Math 113 Calculus – Homework 2

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

Please do not write anything inside the above boxes!

Check that there are 5 questions on your booklet. Write your name on top of every page. Show your work in reasonable detail, unless otherwise stated. A correct answer without proper or too much reasoning may not get any credit.

Q-1) Write the derivatives of the following functions. No partials. Do not show your work.

- \( f(x) = x^3 \), \( f'(x) = \)
- \( f(x) = (\tan x)^{\sec x} \), \( f'(x) = \)
- \( f(x) = \ln(\cosh x^2) \), \( f'(x) = \)
- \( f(x) = x \arctan x^2 \), \( f'(x) = \)
- \( f(x) = x^{1/\ln x} \), \( f'(\pi) = \)
- \( f(x) = 5^x - x^5 \), \( f'(x) = \)
- \( f(x) = x^{\ln x} \), \( f'(e) = \)
- \( f(x) = \frac{x^6 - x^4 + 1}{4x^3 + x - 1} \), \( f'(0) = \)

- Given: \( g(0) = 1, \ g(3) = 17, \ g(8) = 0, \ f(0) = 71, \ f(3) = -1, \ f(8) = \sqrt{2}, \)
  \( g'(0) = \pi, \ g'(3) = \pi e, \ g'(8) = e, \ f'(0) = 2e, \ f'(3) = \ln 3, \ f'(8) = e\sqrt{2}. \)

If \( h(x) = f(3g(x) + 5), \) then \( h'(0) = \)

- Given: \( f(5) = \pi/3, \ f'(5) = \pi/4, \ g(5) = 1, \ g'(5) = 0, \ g'(\sqrt{2}/2) = 5, \)
  \( g'(\sqrt{3}/2) = 7, \ g(1/2) = \pi, \ g(\pi/4) = 11. \)

If \( h(x) = g(\sin(f(x))) \), then \( h'(5) = \)
Q-2) Show that for any \( x > -1 \) and for any integer \( n \geq 0 \),

\[
(1 + x)^n \geq 1 + nx.
\]
Q-3) Sketch the graph of \( f(x) = \frac{x + 1}{x^2 + 1} \). Find the absolute minimum and maximum values of \( f \).
Q-4) Sketch the graph of \( f(x) = x^2 e^{-x^2} \). Find the absolute minimum and maximum values of \( f \).
Q-5) Approximate $\tan 1$ with an absolute error less than $1/1000$, using the Taylor polynomials of $\sin x$ and $\cos x$. 