No. of Pages - 05
No of Questions - 07

SCHOOL OF ACCOUNTING AND BUSINESS

BSc. (APPLIED ACCOUNTING) GENERAL / SPECIAL DEGREE PROGRAMME

YEAR I SEMESTER I (INTAKE VI – GROUP A)

END SEMESTER EXAMINATION – AUGUST 2016

QMT 10130 Business Mathematics

Date	:	12th August 2016
Time	:	9.00 a.m. – 12.00 p.m.
Duration	:	Three (03) hours

Instructions to Candidates:

- Answer only **FIVE (05)** questions.
- All questions carry equal marks.
- The total marks for the paper is 100.
- Formula Sheet is provided.
- Use of scientific calculator is allowed.
- Answers should be written neatly and legibly

Question No. 01

The Marginal cost and the Marginal revenue functions of a commodity produced by a firm have been given below

$$\boldsymbol{MC = 5 + 0.13Q}$$

$$\boldsymbol{MR = 18}$$

The fixed cost has been identified as LKR 120.

i. Find the total revenue **(TR)** function.
ii. Develop the profit function, **($\boldsymbol{\pi}$).**
iii. "$\boldsymbol{MR = MC}$ at the profit maximizing level of output" is a well-known concept. Use this concept and find the maximum profit.

Question No. 02

"KichN" Custom Kitchen Suppliers sells handmade forks and spoons. It costs the store LKR 170 to buy the supplies to make a fork and LKR 130 to buy the supplies to make a spoon. The store sells forks for LKR 560 and spoons for LKR 540. Last April KichN Custom Kitchen Suppliers spent LKR 3790 on materials for forks and spoons. They sold the finished products for a total of LKR 14,720.

i. Identify the unknowns to be evaluated in the above given scenario.
ii. Develop the system of simultaneous equations, solving which the unknowns could be found.
iii. Use a matrix related method to find the number of folks and spoons produced last April through the solution of the system of simultaneous equations you have developed in part (ii).

Question No. 03

i. A sum of LKR 75,000 was deposited in a bank at an interest rate of 8% per annum compounded quarterly. Six years later the rate increased to 12% compounded monthly. If money was not withdrawn, what is the balance in the account at the end of 10 years after the deposit was made?

ii. A machine depreciates by 20% in the first year, then by 10% per annum for the next 4 years and by 3% per annum thereafter. Find the value of the machine after 10 years if its initial price is LKR 750,000

iii. Ms. Madara wishes to take a mortgage of LKR 2 million over a property for 20 years at a rate of 11% per annum.

   a. Find the amount that Ms. Madara has to repay each month.
   b. After 10 years of the mortgage due to various political and financial reasons the interest rate increases to 18% per annum.
      Find the mortgage balance at the end of 10 years.
   c. Find the new monthly repayment of Ms. Madara.
   d. Due to the increase in interest rate how much Ms. Madara has to pay additionally.

Question No. 04

The revenue and cost functions of a company which produces a particular heavy duty drill are given by.

$$\boldsymbol{TR = 21Q - Q^2}$$

and

$$\boldsymbol{TC = \frac{1}{3}Q^3 - 3Q^2 + 9Q + 16}$$

Where $\boldsymbol{Q}$ is the number of drills produced. Assume that all the units produced could be sold without any restriction.

i. Find the fixed cost.
ii. Set up the profit function, $(\boldsymbol{\pi})$, for the given company.
iii. Find the derivative of the profit function with respect to the appropriate variable.
iv. Find the critical points of the profit function, $(\boldsymbol{\pi})$.
v. Find the second order derivatives.
vi. Find the number of units that should be produced to maximize the profits.
vii. Find the maximum profit.

Question No. 05

The demand and supply laws under pure competition are given by $\boldsymbol{p_d = 23 - q^2}$ and $\boldsymbol{p_s = 2q^2 - 4}$ respectively. Where $\boldsymbol{p}$ and $\boldsymbol{q}$ are the price and the quantity respectively.

i. Find the equilibrium quantity and the equilibrium price.
ii. Sketch the demand and the supply functions clearly stating all the required points.
iii. Highlight the consumer and producer surpluses and indicate it in the sketch drawn in part (ii).
iv. Find the consumer surplus.
v. Find the producer surplus.

Question No. 06

A new digitized radio manufacturer finds that his product has a demand of $\boldsymbol{x}$ radios per week at LKR $\boldsymbol{p}$ each, where

$$\boldsymbol{p = 2\left\{100 - \frac{x}{4}\right\}}$$

His cost of production of $\boldsymbol{x}$ digitized radios per week is LKR

$$\boldsymbol{\left\{120x - \frac{1}{2}x^2\right\}}$$

Show that his profit is maximum when the production is 40 digitized radios per week.
Further find his maximum profit per week.

Question No. 07

i. Let $U(x, y, z)$ be a multivariable function of x, y and z defined as follows;

$$\boldsymbol{U(x, y, z) = 5x^2yz + 4xy^2z + 3y^4}$$

without using Euler's theorem prove that

$$\boldsymbol{x\frac{\partial U}{\partial x} + y\frac{\partial U}{\partial y} + z\frac{\partial U}{\partial z} = 4U}$$

ii. "CalMach" is a newly formed company limited which produces scientific calculators and adding machines. The company has identified that the revenue derived from selling $\boldsymbol{x}$ calculators and $\boldsymbol{y}$ adding machines is given by

$$\boldsymbol{TR = -x^2 + 8x - 2y^2 + 6y + 2xy + 50.}$$

a. Find the number of units of calculators and the number of units of adding machines that should be produced to maximize the revenue
b. Find the maximum revenue.

Formula Sheet

$V = P(1+r)^n$	$P_{ODI} = R\left\{\frac{1-(1+r)^{-n}}{r}\right\}$
$A_{ODI} = R\left\{\frac{(1+r)^n - 1}{r}\right\}$	$P_{PER} = R\left\{\frac{1}{r}\right\}$
$FV = PV(1-r)^n$	$i = (1+j)^m - 1$

In the following formulae a, b, c and n are real constants and u, v and w are functions of x . $u = f(x)$, $v = g(x)$ and $w = h(x)$

01.	$\frac{d}{dx}\{cu\} = c\frac{d}{dx}\{u\}$	Factor Rule
02.	$\frac{d}{dx}\{u \pm v\} = \frac{d}{dx}\{u\} \pm \frac{d}{dx}\{v\}$	Sum Rule
03.	$\frac{d}{dx}\{uv\} = u\frac{d}{dx}\{v\} + v\frac{d}{dx}\{u\}$	Product Rule
04.	$\frac{d}{dx}\{uvw\} = uv\frac{d}{dx}\{w\} + u\frac{d}{dx}\{v\}w + \frac{d}{dx}\{u\}vw$	Product Rule
05.	$\frac{d}{dx}\left\{\frac{u}{v}\right\} = \frac{v\frac{d}{dx}\{u\} - u\frac{d}{dx}\{v\}}{v^2}$	Quotient Rule
06.	$\frac{d}{dx}\{u\} = \frac{d}{dv}\{u\}\frac{d}{dx}\{v\}$	Chain Rule
07.	$\frac{d}{dx}\{u^n\} = nu^{n-1}\frac{d}{dx}\{u\}$	Power Rule
08.	$\frac{d}{dx}\{u\} = \frac{1}{\frac{d}{du}\{x\}}$	
09.	$\frac{d}{dx}\{u^v\} = u^v v\frac{d}{dx}\{\ln u\} + u^v \ln u\frac{d}{dx}\{v\}$	