UNIVERSITY OF EMBU

2016/2017 ACADEMIC YEAR

FIRST SEMESTER EXAMINATION

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (HORTICULTURE), BACHELOR OF SCIENCE (AGRICULTURE), BACHELOR OF SCIENCE (RANGE MANAGEMENT), BACHELOR OF SCIENCE(AGRIBUSINESS MANAGEMENT), BACHELOR OF SCIENCE(AGED), BACHELOR OF SCIENCE(WATER RESOURCE MANAGEMENT) AND BACHELOR OF SCIENCE (MAE)

ACS 103/AEB 107: MATHEMATICS

DATE: DECEMBER 7, 2016 **TIME: 11:00AM-1:00PM**

INSTRUCTIONS:

Answer Question ONE and ANY other TWO Questions

QUESTION ONE (30 MARKS)

a) Given that $\log 2 = 0.3010$ and $\log 3 = 0.4771$, find without using a calculator the value of $\log(\frac{9}{8})$ (4 marks)

b) Given the function $g(x) = 5 + \frac{x}{2}$ find the value of $g^{-1}(-1)$ (4 marks)

c) The third term of an arithmetic progression is 11 and the 20^{th} term is 45. Find the sum of the first 25 terms of the A.P (4 marks)

d) Let U= {1,2,3,4,5,6,7,8,9,10,11}, A={1,2,4,5,7}, B={2,4,5,7,9,11}
Find $(A \cap B \cap) \cup B^C$ (3 marks)

e) Solve the simultaneous equation below using the inverse matrix method.

$7x + 9y = 1$

$13y + 10x - 2 = 0$ (3 marks)

f) Differentiate the function $f(x) = \frac{4x^2+x-1}{2x}$ and simplify. (3 marks)

g) Evaluate $\int_0^{\frac{\pi}{2}} -sin2x\ dx$. (3 marks)

h) Solve the inequality

$1 - \frac{3x}{2} \geq x - 4$ and represent the solution graphically. (3 marks)

i) Solve the equation

$x^4 - 2x^2 - 6 = 0$ (3 marks)

QUESTION TWO (20 MARKS)

a) Find the inverse of the matrix $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 1 \\ 3 & 1 & -2 \end{pmatrix}$ using the method of minors, cofactors and adjoint matrix (10 marks)

b) In the Mathematics department of a certain college with 320 students, 85 students are in the college band, 200 students are in sports and 60 students participate in both activities.

i. Draw a Venn diagram to represent this information. (2 marks)

ii. How many students are involved in either band or sports? (2 marks)

iii. How many students are neither involved in the college band nor sports. (2 marks)

c) The sum of the first three terms of a geometric series is 74 and its sum to infinity is 128. Find the common ratio. (4 marks)

QUESTION THREE (20 MARKS)

a) i. The gradient of a curve at any point (x, y) on the curve is $2x^2 - x + 3$. Given that the curve passes through the point $(-3,0)$, find its equation (4 marks)

ii. Find the equation of the normal to the curve at $(-3,0)$ (3 marks)

b) Evaluate

i. $\int_{0.1}^{0.4} 5\ e^{-3x} dx$ (4 marks)

ii. $\int_{-3}^{-2} \frac{2}{5x-1} dx$ (4 marks)

c) Given three sets P,Q and R such that $p = \{x: x \text{ is a natural number between } 10 \text{ and } 16\}$ $Q = \{y: y \text{ in an even no between } 8 \text{ and } 20\}$ and R={7,9,11,14,18,20} find

i. $P - Q$ (3 marks)

ii. $(R - P) \cap Q$ (2 marks)

QUESTION FOUR (20 MARKS)

a) Solve the equation

$$\frac{64^{\frac{1}{x}}}{2^x} = \frac{1}{\sqrt{32}}$$ (5 marks)

b) i) Find the coordinates of the stationary points on the curve $y = x^3 - 6x^2 - 15x + 1$ (4 marks)

ii) Determine their nature using the second derivative test (5 marks)

c) Find $\frac{dy}{dx}$ and simplify given

i. $y = 3(2x + 1)^{-5}$ (2 marks)

ii. $y = (2x + 3)\sqrt{5x + 1}$ (4 marks)

QUESTION FIVE (20 MARKS)

a) Given that $f(x) = \sqrt{x}$ and $g(x)=25 - x^2$.

Find :

i. *fog(x)* (2 marks)

ii. *fog(4)* (2 marks)

b) Express $\frac{x+3}{(x-2)(x+4)}$ in partial fractions. (6 marks)

c) Sketch the graph of the quadratic function shown below by first finding the axis of symmetry, maximum or minimum value of $f(x)$ and the vertex.

$f(x) = 2x^2 - 7x - 4.,\quad -1 \leq x \leq 4$ (10 marks)

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