Provide both a clear and organized presentation. Show all of your work, completely simplify your answers, and use exact values only. No technology, other than a scientific calculator, may be used.

1. (10 pts) If $y = (\cos x)^{\ln x}$, find y'

2. (10 pts) If $y = \tan^3 \sqrt{x^2 e^{5x}}$, find y'

3. (15 pts) If $x^2y^3 - 4x + 5y = \sec\frac{y}{x}$, find y'

4. (10 pts) If $y = \dfrac{1+x\sqrt{x}}{1-x\sqrt{x}}$, find y'

5. (10 pts) Derive $\frac{d}{dx}\left(\tan^{-1} x\right) = \frac{1}{1+x^2}$

6. (10 pts) The number of people infected with this year's pesky *Logarithmic Flu Virus* is given by $p(t) = \frac{200}{4 + e^{-0.2t}}$ where $p(t)$ is measured in hundreds of people and *t* is the number of days beyond the day is broke in this country. What is $p'(10)$ and give a meaningful interpretation of its value.

7. (15 pts) A tangent line (or lines) to a curve passes through the point $(5,-11)$. What is the *x*-coordinate of the point(s) of tangency if the curve is described by the graph of $y = \frac{10}{x^2+1}$

8. (10 pts) If $y = \frac{2}{x\sqrt{x}}$, find $y^{(n)}$

9. (10 pts) Evaluate the limits:

i) $\lim_{x\to 0} \frac{\tan^2 5x}{\sin^2 7x}$

ii) $\lim_{x\to\infty} p(t)$ where $p(t)$ is given in question #6 and give a meaningful interpretation of it.