



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

MAY – JULY 2015 TRIMESTER

FACULTY OF COMMERCE

DEPARTMENT OF ACCOUNTING AND FINANCE

REGULAR PROGRAMME

CMS 500: BUSINESS MATHEMATICS

Date: JULY 2015

Duration: 3 Hours

INSTRUCTIONS: Answer ALL Questions

- Q1. a) Oil is pumped from an oil field at a constant rate each year, so that its oil reserves have been decreasing linearly with time. Geologists estimates that reserves were 400,000 barrels in the year 2002 and 320,000 barrels in 2012.
- i Write an equation describing the amount of oil left in the field at any time. **(3 marks)**
 - ii How much oil (in barrels) was in the field in the year 2007? **(1 mark)**
 - iii If the trend continuous when will the oil well dry out? **(2 marks)**
- b) Consider a product with the following data:
- price per unit = shs 200
- Variable cost = shs 140
- Fixed cost = shs 800,000
- i Determine the breakeven sales. **(2 marks)**
 - ii Sales units required to make a profit of shs 2 million. **(2 marks)**

- c) For a certain commodity the demand equation is given by $\Delta = -3p + 20$. At a price of £1, four units of the commodity are supplied. If the supply equation is linear and the market equilibrium price is £4, find the supply equation. **(4 marks)**
- d) A sales man's daily wages is composed of a fixed amount and a variable component which is dependent on the number of ice-cream units sold. He finds that when he sells 10 units on a given day, he earns shs 600 whereas when he doubles his sales his earnings increase only by kshs 100.
- Determine the fixed earnings and the level of commission earned per unit sold (hint a system of linear equations could be of help) **(4 marks)**
 - What are the salesman's earnings if he sells 30 units? **(1 mark)**
 - On a given day, the salesman is determined to earn shs 3500. Suppose on the previous day he had guaranteed orders of 20 units, how many more must he sell in order to achieve his target earnings? **(2 marks)**
- e) A major bank offers a credit card which can be used domestically. Data gained over time indicate that the collection percentage for credit issued in any month is an exponential function of of the time since the credit was issued. Specifically the function approximating the relationship is:

$p = f(t) = 0.9(1 - e^{-0.08t})$, for $t > 70$, where p equals to the percentage of accounts receivable (in shillings) collected t months after the credit is granted.

- What percentage is expected after 3 months. **(2 marks)**
- What value does p approach as t increases without limit (bound) and hence what is the expected percentage of bad debts. **(2 marks)**

Q2. a) Using differential calculus:

- Determine the slope at the point $(16, \frac{1}{4})$ of the curve

$$y = \frac{1}{\sqrt{x}} \quad \textbf{(3 marks)}$$

ii Determine the turning point (s) of the function $y = 2x^3 + 3x^2 - 12x + 24$ and the nature of the rest point (s) **(6 marks)**

b) The AUCMA company with a manufacturing plant in Kenya assembles and sales x television sets per month. The monthly cost and price – demand equations:

$$c(x) = 60,000 + 60x$$

$$p(x) = 200 - \frac{x}{50}, \text{ for } 0 \leq x \leq 10,000$$

i Find the company's revenue function. **(1 mark)**

ii Find the production level that will maximize profit and the price the company should charge for each television set. **(5 marks)**

c) Evaluate the following integrals:

i $\int_0^4 9x^{1/2} dx$ **(3 marks)**

ii $\int x^2(x^3 + 1)dx$ **(3 marks)**

d) The marginal cost of a certain firm is given by the equation

$$\frac{dx}{dx} = 4 - 0.2x \qquad 0 \leq x \leq 10$$

Where C is in units of thousands of shillings and quantity x produced is in hundreds of units per day. If the number of units produced changes from 200 to 500 units what is the change in cost? **(4 marks)**

Q3. a) To investigate the relationship between monthly household spending on charitable goods (y) and household disposable income(x) a sample of 100 households was taken and the following were calculated from the sample data:

$$\sum xi = 2,600 \qquad \sum yi = 800 \qquad \sum xi yi = 22,600$$

$$\sum xi^2 = 75,300 \qquad \sum \sum yi^2 = 7,230$$

Where Y represents annual household spending on durable goods (in '000') and x represents household disposable income (in '000')

- i Calculate the equation of the least squares regression line. **(10 marks)**
- ii Predict annual spending on durable goods for a household whose disposable income is kshs 30,000. **(2 marks)**
- iii Compute the coefficient of correlation and the coefficient of determination and comment on the results. **(7 marks)**
- b) Suppose that while you are computing the equation of the least squares regression line, you found that the sixth pair of the 10 pairs ($x_6=15, y_6 = 5$) were copied wrongly and the correct values should have been ($x_6 = 10, y_6 = 20$) Given that the following computations had already been done before the mistake was discovered:

i $\sum_{i=1}^{10} y_i$ **(2 marks)**

ii $\sum_{i=1}^{10} x_i$ **(2 marks)**

iii $\sum_{i=1}^{10} x_i y_i$ **(2 marks)**

END