MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECTION 3.2 | **Math 1000 Worksheet** | FALL 2022

SOLUTIONS

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

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

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

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

   (f) We use the Chain Rule, then the Product Rule:
   $$f'(t) = \sec^2(t^2e^t)\cdot(t^2e^t)'$$
   $$= \sec^2(t^2e^t)\cdot[(t^2)'e^t + (e^t)'t^2] = (2te^t+t^2e^t)\sec^2(t^2e^t).$$

   (g) First we use the Quotient Rule, then the Chain Rule:
   $$f'(x) = \frac{(x^2)'(x^3-x)^6 - [(x^3-x)^6]'x^2}{[(x^3-x)^6]^2}$$
   $$= \frac{2x(x^3-x)^6 - 6(x^3-x)^5\cdot(x^3-x)'x^2}{[(x^3-x)^{12}}$$
   $$= \frac{2x(x^3-x)^6 - 6(x^3-x)^5\cdot(3x^2-1)x^2}{(x^3-x)^{12}}$$
   $$= \frac{2x(x^3-x) - 6x^2(3x^2-1)}{(x^3-x)^7}$$
   $$= \frac{-16x^4+4x^2}{(x^3-x)^7}.$$

(h) We use the Chain Rule three times:

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