

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE
OF BACHELOR OF COMMERCE

BCOM 161: BUSINESS MATHEMATICS I

STREAMS: BCOM

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 06/12/2017

2.30 P.M. – 4.30 P.M.

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

- (a) Explain the following terms as used in set theory.
- (i) Finite set [2 marks]
 - (ii) Universal set [2 marks]
- (b) Given that the supply function of an item is $P = 64 + 32Q + 4Q^2$ while the demand function is defined by $P + 12Q^2 = 12Q^2 = 1744 + 24Q$. Determine value of Q where the supply and demand functions intersect. [6 marks]
- (c) Determine the composition of the given sets given that $P = \{p: p \text{ is an even positive integer less than } 24\}$, $R = \{1, 3, 5, 6, 9\}$ and $Q = \{2, 4, 6, 7\}$
- (i) $P \cap Q$ [2 marks]
 - (ii) $n\{R \cup P\}$ [2 marks]
- (d) Multi-choice ltd company manufactures GoTV decoders and sells them for sh. 5000 each. The total cost function is linear. The cost for 100 decoders is sh. 436, 000 while the total cost for 250 decoders is sh. 706, 600. Let x be the number of decoders manufactured and sold.
- (i) Obtain an expression for total cost function. [4 marks]
 - (ii) Find the quantity at which the firm will break even. [2 marks]

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- (e) A US micro-finance bank operating in Kenya provides low cost consumer loan services. A client wishes to borrow a loan to be repaid in equal five annual installments of \$1285.46. A section of the loan repayment schedule is provided in the table below.

Year	Beginning balance	Annual installment amount	Interest payment	Principal payment	Ending balance
1	??	1285.46	450	??	4164.54
2	??	1285.46	??	??	??
3	??	1285.46	??	??	??
4	??	1285.46	??	??	??
5	??	1285.46	??	??	??

Required: complete the table [4 marks]

- (f) Ksh. P invested for n years at a compound rate of interest. The future value that accrues is given by $A = P(1 + R/100)_n$ and the interest earned $I=A-P$. Find the amount (A) and interest (I) for the given P, n, R.
- (i) Ksh. 2400 for $2\frac{1}{2}$ years at 6% compounded annually. [3 marks]
- (ii) Ksh. 1800 for $3\frac{1}{2}$ years at 20% compounded semi-annually. [3 marks]

QUESTION TWO (20 MARKS)

- (a) Explain the meaning of the following pair of terms as used in financial mathematics
- (i) An ordinary annuity and an annuity due [2 marks]
- (ii) Marginal revenue and marginal profit [2 marks]
- (b) Calculate the number of permutations of letters in the word 'DEPARTMENTALIZATION'. [2 marks]
- (c) Solve X in the equation $\log_3 3 + \log_x 27 = 2$ [2 marks]
- (d) The demand function for a certain products is given by $P = 100e^{0.01Q}$ where P is the price per unit (in sh.) when Q units are sold. Suppose the total cost functions given by $TC = 400Q$
- (i) What quantity of the product (to the nearest whole number) will be demanded at a price of sh. 2000 [2 marks]

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- (ii) Calculate the break even quantity (to 1d.p) and price for the product at that point.
[4 marks]

QUESTION THREE (20 MARKS)

- (a) The sum of the series $1+8+15+\dots$ is 396. How many terms does the series contain?
[2 marks]
- (b) A company has a customer base of 20 000 and projects a growth rate of 2% per year for the next 20 years. What will be the number of customers in the 20th year? (Apply sequences and series).
[3 marks]
- (c) Consider the word INTEGRAL.
- (i) How many permutations are possible if all the letters are taken at once?[3 marks]
- (ii) In how many of the permutations in (i) above is A and G next to each other?
[3 marks]
- (d) Use the binomial theorem to find the first three terms in ascending powers of x of $\left(1 - \frac{x}{2}\right)^4$. Hence use your expansion to estimate the value of $(0.992)^4$ [5 marks]
- (e) Juma wants to invest in an insurance policy that requires a deposit of ksh. 10,000 at the end of each year for 8 years. The policy provides compound interest rate at 9% p.a. how much would have accumulated at the end of the 8th year. [4 marks]

QUESTION FOUR (20 MARKS)

- (a) Suppose the profit function of a firm's product is linear and the marginal profit is ksh. 5. If the profit is equal to sh. 200 when 125 units are sold. Write down the equation of the profit function and hence determine the quantity of sales where the firm will break even.
[6 marks]
- (b) A mutual fund offers an investment opportunity where an investor will deposit some amount with the following investment terms:
- (i) A deposit of sh. 20,000 to earn 8% p.a. interest compounded annually for a period of four years.
- (ii) A deposit of sh. 20,000 to earn 6% interest compounded semi-annually for a period of four years.
- By how much will the interest earned over the holding period differ between the two options?

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(c) Consider the following data on students in Eco-tourism management department. It was found that 130 studied French, 90 studied German, 84 studied Russian, 40 studied French and Russian, 30 studied German and Russian, 50 studied French and German while 16 studied all the three languages. 119 students were not studying any of the language. Let F, G and R denote sets of students studying French, German and Russian respectively.

- (i) Represent the data using a Venn diagram. [2 marks]
Find the number of students:
- (ii) Who were actually involved in the survey [2 marks]
- (iii) Studying exactly one language [2 marks]
- (iv) Studying exactly two languages [2 marks]
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