University of Toronto at Scarborough
Department of Computer & Mathematical Sciences

MATA33S **Assignment 7** **Winter 2018**

Tutorial Quiz 4 takes place in Week 9 (Friday March 9 - Thursday March 15). You are responsible for Assignments/Solutions 6 (regular and enhanced; Sections 2.8 and 17.1) and Assignment/Solutions 7, Section 17.2 only (i.e. Problem Questions 1 and 3 - 6 below). There will not be any questions from Section 17.3 on Quiz 4 (i.e. Problem Questions 2 below are not on Quiz 4). It is also assumed you know MATA32 very well.

Study: Sections 17.2 and 17.3 for this assignment (reviewing sections 2.8 and 17.1 would be useful too). Read ahead in Sections 17.4 and 17.5.

Terminology and Concepts to Learn: (In Section 17.2) partial derivatives as rates of change, partial derivatives and marginal quantities, competitive and complementary products (In Section 17.3) implicit partial differentiation

Problems:

1. Section 17.2, Pages 758 - 760 # 1, 2, 4 - 10, 14, 18 - 20.
2. Section 17.3, Page 762 # 1, 2, 5, 6, 10, 11, 13, 14, 16, 19.
3. Find the equation of the horizontal plane that is tangent to the graph of the function $z = G(x, y) = x^2 - 4xy - 2y^2 + 12x - 12y - 1$.
4. Let $P(x, y) = \dfrac{xy}{ax + by}$ where P represents profit; $x, y > 0$ represent sales of products **X** and **Y** (respectively); and $a, b > 0$ are constants. Show that the sum of the marginal profits when $x = y$ is equal to $\dfrac{1}{a+b}$
5. Throughout this problem use the function in #20 on page 795
   (a) Do problem # 20 on page 795
   (b) Verify the concept of marginal as outlined on page 795. That is, verify that $c_x(50, 100) \approx c(51, 100) - c(50, 100)$ and $c_y(50, 100) \approx c(50, 101) - c(50, 100)$.
   (c) Repeat part (b) where you replace 50 with a constant $a > 0$ and 100 with a constant $b > 0$.
6. In this problem, it may be useful to refer to the formulas concerning a cylinder in problem #25 on page 618.
   (a) Assume we have a cylinder (with a top) of height h and base radius r. If the top, bottom, and wall costs per square metre are a, b, and w dollars respectively, find the cost function $K(h, r, a, b, w)$ that give the total material cost as a function of h, r, a, b, and w.
   (b) Find all five partial derivatives of the function K.
   (c) Assume now that $a = w = 1$ and $b = 2$. Write the function $K(h, r, 1, 2, 1)$.
   (d) Consider the level curve $L(\pi)$ for the function you found in part (c). Find a mathematical relationship for h as a function of r (where $h, r > 0$) that describes the points (h, r) on the level curve $L(\pi)$. What inequality must r satisfy so that $h > 0$?