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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2020/2021 ACADEMIC YEAR ONE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF INFORMATION SCIENCE**

**COURSE CODE: MAT 113**

**COURSE TITLE: DIFFERENTIAL CALCULUS**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 18/08/2021 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 THREE (3) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Find the $\lim\_{x\to 0}\frac{x^{3}-1}{x-1}$ (2 marks)
2. Find the derivative of $y$ with respect to $x$ given $ y=\frac{x^{2}+1}{x^{2}-1} $ Differentiate $y$ with respect to $x $given $y=\left[\frac{x}{x+1}\right]^{5}$ (4 marks)
3. $y=6x^{4}+5x^{3}-\frac{3}{2x^{3}}.$ Find $\frac{dy}{dx}$ (3 marks)
4. Evaluate $\lim\_{n\to \infty }\frac{inx}{x}$ (3 marks)
5. Find the differential of the function $y=(x^{2}+1)^{\frac{1}{2}}$ (3 marks)
6. Find the coordinates of any stationary points on the curve $y=x^{3}-2x^{2}-4x$ (5 marks)
7. $V=30t-6t^{2}.$ Find the maximum value of $V$ and the value of $t$ for which it occurs. (4 marks)
8. $y=2x^{2}-3x.$ Find the approximate change in $y$ when $x$ increases from 6 to 6.02 (2 marks)

**QUESTION TWO (20 MARKS)**

1. A rectangular enclosure is formed by using 1200m of fencing wire. Find the greatest possible area that can be enclosed in this way and the corresponding dimensions of the rectangle (5 marks)
2. If $S=4r^{2}$-$10r+7$, find the minimum value of $S $and the value of $r$ which gives this minimum value. (4 marks)
3. A company that manufactures dog food wishes to pack the food in closed cylindrical tins. What should be the dimensions of each tin if each is to have a volume of $128πcm^{3}$ and the minimum possible surface area? (11 marks)

**QUESTION THREE (20 MARKS)**

1. Evaluate $\lim\_{x\to 2}\frac{x^{3}-x^{2}-x-2}{x^{3}-3x^{2}+3x-2}$ (2 marks)
2. Evaluate $\lim\_{n\to \infty }\frac{In x}{x}$ (4 marks)
3. Find the coordinates and nature of the turning points on the curve $y=x^{3}+3x^{2}-9x+6$ (5 marks)
4. Differentiate $y=x^{3}+2x$ from first principles (4 marks)
5. Use definition to find the derivative of $y=\frac{1}{x}$ (5 marks)

**QUESTION FOUR (20 MARKS)**

1. Find $\frac{dy}{dx}$ given that $y^{3}+y^{2}-5y-x^{2}+4=0$ (5 marks)
2. Show that $\lim\_{x\to 0}\frac{\cos(x-1)}{x}$ $=0$ (5 marks)
3. Find the derivative of $y=5x+\cos(x)$ (2 marks)
4. Find the derivative of $y=\sin(x\cos(x))$ (3 marks)
5. Differentiate $y $with respect to $x$ given $y=\frac{\cos(x)}{1-\sin(x)}$ (5 marks)

**QUESTION FIVE (20 MARKS0**

1. From a rectangular piece of thin cardboard, $16cm by 10 cm$, squares of side $x cm$ are removed from each of the four corners. The remainder is folded up to form a tray. Show that the volume of this tray is given by $V=4(x^{3}-13x^{2}+40x)$ and hence find a possible value of $x $which will give the maximum value of $V$ (11 marks)
2. Find the stationary point on the curve $y=x^{3}-3x^{2}+3x+1$ and state its nature (9 marks)