Show all work.

1. **(7 points)** Given that $x^2y^3 = \cot y + \sec x$, find a formula for $\frac{dy}{dx}$.

2. **(5 points)** If $f(x) = \arcsin(e^{\sqrt{x}})$, calculate $f'(x)$.

3. **(3 points)** Find $\frac{d}{dx}\frac{\ln x}{x^2}$.

4. **(5 points)** Determine the equation of a tangent line to the curve $y = 4\sqrt{(x+1)e^x}$ at $(0, 4)$.

5. **(2 point bonus)** Given that $f(x)$ is a function with an inverse, find a formula, in terms of the functions $f$, $f^{-1}$, and $f'$, for the *derivative* of the function $f^{-1}$.