

Show your work in all problems.

1. Find the derivatives of the following functions.

(a)  $s(x) = 8(5 - 3x)^2$

$$u = 5 - 3x$$

$$u' = -3$$

$$f(u) = 8u^2$$

$$f'(u) = 8 \cdot 2u$$

$$s'(x) = 8 \cdot 2 \cdot (5 - 3x) \cdot (-3)$$

(c)  $p(x) = \boxed{2} + \underbrace{\sqrt[3]{x - e^x}}_{f(u)}$

$$u = x - e^x$$

$$u' = 1 - e^x$$

$$f(u) = u^{1/3}$$

$$f'(u) = \frac{1}{3} u^{-2/3}$$

$$p'(x) = \boxed{0} + \frac{1}{3} \cdot (x - e^x)^{-2/3} \cdot (1 - e^x)$$

(d)  $k(x) = \underbrace{\ln(5x)}_{f(u)} + \underbrace{3 \cdot 2^{(x^2 - 3x)}}_{g(w)}$

$$u = 5x$$

$$u' = 5$$

$$f(u) = \ln(u)$$

$$f'(u) = \frac{1}{u}$$

$$w = x^2 - 3x$$

$$w' = 2x - 3$$

$$g(w) = 3 \cdot 2^w$$

$$g'(w) = 3 \cdot 2^w \cdot \ln(2)$$

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

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

point of tangency:  $(1, f(1)) = (1, -1)$

$$f(1) = 3^1 - 4 \cdot 1^2$$

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

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

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