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**KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR**  
**THIRD YEAR, SECOND SEMESTER EXAMINATION**  
**FOR THE BACHELOR OF BUSINESS & INFORMATION TECHNOLOGY**  
**KMA 2313– MANAGEMENT MATHEMATICS**

Date: 12<sup>TH</sup> April 2024  
Time: 8:30AM – 10:30AM

**INSTRUCTIONS TO CANDIDATES**

**ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS**

**QUESTION ONE (30 MARKS)**

- a) Use elimination method to solve the following equation;
- $$\begin{aligned} 2x + y &= 8 \\ 3x - 2y &= -2 \end{aligned}$$
- (2 Marks)
- b) Given that  $h(x) = x^{\frac{1}{2}} - x$ ,  $g(x) = x + 5$  and  $f(x) = x^2$ . Find the values of
- $f(h(25))$  (2 Marks)
  - $g(f(x))$  (1 Marks)
- c) Evaluate the  $\lim_{x \rightarrow 0} \frac{x - \sin x}{x^3}$  (2 Marks)
- d) Evaluate the following definite integral  $\int_0^{\frac{\pi}{6}} x \sin x^2 dx$  (3 Marks)
- e) Find the derivatives of the following
- $y = \ln(x^2 + 3x + 1)$  (3 Marks)
  - $y = \frac{1 + \cos x}{1 - \cos x}$  (2 Marks)
  - $y = 5x^3 \sin x$  (2 Marks)
- f) Evaluate the following integrals:
- $\int (2x + 1)^4 dx$  (2 Marks)
  - $\int x \sin x dx$  (2 Marks)
- g) Gerald's current salary is shs 40,000 per year. His annual pay raise is always a percentage of his salary at the time. What would his salary be if he got four consecutive 4% increase? (2 Marks)
- h) Solve the following quadratic equation  $3x^2 - 2x - 1 = 0$  using factorization method. (3 Marks)
- i) In a survey of 250 people in a town, it was found that 100 liked brand A, 150 brand B and 40 used A and B. How many people:
- Did not use any these brands. (2 Marks)
  - Used only one brand. (2 Marks)

## **QUESTION TWO (20 MARKS)**

- a) A company receives Ksh.4500/= for each of unit of output sold. It has a variable cost of Ksh.2500 per item and a fixed cost of Ksh.160, 000.
- Formulate the profit function (3 Marks)
  - What is its profit if it sells 250 Items (1 Mark)
- b) Solve  $2x^2 + 22x - 84 = 0$
- By completing the square method. (3 Marks)
  - Quadratic Formula (3 Marks)
- c) If the demand function for a product is given by  $p^2 + 2q = 1600$ , and the Supply function is given by  $200 - p^2 + 2q = 0$  find the equilibrium quantity and equilibrium price. (4 Marks)
- d) A plant makes aluminum and copper wire. Each pound of aluminum wire requires 5 kWh of electricity and 1/4 hr. of labor. Each pound of copper wire requires 2 kWh of electricity and 1/2 hr. of labor. Production of copper wire is restricted by the fact that raw materials are available to produce at most 60 lbs. /day. Electricity is limited to 500 kwh/day and labor to 40 person–hrs. /day. If the profit from aluminum wire is \$25/lb. and the profit from copper is \$40/lb. Formulate a linear programming problem that maximizes the plant's profit and solve it graphically. (6 Marks)

## **QUESTION THREE (20 MARKS)**

- a) Find the Interest on a deposit of ten thousand shillings for 3 years at a rate of interest of 10% p.a. compound interest. (3 Marks)
- b) Solve the following simultaneous equations using the matrix method
- $$\begin{aligned}5x - 2y &= 3 \\ y - 3x &= -2\end{aligned}$$
- (4 Marks)
- c) If the deposit of 2000 shillings earns a simple interest of 200 shillings after a period of 5 years, find the rate of interest p.a. (3 Marks)
- d) An investment of Ksh.100,000 is expected to earn an interest rate of 12% p.a. Calculate the value of the investment at the end of year two if:
- Interest is paid annually (2 Marks)
  - Interest is paid semi-annually (2 Marks)
  - Interest is paid quarterly (2Marks)
- e) Jack's Muffin shop makes two sizes of raisin muffins using prepackaged dough and raisins. Each large muffin uses 5 grams of dough and 2 grams of raisins and each small muffin uses 2 grams of dough and 1 gram of raisin. Each day the shop receives 450 grams of dough and 200 grams of raisins. How many large muffins and small muffins should be baked each day to use up all the dough and raisins? (4 Marks)

**QUESTION FOUR (20 MARKS)**

- a) Evaluate  $\lim_{x \rightarrow 5} \left( \frac{x^2 - 25}{x - 5} \right)$  (2 Marks)
- b) State three conditions for a function to be considered continuous at a point. (3 Marks)
- c) Differentiate the following functions:
- i.  $y = 3x^2 + \cos 2x$  (2 Marks)
  - ii.  $y = \frac{1-x}{1+x}$  (3 Marks)
  - iii.  $y = e^{3x} \sin(2x + 1)$  (2 Marks)
  - iv.  $y = \tan(4x^2 - 3x + 1)$  (2 Marks)
  - v.  $y = 5x^3 \cos x$  (2 Marks)
- d) The total cost associated with the production of  $x$  units of an item is given by  $C(x) = 0.007x^3 + 0.003x^2 + 15x + 4000$  Find the marginal cost when 17 units are produced, where by marginal cost we mean the instantaneous rate of change of the total cost at any level of output. (4 Marks)

**QUESTION FIVE (20 MARKS)**

- a) In a recent survey of 400 students in a college, 100 were listed as studying Typing and 150 were listed as studying Accountancy and 75 were registered for both courses.  
Required
- i. Present the above information in a Venn diagram (3 Marks)
  - ii. The number of students in the college who were not registered for either typing or Accountancy (1 Mark)
  - iii. The number of students pursuing typing only (1 Mark)
- b) Find the equation of the tangent and normal to the circle  $x^2 + y^2 = 25$  at the point (4, 3) (5 Marks)
- c) The additional cost (in thousands of shillings) of producing a motor car is given by  $6 + 4x^2 + 1.5e^x$ , where  $x$  is the quantity produced. Determine the total cost producing 5 motor cars if the fixed cost is 7 thousand shillings. It is given that  $e^{-5} = 0.006$  (4 Marks)
- d) After producing 35 units of a product, the production manager determines that the production facility is following the learning curve of the form  $f(x) = 300 - 190e^{-2x}$ , where  $f(x)$  is the rate of labour hours required to produce  $x^{th}$  unit. How many labour hours would be required to produce additional 25 units? (3 Marks)