Q1. If \( x + \sin^{-1}(1/e) = \tan^{-1}(\pi - y) \), find \( y' \), then prove that \( y'' = 2y'(\pi - y) \)

Q2. Find \( \frac{dy}{dx} \) if \( \sin^{-1}t = ty \) and \( \frac{dt}{dx} = \frac{1}{\sqrt{1-t^2}} \)
Q4. Find the $n$th derivative of

I. $y = x^2 + 2$
II. $y = e^{2x}$

Q5. If $f(x) = e^{\frac{x+1}{x-1}}$ find $f(x)^{-1}$, then find the domain of $f(x)^{-1}$. 
Q7. Find the limit, if it exists \( \lim_{x \to 0} \left( \cot^2 x - \csc^2 x \right) \)

Q8. Find the limit, if it exists \( \lim_{x \to 0^+} (1 + 3x)^{\csc x} \)
9. The particle is moving along the curve whose equation is
\[ \frac{2}{3} + \frac{8}{4}y = 0. \]
Assume that the x-coordinate is increasing at the rate of 6 units/second, when the particle is at \( y = 2 \).
- At what rate is the y-coordinate of the point changing at that instant?
- Is the particle rising or falling at that instant?

10. Find all equations of the tangent lines to the curve \( xy^2 + xy = 2 \) at \( x = 1 \).