Nurturing Innovators

SCHOOL OF EDUCATION

SEPTEMBER - DECEMBER 2019 END OF SEMESTER EXAMINATION
REGULAR PROGRAMME

EXAMINATION FOR BACHELOR OF EDUCATION (ARTS)
REM 414: DIFFERENTIAL CALCULUS

INSTRUCTOR: JOHN MBUTHI

DATE: 9TH DECEMBER 2019   **TIME: 2 HOURS**

GENERAL INSTRUCTIONS:

Students are NOT permitted to write on the examination paper during reading time.

This is a closed book examination. Text books/reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

1. **Write your ADMISSION NUMBER clearly on the cover of the answer booklet(s).**

2. **Answer Question ONE and ANY OTHER TWO questions.**

3. **Questions in all sections should be answered in answer booklet(s).**

4. **Marks allocated to each question are shown at the end of the question.**

5. **PLEASE start the answer to EACH question on a NEW PAGE.**

6. **Indicate the number of the questions answered on the cover of the answer booklet(s) in the order you answered them.**

7. **Write your answers in paragraph form unless stated otherwise.**

8. **Keep your phone(s) SWITCHED OFF at the front of the examination room.**

9. **Keep ALL bags and caps at the front of the examination room and do not refer to any unauthorized material before or during the course of the examination.**

10. **You are only allowed to leave the examination room 30 minutes to the end of the Examination.**

QUESTION ONE: COMPULSORY (30 MARKS)

Differentiate the following functions with respect to x:

i. $y = x^{sin(2x-5)}$ [5 marks]

ii. $y = tan(cos(x))$ [5 marks]

iii. $y = e^{sec\,x} + cos(sin(x))$ [5 marks]

iv. $y = \ln(\tan(x))$ [5 marks]

v. $y \cdot sin(x) = x \cdot cos(y)$ [5 marks]

vi. $e^{y(x-3)} = \tan(\ln(\cos(x)))$ [5 marks]

QUESTION TWO

a.   Use linear approximation to estimate the value of $\sqrt[3]{26^2}$, give your answer a single fraction. [8 marks]

b.   At time t = 0 a car is moving at 6 m/s. and driver smoothly accelerates so that the acceleration after t seconds is $a(t) = 3t$ m/s^2. Determine:

   i   the equation for the velocity $v(t)$ of the car after t seconds, [6 marks]

   ii   the distance the car travelled during the time it took to accelerate from 6 m/s to 30 m/s. [6 marks]

QUESTION THREE

a.   An open-top box is to have a square base and a volume of 13500 cm^3. Find the dimensions of the box that minimize the amount of material used. [10 marks]

b.   Each rectangular page of a book must contain 30 cm^2 of printed text, and each page must have 2 cm margins at top and bottom, and 1 cm margin at each side. Find the minimum possible area of such a page. [10 marks]

QUESTION FOUR

a.   Find the equation of the line that is tangent to the graph of $y = \sqrt{x} - \frac{1}{\sqrt{x}}$ at x = 1. [10 marks]

b.   Elly has 400 feet of fencing with which to build a rectangular pen. He will use part of an existing straight wall 100 feet long as part of one side of the perimeter of the pen. Find the maximum area that he can enclose. [10 marks]

QUESTION FIVE

a.   On a certain day, Collins had 1 kg of a radioactive substance X at 1:00 pm. After six hours, only 27 g of the substance remained. Find how much substance X was remaining at 3:00 pm that same day. [10 marks]

b.   In a certain culture of bacteria, the number of bacteria increased tenfold in 10 hours. Assuming natural growth, find how long did it take for their number to double. [10 marks]