FINAL EXAMINATION FOR
BACHELOR OF SCIENCE IN ACCOUNTING & BACHELOR OF BUSINESS STATISTICS
ACADEMIC YEAR: 2024/2025

COURSE NAME: BUSINESS MATHEMATICS ONE
COURSE CODE: BBM1103
SEMESTER: ONE

YEAR OF STUDY: ONE
DATE: November 20, 2024
TIME: 2:00PM – 5:00PM

INSTRUCTIONS

1. Attempt **ONLY FOUR** questions
2. Your answers should be precise and concise.

QUESTION ONE

A) A market research firm in Kampala conducted a survey among 500 small business owners to understand their use of three main digital payment platforms: Mobile Money, Bank Transfer, and Online Payment Gateway. It was found out that 310 businesses use Mobile Money, 210 businesses use Bank Transfer, and 150 businesses use an Online Payment Gateway. 140 businesses use both Mobile Money and Bank Transfer, 80 businesses use both Mobile Money and an Online Payment Gateway, 60 businesses use both Bank Transfer and an Online Payment Gateway, 40 businesses use all three platforms:

i) Represent the data on a Venn diagram, **(5 Marks)**

ii) Determine the number of businesses using at least one of the digital payment platforms. **(3 Marks)**

iii) Determine the number of businesses using exactly two of the platforms. **(3 Marks)**

iv) What is the number of businesses not using any of the three digital payment platforms. **(3 Marks)**

B) When a Barber charged Ugx 4,000 for a haircut, she got 100 customers a week. When the charge was raised to Ugx 5,000, the number fell to 80. Assuming a linear demand equation of price p and number of customers x, determine the following: **(6 Marks)**

i) Marginal revenue function. **(5 Marks)**

ii) The price at which the marginal revenue will be zero.

QUESTION TWO

A) A company manufactures and sells custom-made bicycles. The company's revenue, which depends on the number of bicycles sold, follows a quadratic pattern. After analyzing past sales, the company found that when they sold 100 bicycles in a month, the total revenue was $20,000, and when they sold 200 bicycles, the revenue was $32,000. However, they also discovered that when they sold 300 bicycles, the revenue decreased to $28,000 due to increased production costs.

i) Form a quadratic function that models the company's revenue R(x) where x is the number of bicycles sold. **(8 Marks)**

ii) Using the function from (i), calculate the revenue when 250 bicycles are sold. **(7 Marks)**

B) The marginal revenue function of Kisseka Traders Ltd is $R'(x) = 10(20 - x)e^{-x/20}$, where x is the quantity sold. Find the revenue function for Kisseka Traders Ltd. **(10 Marks)**

QUESTION THREE

A) The production function of a firm is

$$P(L,K) = 10L + L^3K + K^2 + 5K^2L^4 + 2K$$

Where L is weekly labour units in man-hours (in hundreds) and K is investment in Million of shillings spent per week, while P is production per week.

Determine marginal productivities per week when L = 6 and K = 15. **(10 Marks)**

B) A manufacturing firm uses two types of materials X and Y in its product. By using x uni of X and y units of Y, the firm can produce P units of the product, where

$$P(x,y) = 0.52x + 0.48y + 0.12yx - 0.07x^2 - 0.06y^2$$

It costs US$ 5.10 for each unit of X and US$ 1.8 for each unit of Y used and the firm can sell its product at US$15 each. What amounts of X and Y materials can be used by the firm to maximize its profits?

(15 Marks)

QUESTION FOUR

A) A company offers a starting salary of $50,000 with a yearly raise of $2,000. Using your knowledge of Arithmetic Progression, determine the salary in the 10th year. **(10 Marks)**

B) A company produces two types of products, A and B. To produce each unit, they use two raw materials: X and Y. Each unit of product A requires 3 units of material X and 2 units of material Y. Each unit of product B requires 1 unit of material X and 2 units of material Y. The cost per unit of material X is $5, and the cost per unit of material Y is $7. The company needs to produce at least 100 units of product A and 80 units of product B per month.

Required: minimize the total cost of materials used in production using graphical method of Linear Programming. **(15 Marks)**

QUESTION FIVE

A) A company has a revenue function given by $R(x) = 50x - 0.5x^2$ and a cost function $C(x) = 20x + 100$, where x is the number of units sold. Determine

i) The marginal Revenue function **(3 Marks)**

ii) The marginal cost $C'(x)$. **(3 Marks)**

iii) Determine the profit function $P(x)$ **(4 Marks)**

B) Based on operations records of Igara Shoe Manufacturers Ltd, the marginal cost, in dollars, was found to be,

$$C'(x) = x\sqrt{x^2 + 900}$$

where x is the numbers of pairs of Shoes produced per week. What is the increase in cost when production increases from 40 to 80 pairs of Shoes? **(15 Marks)**

EAR OF STUDY	: ONE
EMESTER	: ONE
CADEMIC YEAR	: 2023/2024
ATE	: DECEMBER 8, 2023
URATION	: 3 HOURS (2.00PM – 5.00PM)

STRUCTIONS

The paper has a total of **FIVE** questions.
Attempt any **FOUR** questions **ONLY.**
Your answers should be precise and concise to facilitate the marking process.

ESTION ONE

Use Venn Diagrams to explain seven different set operations **(7 Marks)**

Given that **A** {1, 2} and **B** {a, e} , determine and explain the Cartesian product of **A** and **B.** **(6 Marks)**

The sports committee of Management of MUBS carried out a survey in order to profile the students' preference of three major games; that is Football, Volleyball and Basketball. The following information was gathered after randomly interviewing 145 students. 75 students preferred football, 55 preferred volleyball, 70 preferred basketball, 25 students preferred football and volley ball, 30 preferred football and Basketball, 15 preferred Basketball and volleyball, while 10 liked all the three games.

Required: Use the information provided to:

(6 marks)

i) Present the information using a Venn diagram. (2 marks)

ii) Find the number of students who never preferred all the three games. (2 marks)

iii) Find the number of students who preferred only one of the games. (2 marks)

iv) Find the percentage of students that preferred at least two games. (2 marks)

QUESTION TWO (4 Marks)

A) Explain what the following terms mean in the theory of functions

i) A constant

ii) An independent variable

iii) A dependent variable

(5 Marks)

B) i) If $h(x) = 3x - 5$ and $g(x) = 2x^2 - 7x$, find $(g \circ h)(x)$

(5 Marks)

ii) If $f(x) = 2x - 5$, find the inverse

iii) Bush Transporters Ltd has a depreciation policy for its fleet of trucks of using a straight line method. The current year is coming to an end and external auditors have noted that the books of accounts do not give complete records concerning a truck which was acquired 3 years ago. Its current book value is Ugx 18m/ while its purchase cost was Ugx 42m/ . This type of truck is usually disposed off after 5 years. Use this information to determine the most appropriate linear function for Bush Transport Ltd and estimate the book value at the end of the 4th year of the truck. Also, what will the disposal value of the truck be? (11 marks)

QUESTION THREE

A) Evaluate $f'(x)$ if $f(x) = \frac{e^{2x}}{2x^2+5}$ (6 Marks)

B) Find $\frac{dy}{dx}$ if $y = \ln(2x^2 + 3)$ (6 Marks)

C) The cost of producing x items per week is

$$C(x) = 1000 + 6x - 0.003x^2 - 10^{-6}x^3$$

For the particular item in question, the price at which x can be sold per week is given by the demand equation

p = 12 - 0.0015x.

Required: Determine the volume of sales and price at which the profit will be maximized.

(13 Marks)

QUESTION FOUR

A) i) Evaluate $\int x\, e^{2x^2+1}\, dx$ **(2 Marks)**

ii) Evaluate $\int x^2\, (lnx)\, dx$ **(3 Marks)**

B) A company has established that the supply and demand curves for its product are

Supply: p $200 + x^2$

Demand: p $1{,}200 - 1.5x^2$

(i) Illustrate graphically, areas showing the consumer's Surplus and Producer's surplus, hence determine their values. (3 Marks)

(ii) Evaluate the Producer's Surplus (P.S) and Consumer's Surplus (C.S.). (7 Marks)

C) The marginal revenue of a firm is $R'(x) = 100(30 - x)\, e^{-x/30}$. Find the revenue function and the demand equation of the product. **(10 Marks)**

QUESTION FIVE

A) i) The sum of the series $1 + 8 + 15 + \cdots$ is 396. How many terms does the series contain? **(5 Marks)**

ii) The 2nd, 3rd and 9th term of an arithmetic progression are three consecutive terms of a geometric progression. Find the common ratio of the geometric progression.

(5 Marks)

B) i) Briefly explain what Linear Programming is. **(2 Marks)**

ii) State any three assumptions on which Linear programming is based. **(3 Marks)**

iii) Muko Expert Metal Ltd manufacture s two products, X and Y. Each of these requires a certain amount of time on the assembly line and a further amount of time in the finishing shop. Each item of type X needs 5 hours for assembly and 2 hours for finishing, and each item of type Y needs 3 hours for assembly and 4 hours for finishing. In any week, the firm has available 105 hours of the Assembly line and 70 hours in the finishing shop. The firm can sell all it has produce and makes a profit of $200 on each item of X and $160 on each item of Y. Using the graphical method of Linear Programming, find the number of each type that should be manufactured per week to maximize the total profit. **(10 Marks)**

OF STUDY : ...MI1103

SEMESTER : BUSINESS MATHEMATICS ONE

ACADEMIC YEAR : ONE

DATE : ONE

DURATION : 2022/2023

: 11^{TH} JANUARY, 2023.

: 3 HOURS (2.00PM – 5.00PM)

INSTRUCTIONS

1. The paper has a total of FIVE questions.
2. Attempt any **FOUR** questions ONLY.
3. Your answers should be precise and concise to facilitate the marking process.

QUESTION ONE

a) Mention three problems associated with mathematical modeling. **(4 Marks)**

b) Distinguish between the following terms as used in set theory.

i. Disjoint set and union set. **(3 Marks)**

ii. Cardinality of a set and Compliment of a set. **(3 Marks)**

c) Of the 200 candidates who were interviewed for a Field Officer position, 100 could drive a car, 70 could ride a motor bike and 140 could ride a bicycle. 40 of them could, drive a car and ride a motor bike, 30 could, ride a motor bike and a bicycle and 60 could, drive a car and ride a bicycle and 10 could drive and ride a motor bike and bicycle.

i. Present the following information using a Venn diagram. **(10 Marks)**

ii. Determine the number of candidates who did not know how to operate any of the three modes of transport. **(2 Marks)**

iii. What is proportion of candidates who could operate only one mode of transport? **(3 Marks)**

QUESTION TWO

a.) Distinguish between the following terms as used in the discussion of functions

i. Linear function and Quadratic function. **(2 marks)**

ii. Dependent variable and independent variables. **(2 marks)**

iii. Domain and Range. **(2 marks)**

b.) Given that $f(x) = 8x - x^2$ and $g(x) = 3x + 2$

Determine;

i. $f(2)$ **(2 marks)**

ii. $g \circ f(2)$ **(2 marks)**

iii. $g^{-1}(x)$ **(2 marks)**

iv. The domain of the function $\frac{g(x)}{f(x)}$ and give a reason for your answer. **(4 Marks)**

c.) Kampala Battery manufacturing Ltd has a fixed cost of **6m/=** per week and the cost of labour and materials is **30,000/=** per battery. If the factory produces x batteries per week determine the cost function of this enterprise. If each battery is sold at **50,000/=**, derive the revenue and the profit function. **(9 Marks)**

QUESTION THREE

a) Given $f(t) = \frac{1}{\sqrt{t^2+3}}$, find $f'(t)$. **(4 Marks)**

b) The cost of producing x items per week is

$C(x) = 1000 + 6x - 0.003x^2 - 10^{-6}x^3$

For the particular item in question, the price at which x can be sold per week is given by the demand equation

$p = 12 - 0.0015x$.

Required: Determine the volume of sales and price at which the profit will be maximized. **(8 Marks)**

c) Jinja Timber Leaders Ltd can produce P units of executive sets when it uses L units of labour and K units of capital, where

$P(L,K) = 100\, L^{3/4}K^{1/4}$

(i) Calculate total output when L =81 and K =16 **(4 Marks)**

(ii) Calculate the marginal productivities when L =81 and K =16 **(4 Marks)**

(iii) Make a linear approximation of production when L changes to 80 and K to 15. **(5 Marks)**

QUESTION FOUR

a) Evaluate $\int \frac{2x+3}{(x^2+3x+1)^3}\,dx$ **(5 Marks)**

b) The marginal revenue function of Kabingo Dairy Farm has been modelled to be $R'(x) = 10(20 - x)\, e^{-x/20}$ where x is the number of litres produced per month. Find the revenue function and the demand equation of the milk. **(10 Marks)**

c) Marginal cost of a certain Kikubo Enterprises Ltd. is given by $C'(x) = 15.7 - 0.002x$ whereas the marginal revenue is $R'(x) = 22 - 0.004x$.
Determine the increase in profit when the sales are increased from 500 to 600 units.
(10 Marks)

QUESTION FIVE

a) Micheal works for a company that pays ugx 1 on the first day, ugx 2 on the second day, ugx 4 on the third day and so on. If the daily wage keeps doubling, what is his total income for one month? Take a month to have 31 days. **(6 marks)**

b) The sixth term of an AP is -5 and the tenth term is -21. Find the sum of the first 30 terms. **(6 Marks)**

c) If the fifth term of a GP is 162 and the eighth term is 4374, find the sum of the first 10 terms. **(6 marks)**

d) Using the ratio test of convergence, determine whether the series is convergent or divergent **(7 marks)**

$\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \frac{4}{5} + \cdots$

UNIVERSITY

COURSE NAME	: BBM1103
YEAR OF STUDY	: BUSINESS MATHEMATICS ONE
SEMESTER	: ONE
ACADEMIC YEAR	: 2021/2022
DATE	: MAY 11, 2022
DURATION	: 3 HOURS (2.00PM – 5.00PM)

INSTRUCTIONS

1. The paper has a total of **FIVE** questions.
2. Attempt any FOUR questions ONLY.
3. Your answers should be precise and concise.

QUESTION ONE

A) Distinguish between the following terms as used in set theory

i) Infinite set and Null set **(2 Marks)**

ii) Equal sets and Equivalent sets **(2 Marks)**

iii) Cardinality of sets and Union of sets **(3 Marks)**

iv) Disjoint set and Universal set **(2 Marks)**

B) Given that you have three sets whose elements are less than 7 such that; A is a set of Natural numbers, B is a set of odd numbers and C is a set of prime numbers. Find

i) $A \cap B \cap C$ **(2 Marks)**

ii) $(B \cap C)'$ **(3 Marks)**

iii) $(B \cup C)$ **(2 Marks)**

C) The sports committee of Management of MUBS carried out a survey in order to profile the students' preference of three major games; that is Football, Volleyball and Basketball. The following information was gathered after randomly interviewing 145 students. 75 students preferred football, 55 preferred volleyball, 70 preferred basketball, 25 students preferred football and volley ball, 30 preferred football and Basketball, 15 preferred Basketball and volleyball, while 10 liked all the three games.

Required: Use the information provided to:

i. Present the information using a Venn diagram. **(6 marks)**

ii. Find the number of students who preferred all the three games. **(1 marks)**

iii. Find the number of students who preferred only one of the games. **(1 marks)**

iv. Find the percentage of students that preferred at least two games. **(1 marks)**

QUESTION TWO

A) Distinguish between the following terms as used in the discussion of functions

i. Linear function and Non-linear function. **(2 marks)**

ii. Dependent variable and independent variables. **(2 marks)**

iii. Domain and Range. **(2 marks)**

B) Given that $f(x)=4x-x^2$ and $g(x)=2x-1$

Determine;

i. $f(2)$ **(2 marks)**

ii. $g \circ f(2)$ **(2 marks)**

iii. $g^{-1}(x)$ **(2 marks)**

iv. The domain of the function $\frac{f(x)}{g(x)}$. Justify your answer. **(2 Marks; 2 Marks)**

C) Kampala Battery manufacturing Ltd has a fixed cost of **3m/=** per week and the cost of labour and materials is **15,000/=** per battery.

Required:

i) If the factory produces x batteries per week, determine the cost function of this enterprise. **(3 Marks)**

ii) If each battery is sold at **25,000/=**, derive the revenue and the profit function. **(3 Marks; 3 Marks)**

QUESTION THREE

A) Given a function $f(x) = x^n$; state the general form of the power formula of differentiation and hence find $f'(x)$ given that $f(x) = \sqrt{x} - \frac{1}{x^2}$ **(2 Marks; 3 Marks)**

B) Mukono Enterprises Ltd. has established that the demand equation of their Matooke flour is given as $p = 300e^{-x/20}$, where x is the number of bags sold at a price p (thousands UShs.). If the enterprise has a fixed cost of 500 (thousands UShs.) and the variable cost is 20 (thousands Ushs.) per bag; find the marginal revenue and marginal profit functions.

(3 Marks; 6 Marks)

C) i) A production function of a company has been established to take the form,

$$P(L,K) = cL^a K^b$$

Where a, b and c are positive constants, and $a + b = 1$.

(5 Marks)

Show that $L\frac{\partial P}{\partial L} + K\frac{\partial P}{\partial K} = P(L,K)$.

ii) The production function of KAMU Hides and Skins factory has been established to be;

$$P(L,K,T) = 5L + 2L^2T + 3LT^2K + 10KT + 2T^3LK^3$$

where L is labour in man-hours, K is cost of capital in millions of Shillings and T is thousands of power units consumed per week.

Required:

i) Determine marginal productivities when $L = 5$, $K = 10$ and $T = 15$ **(3 Marks)**

ii) Explain the results in (i) above. **(3 Marks)**

QUESTION FOUR

A) Evaluate the following integral. **(5 Marks)**

$$\int 4x(2x^2 + 1)^5 \, dx$$

B) A company has established the following supply and demand curves for its product:

Supply: $200 + x^2$

Demand: $1{,}200 - 1.5x^2$

Required:

i) Illustrate graphically areas showing the consumer's Surplus and Producer's surplus. **(4 Marks)**

ii) Determine the consumer's Surplus and Producer's surplus. **(5 Marks)**

C) From operation records of Igara Shoe manufacturers Ltd, the marginal cost, in dollars, was found to be,

$$C'(x) = x\sqrt{x^2 + 2500}$$

Where x is the numbers of pairs produced per week. If the fixed costs per week are $ 100, find the cost function. (5 Marks)

D) In Tororo metal works factory, it has been established that a person working for t hours on a particular machine, produces x units in the first period. While the rate of production (number of units per hour) is given by:

$\frac{dx}{dt} = 10(1 - e^{-t/50})$.

Required:

How many units are produced during the person's first 50 hours on the machine?

(6 Marks)

QUSTION FIVE

A) i) Find the sum of the first 20 terms of the progression

$2 + 5 + 8 + 11 + 14 + \ldots\ldots$ **(3 Marks)**

ii) A member of staff of your company agrees to repay his interest-free loan of 5,800,000/= in a number of months, each monthly payment exceeding the previous one by 20,000. If the first payment at the end of the first month is 100,000/=, in how many months will he clear his loan? **(5 Marks)**

B) i) Find the sum of the first 10 elements of the series **2-4+8-16 + …..** **(3 Marks)**

ii) A company acquires a cotton Ginnery machine at **10m/=** and depreciates at an annual rate of **10%** on its reducing value. Its ultimate scrap value is estimated at **5,314, 410/=**. Find the effective life of the machine. **(5 Marks)**

C) A farm owner has two crops grown on his farm; crop **X** and crop **Y**. The farm majorly depends on three resources for production; that is land, labour and time. Crop **X** requires 2 acres of land for production, **5** units of labour and **1** hour for cultivation. Production of crop **Y** requires 1 acre of land, 5 units of labour and **3** hours for cultivation. There is a total **14** acres of land available for production, a total of 40 workers and only 18 hours of the week for cultivation. The objective of the farmer is to cultivate **50** units of crop **X** per week and 30 units of crop **Y** per week. Using any linear programming techniques, determine the combination of crops that will maximize profits. **(9 Marks)**

END OF EXAMNATION PAPER

C) From operation records of Igara Shoe manufacturers Ltd, the marginal cost, in dollars, was found to be,

$$C'(x) = x\sqrt{x^2 + 2500}$$

Where x is the numbers of pairs produced per week. If the fixed costs per week are $ 100, find the cost function. (5 Marks)

D) In Tororo metal works factory, it has been established that a person working for t hours on a particular machine, produces x units in the first period. While the rate of production (number of units per hour) is given by:

$\frac{dx}{dt} = 10(1 - e^{-t/50})$.

Required:

How many units are produced during the person's first 50 hours on the machine?

(6 Marks)

QUSTION FIVE

A) i) Find the sum of the first 20 terms of the progression

$2 + 5 + 8 + 11 + 14 + \ldots\ldots$ (3 Marks)

ii) A member of staff of your company agrees to repay his interest-free loan of 5,800,000/= in a number of months, each monthly payment exceeding the previous one by 20,000. If the first payment at the end of the first month is 100,000/=, in how many months will he clear his loan? (5 Marks)

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END OF EXAMNATION PAPER

BER 20, 2019

TIME: 2:00 – 5:00 PM

INSTRUCTIONS:

1. Attempt ONLY Four Questions in ALL
2. Section A is COMPULSORY
3. Choose One question from each of Section B and C
4. Your answers should be precise and concise

SECTION A

QUESTION ONE

a) Distinguish between the following terms as used in business mathematics
   i) Quantitative and Qualitative Variable (2 Marks)
   ii) Data and Model (2 Marks)
   iii) Equation and Rational number (2 Marks)

b) Citing an example of an organizational challenge, explain how the mathematical analysis approach can be used to solve the challenge. (15 Marks)

c) Explain any two situations when the mathematical analysis approach would not be the most appropriate to solve an organization challenge. (4 Marks)

QUESTION TWO

a) A survey of 600 workers in a plant indicated that 410 owned houses, 480 owned cars, 530 owned Televisions, 410 owned cars and televisions, 340 owned cars and houses,370 owned houses and Televisions and 300 owned all the three. Determine using a Venn diagram; (3 Marks)
   i) Number of people who owned none of the items mentioned. (2 Marks)
   ii) Number of people who owned only one item. (2 Marks)
   iii) Number of people with at least two items (2 Marks)

b) MUBBS Limited specializes in renting out certain types of equipment. In their planning process they have invited you to analyse the relationship between profit and the number of units of the equipment rented out. Provide in table 1 are daily units rented out and profits.

Table 1: Daily units rented out and profits.

Number of units rented out per day	Total daily profit Thousands
20	600
30	1100
40	1400

Assuming that the relationship between profit and the number of units of equipment rented out is linear. Determine the function relating the daily profit (p) and the number of units (x) rented out. **(7 Marks)**

c) i) Given the functions $h(x)=3x-5$ and $g(x)=2x^2-7x$. Find the composite function, $g \circ h(x)$ **(2 Marks)**

ii) Prove by induction that $1^2+2^2+3^2+.....+(n-1)^2+n^2=\frac{n(n+1)(2n+1)}{6}$ for every positive integer n. **(5 Marks)**

ii) Evaluate $\lim_{x\to 2}\frac{x^2-4}{x-2}$ **(2 Marks)**

SECTION B

QUESTION THREE

a) Sarah is carrying out a series of experiments which involve using increasing amounts of a chemical. In the first experiment she uses 6g of the chemical and in the second experiment she uses 7.8g of the chemical. Given that the amounts of the chemical used form an arithmetic progression, find the total amount of chemical used in the first 30 experiments. **(4 Marks)**

b) A vehicle manufacturing company that makes 200 vehicles each month plans to increase its production. The number of vehicles produced is to be increased by 20 each month from 200 in month 1 to 220 in month 2, to 240 in month 3 and so on until it is producing 600 in month N. **(4 Marks)**

i) Find the value of N

ii) The company then plans to continue to make 600 vehicles each month. Find the total number of vehicles that will be made in the first 52 months starting from and including month 1. **(5 marks)**

c) With examples, distinguish between convergent and divergent series. **(4 Marks)**

d) Use D' Alembert's ratio test to check whether the series below converges or diverges. (3 Marks)

$$1 + \frac{2^2}{3} + \frac{3^2}{5} + \frac{4^2}{7} + \ldots\ldots\ldots$$

QUESTION FOUR

a) Write short notes on the following terms as applied in linear programming.

i) Optimal solution **(2 Marks)**

ii) Decision variables **(2 Marks)**

iii) Feasible region **(2 Marks)**

b) Explain any four assumptions of linear programming. **(8 Marks)**

c) Using the simplex method of solving linear programming problems, **(11 Marks)**

Maximize: $\pi = 4x_1 + 3x_2$

Subject to: $2x_1 + x_2 \leq 50$

$x_1 + 3x_2 \leq 90$

$x_1, x_2 \geq 0$

SECTION C

QUESTION FIVE

a) Using examples, briefly explain any **FOUR** business or economic applications of derivatives. **(4 Marks)**

b) Given that a function Z depends on two variables X, and Y such that; $Z = f(x, y)$.

i) State the first order conditions for Z to be optimized. **(2 Marks)**

ii) Suppose the matrix H represents the hessian determinant of the second derivatives of the function Z above as:

$H = \det\begin{pmatrix} Z_{XX} & Z_{XY} \\ Z_{YX} & Z_{YY} \end{pmatrix}$, state the second order conditions for Z to be minimum and maximum extrema points. **(4 Marks)**

c) Suppose the market demand for company's product is defined as $P = 300 - 12Q$, and the company's cost function is $TC = 660 + 12Q$. Where Q represents the units of a good and P is the price in USD.

Determine:

a) The value of Q and the total revenues if the company operates at break-even point. **(8 Marks)**

b) The value of Q and the company's marginal revenue if the managers maximize profits. (7 Marks)

QUESTION SIX

a) The quantity demanded for a good A is defined by the function

$$Q_A^d = 200 - 4P_A + 0.4Y + 0.3P_B,$$

where P_A is good A's own price, P_B is price for good B, and Y is consumers disposable income. Suppose $P_A = 10$ USD, $P_B = 20$ USD, and Y = 500 USD,

Determine:

i) The Price and Income elasticity of demand for good A. **(2 Marks, 2 Marks)**

ii) Comment on the relationship between goods A and B. (2 Marks)

b) Briefly explain the relationship between differentiation and integration as business mathematics calculus concepts. (2 Marks)

c) The demand and supply of a good is defined by the functions $P = 600e^{-0.3Q}$ and $P = 4e^{0.8Q}$, respectively.

i) Determine the price and quantity when the market is at equilibrium. **(3 Marks, 3 Marks)**

ii) Calculate the consumer's surplus, producer's surplus, and total surplus. **(3 Marks, 3 Marks, 2 Marks)**

iii) Suppose the government wishes to implement a policy that set the minimum selling price of this good above the equilibrium price. Briefly explain the effect of this policy on consumer surplus and producers' profits (3 Marks)

B-MATH, FINALS done

MAKERERE UNIVERSITY BUSINESS SCHOOL

END OF SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF BUSINESS STATISTICS & BACHELOR OF SCIENCE IN ACCOUNTINGOF MAKERERE UNIVERSITY ACADEMIC YEAR 2018/2019

Final 40:3

COURSE NAME: BUSINESS MATHEMATICS I **YEAR OF STUDY:** ONE

COURSE CODE: BBM1103 **DATE:** 21/NOVEMBER/2018

SEMESTER: ONE **TIME:** 2:00 – 5:00 PM

INSTRUCTIONS:

1. Attempt ONLY Four Questions in ALL
2. **Question ONE is COMPULSORY**
3. Your answers should be precise and concise

QUESTION ONE

A paper presenter in the 14th ORSEA Conference held at Dar es Salaam commented that; Whereas, Quantitative or Mathematical modelling is fronted as the most appropriate approach to managerial decision making making, Business managers ought to also accord particular attention, Qualitative factors that may affect the decision(s) in question.

Arising from the above statement, answer the following questions;

i. With examples, distinguish between Qualitative and Quantitative variables. **(3 Marks)**

ii. Using an organizational illustration, explain the steps involved in the Quantitative or Mathematical analysis approach. **(18 Marks)**

iii. Explain the situations in which the quantitative analysis approach may be limited in regard to managerial decision making. **(4 Marks)**

QUESTION TWO,

a) Given the functions f(x) and g(x), defined as; $f(x)=x^2-4x+2$ and $g(x)=3x-7$

Find (2 Marks)

i. $g \circ f(3)$ (2 Marks)

ii. $f \circ g(x)$

b) Evaluate the following

i. $\lim_{x\to 2}\frac{x^2-4}{x-2}$ (3 Marks)

ii. $\lim_{x\to 0}\frac{\sqrt{x+1}-1}{x}$ (3 Marks)

c) A salesman's daily wages is composed of a fixed amount and a variable component, which is dependent on the number office cream units sold. He finds that when he sells 10 units on a given day, he earns Sh 60,000 and when he doubles his sales his earnings increase by only Sh 10,000. Determine;

i. The amount of commission he gets per unit sold? (3 Marks)

ii. The salesman' minimum earning per day? (3 Marks)

iii. The salesman's earnings if he sells 40 units? (3 Marks)

iv. How many more units must he sell in order to achieve his target of earning of Shs. 350,000 tomorrow, given that has received a guaranteed order for 20 units today. (6 Marks)

QUESTION THREE

a) Prove by mathematical induction that for every integer n ϵ Ñ, it follows that

$$1^2+2^2+3^2+\ldots\ldots\ldots\ldots+(n-1)^2+n^2=\frac{n(n+1)(2n+1)}{6}$$ 9 Marks

b) A company has a range of computer facility assistants, each of whom is competent in the use of at least one of 3 utility packages: Word processor (W), Database Management System (D) and a Spreadsheet(S). A survey shows that 30 can use a word processor, 25 can use a Database Management System and 28 are competent in the use of a Spreadsheet. Of the Computer facility assistants who can use a Database Management System, 14 can

also use a Word Processor while 6 have no other skill. 6 of the Computer Assistants can use a Word Processor and Spreadsheet but not a Database Management System while 4 have all three skills.

Required:

Determine the number of Computer Facility Assistants who are members of the following sets.

i. $W \cup D \cup S'$ 4 Marks

ii. $(W \cup S)' \cap S$ 4 Marks

iii. $D \cap S$ (4 Marks)

iv. Universal set (4 Marks)

QUESTION FOUR

a) You have been appointed as the new General Manager at KONKA hardware LTD. Mr. Kakeeto, the owner of the organization has analyzed and found out that the total cost (TC) and total revenue (TR) functions of his organization are as follows;

$TC = 570 + 2Q^2 - 60Q$

$TR = 100 - 7Q^2 + 280Q$

Where Q is the quantity produced by the organization.

Using the information provided to you, help Mr. Kakeeto to determine;

i. The quantity produced in order to minimize costs (4 marks)

ii. The quantity produced in order to maximize revenue (4 marks)

iii. The quantity produced in order to maximize profits (5 marks)

iv. The maximum profit (4 marks)

b) Given the supply equation and demand equation as;

$P = \frac{1}{12}Q + 1$ and $P = -\frac{1}{4}Q + 9$ respectively.

Estimate the Consumer surplus and Producer surplus if the price is 3units. (8 Marks)

QUESTION FIVE

a) With examples, distinguish between an Arithmetic sequence and Geometric sequence.
(4 Marks)

b) In the year 2000, a shop sold 150 computers. Each year the shop sold 10 more computers than the year before, so that the shop sold 160 computers in 2001, 170 computers in 2002, and so on. By applying the knowledge of sequences and series,

i. How many computers were sold in 2007? **(4 Marks)**

ii. Calculate the total number of computers the shop sold from 2000 to 2015 inclusive.
(4 Marks)

c) Kana is contracted to do a business for 20 years. In the first year, she earns a salary of $25000. If her salary is doubled each year, how much salary will she have accumulated at the end of her contract? **(5 Marks)**

d) Use D' Alembert's ratio test to check whether the series below converges or diverges.

$$1+\frac{2^2}{3}+\frac{3^2}{5}+\frac{4^2}{7}+\ldots\ldots$$ **(8 Marks)**

QUESTION SIX

a) Define the term linear programming as applied in business mathematics and explain any three of its applications in business. **(6 Marks)**

b) Explain any four limitations of linear programming. **(4 Marks)**

c) Using the simplex method of solving linear programming problems, **(15 Marks)**

Maximize: $\pi = 4x + 3y$

Subject to: $2x + y \leq 50$

$x + 3y \leq 90$

$x, y \geq 0$

END OF QUESTION PAPER

MATH, FINALS

Daniel 12.1.18

MAKERERE UNIVERSITY BUSINESS SCHOOL

FINAL EXAMINATION FOR THE DEGREE OF
BACHELOR OF BUSINESS STATISTICS & BACHELOR OF SCIENCE IN ACCOUNTING OF MAKERERE UNIVERSITY ACADEMIC YEAR 2017/2018

COURSE NAME: BUSINESS MATHEMATICS I YEAR OF STUDY: ONE

COURSE CODE: BBM1103 DATE: 29/NOVEMBER/2017

SEMESTER: ONE TIME: 2:00 – 5:00 PM

INSTRUCTIONS:
1. Attempt ONLY Four Questions in ALL
2. **Question ONE is COMPULSORY**
3. Your answers should be precise and concise

QUESTION ONE

The mathematical analysis approach is the best approach to arrive at managerial decision.

i. Using examples what is meant by the mathematical analysis approach. **(21 Marks)**

ii. Explain how the mathematical analysis approach would fail at modeling business problems. **(4 Marks)**

QUESTION TWO

a) The sets L, M and N in a universal set consisting of the first 10 lower-case letters of the alphabet are L = {a, b, c} M = {b, c, a, e} N = {a, d, e, f}

Required:
Using a Venn Diagram determine members of the following sets: **(5 Marks)**

i) L^c **(2 Marks)**
ii) $L \cap M \cap N^c$ **(2 Marks)**
iii) $(L \cap M \cap N)^c$ **(2 Marks)**
iv) What is the cardinality of L X M X N **(2 Marks)**

If $f(x) = x^2 - 4x + 2$ and $g(x) = 3x - 7$, find $(f \circ g)(x)$. **(3 Marks)**

II. If $g(x) = -6x + 5$ and $h(x) = -9x - 11$, find $(g \circ h)(x)$. **(3 Marks)**

c) Using Mathematical Induction, prove that that the rule below is true for every natural number

$$1+2+3+\ldots\ldots\ldots\ldots\ldots\ldots+(n-1)+n = \frac{n(n+1)}{2}$$ **(6 Marks)**

QUESTION THREE

a) Find the first and second derivatives of the following functions (3 marks)

i) $xy = 3x^3 - 2x(x+3)$ (5 marks)

ii) $y = \frac{2(x-1)}{x^2+6}$

c) Mary and Joseph are traders. According to their records, it is established that their revenue is governed by $R = -3q^2 + 1200q$. The cost was established to be represented by $C = 5q^2 - 2200q$. They were however not sure how to proceed from this point into other operations related to the financials of their business. Nonetheless, they have been able to identify what they currently want to know. Find:

i.) The marginal revenue and marginal cost functions (5 marks)
ii.) The profit function (3 marks)
iii.) The quantity to be sold in order to minimize costs (4 marks)

QUESTION FOUR

a) Explain any five (5) assumptions of linear programming. (10 marks)

b) Using simplex tableau method, solve the following linear programming model given x and y as decision variables (15 marks)

Maximize $P = 70x + 50y$

St

$4x + 3y \leq 240$

$2x + y \leq 100$

$x \geq 0$

$y \geq 0$

QUESTION FIVE

a) Distinguish between arithmetic and geometric sequences. (4 marks)

b) Find the sixth terms of the following sequences

i) 2, 4, 6, 8, 10, … (4 marks)

ii) $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \ldots$ (4 marks)

c) A Television Station considered giving away $ 4,000 every day in the month of August for a total of $ 124,000. Instead, they decided to increase the amount given every day while still giving the same total amount. If they want to increase the amount by $ 100 each day, how much should they give away the first day? (4 marks)

d) Using the ratio test, test the convergence of $\frac{1}{1} + \frac{3}{2} + \frac{5}{2^2} + \frac{7}{2^3} + \ldots$ (9 marks)

END OF QUESTION PAPER