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SCHOOL OF ACCOUNTING AND BUSINESS
BSc. (APPLIED ACCOUNTING) GENERAL / SPECIAL DEGREE
PROGRAMME

YEAR I SEMESTER I (Group B)
END SEMESTER EXAMINATION – DECEMBER 2014

QMT 10130 Business Mathematics

Date : 14th December 2014
Time : 9.00 a.m. – 12.00 p.m.
Duration : Three (03) hours

Instructions to Candidates:

- Answer **ALL** questions.
- Allocated marks are shown alongside the question.
- Total marks for the paper is 100
- Use of non-programmable scientific calculator is allowed.
- Formula will be provided.
- Answers should be written clearly with the required steps.

Question No. 01

1. Answer the following questions for the line passing through points P(1,1) and Q(3,5).

a. Draw the graph of the line.

(1 Mark)

b. Find the gradient (Slope) of the line.

(1 Mark)

c. Find the points where the line intersect x and y axes.

(1 Mark)

d. Find the co-domain of the above function if the domain is the system of real numbers.

(1 Mark)

e. State whether the above function is one-to-one describing the reasons.

(1 Mark)

2. Solve the following 2x2 linear system of simultaneous equations algebraically.

$$x + 2y = 50$$

$$3x + 4y = 110$$

(2 Marks)

3. A garment manufacturing entity uses two types of threads namely **nylon** and **cotton** for producing **skirts** and **trousers** in its production lines. The entity uses 5 cones of **nylon** and 5 cones of **cotton** threads for producing **pair of trousers** and 4 cones of **nylon** and 3 cones of **cotton** for producing a **skirt**. The manufacturing entity currently holds 310 cones of **nylon** threads and 270 cones of **cotton** threads in its raw material stores.

a. Identify the unknowns in the above problem.

(2 Marks)

b. Develop a system of simultaneous equations representing the problem using the identified unknowns.

(6 Marks)

c. Find the number of trousers and skirts produced by the entity by solving above system of simultaneous equations.

(3 marks)

(Total 18 Marks)

Question No 02

1. The 5th and 21st terms of an arithmetic progression are 20 and 100 respectively. Given that the progression represents the total distance travelled by a vehicle in meters moving at a constant speed in each second, answer the following questions.
 - a. Find the first term and the common difference.
(4 Marks)
 - b. Describe attributes of the moving vehicle using the first term and the common difference.
(1 Mark)
 - c. Find the 61st term of the above series.
(2 Marks)
 - d. State what is represented by the 61st term of the above series for the moving vehicle.
(1 Mark)
 - e. Find the Sum of the first 20 terms.
(2 Marks)
2. Kamal was given Rs. 7,350 for his monthly expenses by his father. Kamal takes Rs. 100 for his expenses on the first day and ten rupees more than the previous day on every following day. How many days can he survive with the available amount?
(3 Marks)
3. Nimal's clothing shop opened eight years ago. The first year he had a profit of Rs 2,000. Each year thereafter his profits averaged 50% greater than the previous year. How much profit will Nimal earn at his 20th year of business? What will the total amount of profit Nimal earned over his last 8 years?
(3 Marks)

(Hint: The roots of the quadratic equation $ax^2 + bx + c = 0$ is given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$)

(Total 16 Marks)

Question No. 03

The cost and the revenue function of a company producing a particular garment are

$C(q) = 3q^3 - 4q^2 + 500q + 15,000$ and $R(q) = 8000q - 4q^2$ respectively. Where q is the number of garments produced. Assuming that all the garments produced are sold, answer the following questions.

- a. Find the fixed cost.
(2 Marks)
- b. Derive the profit function $P(q)$
(2 Marks)
- c. Find the first order derivative of the profit function.
(2 Marks)
- d. Find the critical points.
(2 Marks)
- e. Find the second order derivative.
(2 Marks)
- f. Find the number of garments produced and sold to maximize profit
(2 Marks)
- g. Find the maximum profit
(2 Marks)
- h. Find the revenue earned and cost incurred at the maximum profit level of production.
(2 Marks)

(Hint: The roots of the quadratic equation $ax^2 + bx + c = 0$ is given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$)

(Total 16 Marks)

Question No. 04

1. Given that $y = 4x^2$ find the following.

a. Δy

(1 Mark)

b. $\frac{\Delta y}{\Delta x}$

(1 Mark)

c. $\lim_{\Delta x \rightarrow 0} \frac{\Delta y}{\Delta x}$ (i.e. first order derivative)

(1 Mark)

2. If $U(x, y) = x^4 + x^2y^2 + y^4$ Find the following

a. Find first order partial derivatives U_x, U_y

(1 Mark)

b. Show that $xU_x + yU_y = 4U$

(2 Marks)

c. Find the second order partial derivatives $U_{xx}, U_{xy}, U_{yx}, U_{yy}$

(3 Marks)

3. Analyze the profit function $P(x, y) = 100x - 2x^2 + 400y - 4y^2$

a. Find the first order partial derivatives P_x and P_y .

(1 Mark)

b. Solve for x and y by setting P_x and P_y to zero.

(1 Mark)

c. Find the second order partial derivatives P_{xx}, P_{yy} and P_{xy} .

(4 Marks)

d. Find the maximum Profit.

(3 Marks)

(Total 18 Marks)

Question No. 05

1. The demand and supply function of a commodity in a perfect competition are given by $P_d = 100 - q^2$ and $P_s = 3q^2 + 36$ respectively. Where P_d , P_s , and q are demand price, supply price and quantity respectively.
- a. Find the equilibrium price and quantity. (1 Mark)
- b. Sketch the demand and supply functions for $q \geq 0$ clearly stating all the required points. (2 Marks)
- c. Highlight the consumer surplus and the producer surplus distinctively in the sketch in part (b). (1 Mark)
- d. Find the consumer surplus. (4 Marks)
- e. Find the producer surplus. (4 Marks)
2. If the marginal revenue of a commodity is $(q) = 3q^2 - 12q + 11$, Find the revenue function given that total revenue is -6 when $q = 0$. Also show that to earn revenue q need to take values greater than 3. (4 Marks)

(Hint: First order derivative of total revenue with respect to quantity is defined as the marginal revenue.)

(Total 16 Marks)

Question No. 06

1. How long do you have to wait for an investment to double at the interest rate of 12% compounded semiannually?

(2 Marks)

2. A machine valued Rs. 400,000 depreciates at 6% per annum. How many years will it takes for its value to be reduced to Rs. 200,000.

(3 Marks)

3. Find the best option to invest Rs 40,000 for a period of 8 years.

- a. Option I : 1.5% compounded quarterly
- b. Option II : 3.2% compounded semi annually

(4 Marks)

4. A machine has to be replaced after using 5 years at a cost of Rs. 100,000. In order to collect this amount, the company has decided to make 5 annual investments starting immediately at 8% annual interest. Find the value of the annual investment to achieve the target.

(3 Marks)

5. Find the best option to invest, given the following annuities assuming 8% annual interest rate.

- a. Annuity I : Rs. 5,000 each year for 20 years
- b. Annuity II : Rs. 5,500 each year for 15 years

(4 Marks)

(Total 16 Marks)