

Show your work in all problems.

1. Find the derivatives of the following functions.

$$\begin{aligned} \text{(a)} \quad s(x) &= 12(4x - 1)^2 & u &= 4x - 1 & f(u) &= 12u^2 \\ & & u' &= 4 & f'(u) &= 12 \cdot 2 \cdot u \\ s'(x) &= 12 \cdot 2 \cdot (4x - 1) \cdot 4 & &= 96(4x - 1) \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad p(x) &= \ln(x - e^x) & u &= x - e^x & f(u) &= \ln(u) \\ & & u' &= 1 - e^x & f'(u) &= \frac{1}{u} \end{aligned}$$

$$p'(x) = \frac{1}{x - e^x} \cdot (1 - e^x)$$

$$\begin{aligned} \text{(d)} \quad k(x) &= \boxed{5x} + \underbrace{3 \cdot 2^{(x + \sqrt{x})}}_{f(u) = 3 \cdot 2^u} & u &= x + \sqrt{x} = x + x^{1/2} \\ & & u' &= 1 + \frac{1}{2}x^{-1/2} \\ & & f'(u) &= 3 \cdot 2^u \cdot \ln(2) \end{aligned}$$

$$k'(x) = \boxed{5} + 3 \cdot 2^{x + \sqrt{x}} \cdot \ln(2) \cdot \left(1 + \frac{1}{2}x^{-1/2}\right)$$

2. Find the equation of the tangent line to the curve  $y = f(x) = 4x^2 - 3^x$  at  $x = 1$ .

$$\text{point of tangency: } (1, f(1)) = (1, 1) \qquad f(1) = 4 \cdot 1^2 - 3^1 = 1$$

$$f'(x) = 4 \cdot 2x - 3^x \cdot \ln(3)$$

$$\text{Slope} = m = f'(1) = 8 - 3 \cdot \ln(3) = 4.7042$$

$$\text{eqn. of tangent line: } y - 1 = 4.7042(x - 1)$$