

2. (12 points) Find the indicated derivatives.

(i) $\frac{d^2}{dx^2} \ln(x^3 + x)$

(ii) $\frac{d}{dx} \tan^{-1}(\sin x)$

(iii) $\frac{dy}{dx}$ for $x^2 + xy + y^2 = 4$ in terms of x and y .

(iii) $\frac{dy}{dx}$ for $y = (y^2 + 1)^x$ in terms of x and y .

$$\frac{d}{dx} \left(\frac{3x^2 + 1}{x^3 + x} \right) = \frac{6x(x^3 + x) - (3x^2 + 1)^2}{(x^3 + x)^2}$$

$$\frac{\cos x}{1 + \sin^2 x}$$

iii) $2x + xy' + y + 2yy' = 0 \Rightarrow y' = -\frac{2x + y}{x + 2y}$

iv) $\ln y = x \ln(y^2 + 1)$

$$\frac{y'}{y} = \frac{2xyy'}{y^2 + 1} + \ln(y^2 + 1)$$

$$\Rightarrow y' = \frac{\ln(y^2 + 1)}{\frac{1}{y} - \frac{2xy}{y^2 + 1}}$$