



GARISSA UNIVERSITY

**UNIVERSITY EXAMINATION 2017/2018 ACADEMIC YEAR ONE
FIRST SEMESTER EXAMINATION**

SCHOOL OF BUSINESS AND ECONOMICS

FOR THE DEGREE OF BACHELOR OF BUSINESS MANAGEMENT

COURSE CODE: BBM 115

COURSE TITLE: BUSINESS MATHEMATICS II

EXAMINATION DURATION: 3 HOURS

DATE: 14/12/17

TIME: 09.00-12.00 PM

INSTRUCTION TO CANDIDATES

- The examination has SIX (6) questions
- Question ONE (1) is COMPULSORY
- Choose any other THREE (3) questions from the remaining FIVE (5) questions
- Use sketch diagrams to illustrate your answer whenever necessary
- Do not carry mobile phones or any other written materials in examination room
- Do not write on this paper

This paper consists of FIVE (5) printed pages

please turn over



QUESTION ONE (COMPULSORY)

YOU MAY FIND THE FOLLOWING FORMULAE USEFUL TO ANSWER THE QUESTIONS IN THIS PAPER.

1. **Compound Interest Formula, $A = P(1 + i)^n$**
2. **Continuous compounding, $A = Pe^{rt}$**
3. **Future Value of an annuity, $FV = R \left[\frac{(1+i)^n - 1}{i} \right]$**
4. **Loan amortization, $P = V \left[\frac{i(1+i)^n}{(1+i)^n - 1} \right]$**

- (a) Define the following terms as used in business: **[2 marks]**
- i. an annuity
 - ii. A perpetuity
- (b) How long does it take to save \$500,000 if you place \$500 per month in an account paying 6% per year compounded monthly? **[3 marks]**
- (c) Given that $y = 4x^3 - 7x^2 + 5x - 3$ find $\frac{dy^2}{dx^2}$ **[2 marks]**
- (d) Find the slope of the function $f(x) = 6x^2 - 0.5x^3$ when $x = 10$ **[3 marks]**
- (e) Given the demand function $P = 20 - 3Q$. Determine the revenue function and the marginal revenue function. **[4 marks]**
- (f) Evaluate $\int_1^3 \frac{1}{x^2} dx$ (2 marks)
- (g) The marginal cost (MC) function is given by $MC = 18 + 12Q - 9Q^2$ and $TC = 100$ when $Q = 0$. Find the total cost (TC) function. **[3 marks]**
- (h) To save for retirement, Mary decides to deposit Ksh 206,000 into an Individual Retirement Account (IRA) each year for the next 30 years. What will the value of the IRA be when she makes his 30th deposit? Assume that the rate of return of the IRA is 4% per annum compounded annually. **[3 marks]**
- (i) How much money should be invested now at 8% per year so that after 4 years, the amount will be Ksh. 1,034,500 when the interest rate is compounded continuously **[3 marks]**



QUESTION TWO

- (a) Use the chain rule to find the derivative of y with respect to x given that;

$$y = (3x^2 - 2)^4 \quad [4 \text{ marks}]$$

- (b) Differentiate the function $y = (2x + 1)(5x^2 - 1)$ with respect to x . [2 marks]

- (c) A firm produces Q tons of a valuable metal per month a total cost (TC) given by

$$TC = \frac{1}{3}Q^3 - 5Q^2 + 75Q + 10$$

Find at what level of output (Q), the marginal cost attains minimum. [5 marks]

- (d) The cost function of a firm is given by $C = 100 + Q + 2Q^2$ where Q is the output.

- (i) Determine average cost (AC) function and the marginal cost (MC) function.

- (ii) Show that the slope of the AC function is given by $\frac{1}{Q}(MC - AC)$ [4 marks]

QUESTION THREE

- (a) The output, Q for a firm over time, t in years is given by the function

$$Q = \frac{t^3}{30} + \frac{t^2}{5} + \frac{3t}{10} + 120$$

Determine the years in which the output is at maximum and minimum [5 marks]

- (b) The cost function of a firm is given by $C = 680 + 4Q + 0.1Q^2$ and the demand function is given

$$P = 12 - \frac{Q}{500}$$

- i. Find the profit (π) function. [3 marks]
- ii. Determine the marginal profit function and hence find the production level (q), that will maximize the profit? [3 marks]
- iii. Using the second derivative, confirm that the production level (q) found in (ii) above, will give the maximum profit. [3 marks]
- iv. What is the maximum profit? [1 mark]



QUESTION FOUR

The demand function for a good is given by $P = 50 - 2Q$, while the total cost (TC) is given by $TC = 160 + 2Q$, where P is the price and Q is the quantity.

- i. Write down expressions for the total revenue (TR) function, the marginal revenue (MR) function. **[4 marks]**
- ii. Sketch the TC and TR functions on the same diagram **[4 marks]**
- iii. Find algebraically, in terms of Q, when the firm breaks even and when makes a profit **[4 marks]**
- iv. Find the marginal profit at $Q = 1$. **[3 marks]**

QUESTION FIVE

- (a) Find the area bounded by the curve $y = x^2$, the x-axis and the lines $x = 2$, and $x = 5$. **[3 marks]**
- (b) The marginal propensity to consume (MPC) out of national income Y is 0.65. Find the corresponding savings function(S) given that $S = -45$ when $Y = 0$ **[4 marks]**
- (c) A production manager has compared the dexterity test scores of five assembly-line employees with their hourly productivity. The data are recorded in the table below.

Employee	1	2	3	4	5
Score on dexterity test (x)	12	14	17	16	11
Units produced per hour (y)	55	63	67	70	51

- i. Determine the least squares regression line, which may be used to predict the units, produced per hour from the score on dexterity test. **[6 marks]**
- ii. Estimate the hourly productivity of an employee whose score on dexterity test is 20 **[2 marks]**



QUESTION SIX

- (a) Define the term loan amortization **[1 mark]**
- (b) John intends to amortize a loan of \$10,000 at a rate of 5% per year in six years. He decides to make annual equal payments at the end of each year. How much will John pay annually **[3 marks]**
- (c) Mrs. Kimani has just purchased a \$300,000 house and has made a down payment of \$60,000. She plans to amortize the balance at 6% per year for 360 months. What is her total interest payment **[4 marks]**
- (d) Calculate the time it will take for certain amount money invested at a rate of 10% per year compounded quarterly to increase by 50%. **[3 marks]**
- (e) To provide for future education costs, a family makes deposits \$9,269 in a savings account that pays an interest rate of 4% per year compounded continuously. What will be the amount of the savings after 3 years. **[4 marks]**

