+1}$
   (c) $f(x) = (4 - e^{-5x})^3$
3. Find an equation of the tangent line to the graph of $f(x) = e^{-x^2}$ at the point $x = 1$.
4. Study the function $f(x) = x^2 e^{-x}$ with respect to monotonicity, i.e., find the intervals where it is increasing and where it is decreasing.
5. Find the inflection points of the function $f(x) = 2e^{-x^2}$.
6. Find the derivatives of the following functions:
   (a) $f(x) = \ln(5x^2 + 1)$
   (b) $f(x) = \ln \frac{x+1}{x-1}$
   (c) $f(x) = \frac{3 \ln x}{x^2}$
   (d) $f(x) = \sqrt{\ln x + x}$
7. Use logarithmic differentiation to compute the derivatives of the following functions:
   (a) $y = \frac{\sqrt{4+3x^2}}{\sqrt[3]{x^2+1}}$
   (b) $y = x^{\ln x}$
8. Find an equation of the tangent line to the graph of $f(x) = \ln x^2$ at the point $x = 2$.
9. Study the function $f(x) = x^2 + \ln x^2$ with respect to concavity, i.e., determine the intervals over which it is concave up and those over which it is concave down.
10. Find the absolute extrema of the following functions in the indicated closed intervals:
    (a) $f(x) = e^{x^2-9}$ on $[-3, 3]$;
    (b) $f(x) = x - \ln x$ in $[\frac{1}{2}, 3]$