1. Compute the following derivatives:

(a) \( \frac{d}{dx} [(1 + \cos^2 x)^2] \)

(b) \( \frac{d}{dt} \left[ \sqrt{\sin \sqrt{t}} \right] \)

(c) \( \frac{d}{dx} \left[ \sin^{-1} (x^2 - 1) \right] \)

(d) \( \frac{d}{dx} \left[ \tan^{-1} (e^x) \right] \)

(e) \( \frac{d}{dx} \left[ \ln \left( \frac{1}{\cos x + 1} \right) \right] \)
2. Use implicit differentiation to compute $\frac{dy}{dx}$ for the following equations:

(a) $x\sqrt{1+y} + y\sqrt{1+2x} = 2x$

(b) $x\sin y + \cos 2y = \cos y$

(c) $xy = \tan^{-1}(xy)$

(d) $e^y = \ln(xy)$
3. Use logarithmic differentiation to compute the derivatives of the following functions with respect to \( t \).

(a) \( f(t) = \sqrt{\frac{t + 1}{t + 2}} \)

(b) \( f(t) = \frac{1}{t(t + 1)(t + 2)(t + 3)} \)
4. The frequency of vibrations of a vibrating violin string is given by

\[ f = \frac{1}{2L} \sqrt{\frac{T}{\rho}} \]

where \( L \) is the length of the string, \( T \) is the tension, and \( \rho \) is its linear density. Find the rate of change of the frequency with respect to

(a) the length (when \( T \) and \( \rho \) are constant)

(b) the tension (when \( L \) and \( \rho \) are constant)

(c) the linear density (when \( T \) and \( L \) are constant)