(1) [3] Differentiate $y = x^2 e^x$

$$y' = 2x e^x + x^2 e^x$$

(2) [4] Differentiate $y = \ln\left(e^{-x} + xe^{-x}\right)$

$$y' = \frac{1}{e^{-x} + xe^{-x}} \cdot \left[-e^{-x} + e^{-x} - xe^{-x}\right]$$

$$= \frac{-xe^{-x}}{e^{-x}(1+x)}$$

$$= \frac{-x}{1+x}$$

(3) [8] Use logarithmic differentiation (or some other method) to determine the derivative of

$$y = (\tan x)^{1/x}$$

$$\ln y = \left(\frac{1}{x}\right) \ln(\tan x)$$

$$\frac{1}{y} y' = \left(\frac{-1}{x^2}\right) \ln(\tan x) + \left(\frac{1}{x}\right) \frac{1}{\tan x} \cdot \sec^2 x$$

$$\therefore y' = (\tan x)^{\frac{1}{x}} \left[\frac{-1}{x^2} \ln(\tan x) + \frac{\sec^2 x}{x \tan x} \right].$$