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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2018/2019 ACADEMIC YEAR ONE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: MAT 110**

**COURSE TITLE: BASIC CALCULUS**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 05/02/2020 TIME: 09.00-11.00 AM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) 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 FOUR (4) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

**Q1. (a)**  Evaluate  **(3 marks)**

 **(b)** Differentiate the following with respect to :

 (i)  **(3 marks)**

 (ii)  **(3 marks)**

 (iii)  **(3 marks)**

 **(c)** Find the derivative of the function  from the first principles.

 **(3 marks)**

 **(d)**  The radius of a variable sphere is increasing at the rate of per second. How

 fast is the surface area of the surface of the sphere increasing when the radius is

  **(3 marks)**

 **(e)** If  and , find the equation of the tangent and normal at .

 **(6 marks)**

 **(f)** The perimeter of an isosceles triangle is . Find the dimension of the sides for

 maximum area of thetriangle. **(6 marks)**

**QUESTION TWO**

 **Q2. (a)**  Differentiate the following with respect to   **(4 marks)**

 **(b)** The parametric equations of a curve are  and . Find the equation of

 the normal at  **. (6 marks)**

 **(c)** A window in the form of a rectangle is surmounted by a semi-circle. If the perimeter

 of the window is to be metres , find the dimensionsso that the greatest amountof

light may be admitted. **(10 marks)**

**QUESTION THREE**

 **Q3. (a)** If , show that  **(5 marks)**

 **(b)** Given that ,  and , find the values of 

 and  **(7 marks)**

 **(c)** Verify Rolle’s theorem for the function  on  ** (8 marks)**

**QUESTION FOUR**

 **Q4. (a)** Find the derivatives of the following with respect to :

(i)  **(4 marks)**

 (ii) , is a constant **(3 marks)**

 (iii)  **(3 marks)**

 **(b)**  Find the point of inflexion on the graph of the function .

  **(4 marks)**

 **(c)**  Verify mean value theorem for thefunction  in the

 interval  and find  **(6 marks)**

 **QUESTION FIVE**

 **Q5. (a)** Show that the  is an increasing function of  for .

  **(4 marks)**

  **(b)**  Show that the function defined by  is derivable at . **(4 marks)**

 **(c)** An open rectangular tank, with a square base and vertical sides, is to be constructed of

 sheet metal to hold a given quantity of water. Show that the cost of the material will be

 least when the depth is half the width. **(6 marks)**

 **(d)** Verify Rolle’s theorem for the function,  on the  **(6 marks)**