1. Find the equation of the tangent line and normal line to

(a) ~~$y^2 + \tan x^2 y = x$ at $(1, 0)$~~.

(b) $x^2 + \left(y - \sqrt{|x|}\right)^2 = 3$ at $(1, 1 - \sqrt{2})$.

2.

(a) If $y = A\sin(\ln x) + B\cos(\ln x)$, where A and B are constants, show that

$$x^2 y'' + xy' + y = 0.$$

(b) Find the first and second derivative of

$$f(x) = \tan(\ln x^2).$$

3.

(a) Find the first and second derivatives of $\ln(y^2) + \sin(x + 1) = e^x$.

(b) Find the first derivative of $y^x = \tan x$
Hint: Notice $y^x = e^{x \ln y}$.

Be sure to substitute for y' when appropriate.

4. Show the definitions of the following derivatives are correct

(a) $\frac{d}{dx}\left[\cos^{-1} x\right] = -\frac{1}{\sqrt{1-x^2}}$ by using **Theorem 4** in the book.
Hint: Let $f^{-1}(x) = \cos^{-1} x$.

(b) $\frac{d}{dx}\left[a^x\right] = \ln a \cdot a^x$, where a is a constant.

(i) By using **Theorem 4** in the book.
Hint: Let $f^{-1}(x) = a^x$.

(ii) By using **Logarithmic Differentiation** .