

MEMORIAL UNIVERSITY OF NEWFOUNDLAND
DEPARTMENT OF MATHEMATICS AND STATISTICS

SECTION 3.2

Math 1000 Worksheet

FALL 2023

SOLUTIONS

1. (a) $\frac{dy}{dx} = \frac{1}{2}(4e^x + 2)^{-\frac{1}{2}} \cdot \frac{d}{dx}[4e^x + 2] = \frac{1}{2}(4e^x + 2)^{-\frac{1}{2}} \cdot 4e^x = \frac{2e^x}{\sqrt{4e^x + 2}}$

(b) $y' = \cos(x^2 - 7x) \cdot (x^2 - 7x)' = \cos(x^2 - 7x) \cdot (2x - 7)$
 $= (2x - 7) \cos(x^2 - 7x)$

(c) $f'(x) = e^{5x} \cdot (5^x)' = e^{5x} \cdot [5^x \ln(5)] = e^{5x} 5^x \ln(5)$

(d) We use the Chain Rule twice:

$$\frac{dy}{dx} = -\sin(\cos(x)) \cdot \frac{d}{dx}[\cos(x)] = -\sin(\cos(x)) \cdot [-\sin(x)]$$
$$= \sin(x) \sin(\cos(x)).$$

(e) We use the Product Rule, then the Chain Rule for each of the resulting derivatives:

$$\begin{aligned} \frac{d}{dx}[f(x)] &= \frac{d}{dx}[(5 - 2x)^{-4}]e^{\sec(x)} + \frac{d}{dx}[e^{\sec(x)}](5 - 2x)^{-4} \\ &= -4(5 - 2x)^{-5} \cdot \frac{d}{dx}[5 - 2x]e^{\sec(x)} + e^{\sec(x)} \cdot \frac{d}{dx}[\sec(x)](5 - 2x)^{-4} \\ &= -4(5 - 2x)^{-5} \cdot (-2)e^{\sec(x)} + e^{\sec(x)} \cdot [\sec(x) \tan(x)](5 - 2x)^{-4} \\ &= 8(5 - 2x)^{-5}e^{\sec(x)} + (5 - 2x)^{-4}e^{\sec(x)} \sec(x) \tan(x). \end{aligned}$$

(f) We use the Chain Rule, then the Product Rule:

$$\begin{aligned} f'(t) &= \sec^2(t^2 e^t) \cdot (t^2 e^t)' \\ &= \sec^2(t^2 e^t) \cdot [(t^2)'e^t + (e^t)'t^2] = (2te^t + t^2 e^t) \sec^2(t^2 e^t). \end{aligned}$$

(g) First we use the Quotient Rule, then the Chain Rule:

$$\begin{aligned} f'(x) &= \frac{(x^2)'(x^3 - x)^6 - [(x^3 - x)^6]'x^2}{[(x^3 - x)^6]^2} \\ &= \frac{2x(x^3 - x)^6 - 6(x^3 - x)^5 \cdot (x^3 - x)'x^2}{[(x^3 - x)^{12}]^2} \\ &= \frac{2x(x^3 - x)^6 - 6(x^3 - x)^5 \cdot (3x^2 - 1)x^2}{(x^3 - x)^{12}} \\ &= \frac{2x(x^3 - x) - 6x^2(3x^2 - 1)}{(x^3 - x)^7} \\ &= \frac{-16x^4 + 4x^2}{(x^3 - x)^7}. \end{aligned}$$

(h) We use the Chain Rule three times:

$$\begin{aligned}h'(x) &= \cos(\cos(\tan(x)))[\cos(\tan(x))]' \\ &= \cos(\cos(\tan(x)))[\cos(\tan(x))]' \\ &= -\cos(\cos(\tan(x)))\sin(\tan(x))[\tan(x)]' \\ &= -\cos(\cos(\tan(x)))\sin(\tan(x))\sec^2(x).\end{aligned}$$