1. (4 points) Differentiate using logarithmic differentiation: 
\[ y = e^{-x} \sin^2 x \sqrt{\ln(x^2 + 1)} \]

2. (3 points) To the delight of his onlookers, John the juggler, tosses a ball straight up in the air with an initial velocity of 10 feet per second. The ball is 2 ft above the ground when it is first released. Its height at time \( t \) is given by \( s = -10t^2 + 10t + 2 \). What is the ball’s maximum height?
3. (3 points) There is a point on the curve $f(x) = e^{2x}$ such that the tangent line to the curve at this point is perpendicular to the line $y = -2x + 1$. Find the $y$-coordinate of this point in simplified form.