

$$1b) \quad y = \ln(t+1)^2 = 2 \ln(t+1)$$

$$y' = 2 \frac{1}{t+1} = \frac{2}{t+1}$$

$$1c) \quad f(x) = \ln \frac{\sqrt{4+x^2}}{x} = \frac{1}{2} \ln(4+x^2) - \ln x$$

$$f'(x) = \frac{x}{4+x^2} - \frac{1}{x} = \frac{-4}{x(x^2+4)}$$

$$1d) \quad g'(t) = \frac{t^2(1/t) - 2t \ln t}{t^4} = \frac{1 - 2 \ln t}{t^3}$$

$$1e) \quad \frac{dy}{dx} = \frac{1}{\ln x^2} \frac{d}{dx} (\ln x^2) = \frac{(2x/x^2)}{\ln x^2} = \frac{2}{x \ln x^2} = \frac{1}{x \ln x}$$

$$2b) \quad f(x) = \ln \sqrt{1 + \sin^2 x}$$

$$= \frac{1}{2} \ln(1 + \sin^2 x), \quad \left(\frac{\pi}{4}, \ln \sqrt{\frac{3}{2}} \right)$$

$$f'(x) = \frac{2 \sin x \cos x}{2(1 + \sin^2 x)} = \frac{\sin x \cos x}{1 + \sin^2 x}$$

$$f'\left(\frac{\pi}{4}\right) = \frac{(\sqrt{2}/2)(\sqrt{2}/2)}{(3/2)} = \frac{1}{3}$$

$$\text{Tangent line: } y - \ln \sqrt{\frac{3}{2}} = \frac{1}{3} \left(x - \frac{\pi}{4} \right)$$

$$y = \frac{1}{3}x + \frac{1}{2} \ln \left(\frac{3}{2} \right) - \frac{\pi}{12}$$

$$3b) \quad 12x^2 + \frac{2}{y}y' + 2y' = 2$$

$$\left(\frac{2}{y} + 2 \right) y' = 2 - 12x^2$$

$$y' = \frac{2 - 12x^2}{2/y + 2}$$

$$y' = \frac{y - 6yx^2}{1 + y} = \frac{y(1 - 6x^2)}{1 + y}$$

$$4b) \quad 1 + y' = \frac{2x + 2yy'}{x^2 + y^2}$$

$$x^2 + y^2 + (x^2 + y^2)y' = 2x + 2yy'$$

$$\text{At } (1, 0): 1 + y' = 2$$

$$y' = 1$$

$$\text{Tangent line: } y = x - 1$$

$$5b) \quad \ln y = 2 \ln x + \frac{1}{2} \ln(3x - 2) - 2 \ln(x + 1)$$

$$\frac{1}{y} \left(\frac{dy}{dx} \right) = \frac{2}{x} + \frac{3}{2(3x - 2)} - \frac{2}{x + 1}$$

$$\frac{dy}{dx} = y \left[\frac{3x^2 + 15x - 8}{2x(3x - 2)(x + 1)} \right]$$

$$= \frac{3x^3 + 15x^2 - 8x}{2(x + 1)^3 \sqrt{3x - 2}}$$