Handout 8

MATH 140 Lab: Section 1

Lab Instructor (TA): Mohammed Kaabar

Student's Name: Mohammed KA Kaabar

Student's ID: -Solution-

***Note:** This handout covers some of the most important problems about differentiation.*

Problem 1: Differentiate the following functions:

Part a: $x^2y^2 + 3y = 4x$

Part b: $xe^y - 3y\,sin(x) = 1$

Part c: $e^y - \ln y = 2x$

Part d: $h(x) = x(\sqrt[3]{x} + 3)$

Part e: $g(x) = \frac{x^2-1}{x+x^2}(x+2)$

Part f: $m(x) = x^3e^{2x}\sin(4x)$

(a) $2xy^2 + x^2 \cdot 2yy' + 3y' = 4$

$2x^2yy' + 3y' = 4 - 2xy^2$

$y'(2x^2y + 3) = (4 - 2xy^2)$

$$y' = \frac{(4-2xy^2)}{(2x^2y+3)}$$

(b) $e^y + xe^y \cdot y' - 3y'\sin(x) - 3y\cos(x) = 0$

$xy'e^y - 3y'\sin(x) = 3y\cos(x) - e^y$

$y'(xe^x - 3\sin(x)) = (3y\cos(x) - e^y)$

$$y' = \frac{(3y\cos(x) - e^y)}{(xe^x - 3\sin(x))}$$

(c) $e^y \cdot y' - \frac{y'}{y} = 2 \Rightarrow y'(e^y - \frac{1}{y}) = 2$

$$\Rightarrow y' = \frac{2}{(e^y - \frac{1}{y})}$$

(d) $h(x) = x(x^{3/2} + 3) \Rightarrow h'(x) = x\left(\frac{1}{3}x^{-2/3}\right) + (x^{1/3} + 3)$

Problem 2: Find the equation of the tangent line to the curve of $x^2y^2 = 4y$ at (2,1). (x_1, y_1)

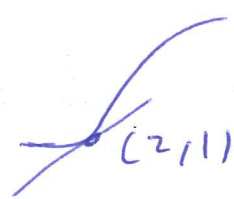
$x^2 \cdot 2yy' + 2xy^2 = 4y'$

$2x^2yy' - 4y' = -2xy^2 \Rightarrow y' = \frac{-2xy^2}{2x^2y-4} \Rightarrow y'|_{(2,1)} = \frac{-2(2)(1)^2}{2(4)(1)-4} = \frac{-4}{4}$

$$y' = -1$$

$y - 1 = -1(x - 2)$

$y = x + 2 - 1 \Rightarrow \boxed{y = x + 1}$



(e) $g'(x) = (x+2)\left(\frac{(x+x^2)(2x) - (1+2x)(x^2-1)}{(x+x^2)^2}\right) + \left(\frac{x^2-1}{x+x^2}\right)$

(f) $m'(x) = 3x^2 e^{2x}\sin(4x) + x^3 e^{2x} \cdot 2 \cdot \sin(4x) + x^3 e^{2x}\cos(4x) \cdot (4)$