

Instructions: Work the problems below as directed. Show all work. Clearly mark your final answers. Use exact values unless the problem specifically directs you to round. Simplify as much as possible. Partial credit is possible, but solutions without work will not receive full credit.

1. Find the indicated derivative.

a.  $f'(x), f(x) = \arctan(3x) \operatorname{arcsec}(3x)$

$$\frac{3 \operatorname{arcsec} 3x}{1+9x^2} + \frac{3 \arctan(3x)}{3x \sqrt{9x^2-1}}$$

b.  $f'(x), f(x) = x^2 e^x$

$$f'(x) = 2x e^x + x^2 e^x = (2x + x^2) e^x$$

c.  $f'(x), f(x) = 2^{4x} + \ln(\sec x) = 16^x + \ln(\sec x)$

$$f'(x) = (\ln 16) 16^x + \frac{\sec x \tan x}{\sec x} = (\ln 16) 16^x + \tan x$$

d.  $f'(x), f(x) = \log \sqrt{5x-7} = \frac{1}{2} \log_5(5x-7)$

$$f'(x) = \frac{1}{2} \cdot \frac{5}{5x-7}$$

2. Find  $\frac{dy}{dx}$  for the implicitly defined function  $y \sin x = y^2 + 2e^x$ .

$$y' \sin x + y \cos x = 2y y' + 2e^x$$

$$y' = \frac{dy}{dx} = \frac{2e^x - y \cos x}{\sin x - 2y}$$

$$y' \sin x - 2y y' = 2e^x - y \cos x$$

$$y' (\sin x - 2y) = 2e^x - y \cos x$$

3. Find the equation of the tangent line to the graph  $x^2 + 2xy - 3y^2 = 0$  at the point (1,1).

$$2x + 2y + 2xy' - 6yy' = 0$$

$$2x + 2y = (6y - 2x) y'$$

$$\frac{dy}{dx} \Big|_{(1,1)} = \frac{1+1}{3-1} = \frac{2}{2} = 1$$

$$\frac{x+y}{3y-x} = \frac{2x+2y}{6y-2x} = y'$$