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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2019/2020 ACADEMIC YEAR ONE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: MAT 113**

**COURSE TITLE: DIFFERENTIAL CALCULUS**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 17/02/2020 TIME: 2.00-4.00 PM**

**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 THREE (3) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Perform the indicated function evaluations for . Find **[2 marks]**
2. The difference quotient of a function is defined to be,

Compute the difference quotient for

 **[5 marks]**

1. Find the domain and range of

. **[5 marks]**

1. Compute and for , **[4 marks]**
2. Evaluate , if it exists. **[3 marks]**
3. Find the tangent line to
4. at **[3 marks]**
5. at **[4 marks]**
6. The position of an object is given by . Determine all the points where the object is not moving. **[4 marks]**

**QUESTION TWO**

1. Evaluate the limit, if it exists
 **[3 marks]**
2. We are going to fence in a rectangular field. If we look at the field from above the cost of the vertical sides are $10/m, the cost of the bottom is $2/m and the cost of the top is $7/m. If we have $700 determine the dimensions of the field that will maximize the enclosed area.  **[3 marks]**
3. Determine the absolute extrema of on

 **[10 marks]**

1. Given the functions
and

determine the inverse value of , . **[4 marks]**

**QUESTION THREE**

1. Find the inverse for . Verify your inverse by computing one or both of the composition as discussed in lectures. **[6 marks]**
2. Given that , and , use the limit properties to compute
 **[4 marks]**
3. Differentiate **[6 marks]**
4. Determine all the number(s) which satisfy the conclusion of Mean Value Theorem for on **[4 marks]**

**QUESTION FOUR**

1. Suppose that the volume of water in a tank for is given by
2. Is the volume of water increasing or decreasing at ?
3. Is the volume of water increasing or decreasing at ?
4. Does the volume of water ever stop changing? If yes, at what times(s) does the volume stop changing? **[12 marks]**
5. Determine the critical points of
. **[8 marks]**

**QUESTION FIVE**

1. For answer each of the following questions.
2. Determine the possible inflection points of the function. **[4 marks]**
3. Determine the intervals on which the function is concave up and concave down **[4 marks]**
4. For on answer each of the following questions.
5. Identify the critical points of the function. **[2 marks]**
6. Determine the intervals on which the function increases and decreases **[4 marks]**
7. Classify the critical points as relative maximums, relative minimums or neither.

 **[2 marks]**

1. Determine the inflection points of the function. **[2 marks]**
2. Use the information from steps above to sketch the graph of the function. **[2 marks]**