<table>
<thead>
<tr>
<th>Problem</th>
<th>Points</th>
<th>Score</th>
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Show all work.

1. Use the definition that $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ to compute $f'(x)$ for the following functions.
   (14 points, a=6, b=8)
   
   a) $f(x) = 2x^2 + x$

   b) $f(x) = \frac{x}{x^2 + 1}$

2. Evaluate show steps

   $\lim_{h \to 0} \frac{\sqrt{1+h} - 1}{h}$

   (10 points)
3. Find the derivative $f'(x)$ for the following functions, using the derivative rules and showing any steps you use. Do not simplify. Calculator answers with no work are worth one point.

(30 points, 5 each)

a) $f(x) = x^{15} + \frac{x}{x-3} + x^{\sqrt{2}} + \frac{1}{2x}$

b) $f(x) = (e^{x^5} + (x^2 + 1)^7)^{33}$

c) $f(x) = \sqrt{x^3 + \tan(x^3)}$

d) $f(x) = \frac{x^3 + \ln x}{\cos x + \ln x}$

e) $f(x) = x^4 e^{x^2} \ln(e^x + 1)$

f) $f(x) = (\sin(x + \cos(x + \tan x)))^7$
4. Solve for $x$:
(12 points, 3 each)

a) $4^x = 1/8$

b) $e^{2\ln x} e^{-3\ln x} = 5$

c) $e^{\ln(x^3) + 3\ln x} = 64$

d) $\ln(2x + 1) = 5$

5. If $f(x) = xe^x$, compute $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}(x)$. Find a formula for $f^{(n)}(x)$.
(10 points)
6. Find the values for the constants $A, B, C$ so that $y = Ae^x + Bx + C$ satisfies the equation $y'' + 2y' + y = x + 8e^x$. (Here $y'$ is the derivative of $y$, etc.)
(10 points)

7. If $f(x) = e^x \cos x$, compute $f'(x), f''(x), f'''(x)$, and $f^{(4)}(x)$. Find a formula for $f^{(n)}(x)$.
(12 points)