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**MAASAI MARA UNIVERSITY**

**REGULAR UNIVERSITY EXAMINATION**

**2018/2019 ACADEMIC YEAR**

**SECOND YEAR FIRST SEMESTER EXAMINATIONS**

**FOR**

**THE DEGREE OF BACHELOR OF SCIENCE**

**MAT 2110: VECTOR ANALYSIS**

**DATE: 13TH DECEMBER 2018 TIME: 8.30 -10.30AM**

 INSTRUCTIONS TO CANDIDATES

1. This paper contains **FOUR** (4) questions
2. Answer question **ONE (1)** and any other **TWO** (**2**) questions
3. Do not forget to write your Registration Number.

**QUESTION ONE (30 MARKS)**

1. Determine a unit vector perpendicular to the plane of  and .. **[4mks]**

1. A particle moves along the curve  where t is the time. Find the components of its velocity at time t=1 in the direction  **[4mks]**
2. Find a unit normal to the surface  at the point P(1,1,1)

**[4 mks]**

1. Prove that  **[6mks]**
2. Suppose . Evaluate  where C is the curve in the xy-plane,

from (0,0) to (1,2) **[5mks]**

1. Find the area of the ellipse  **[3mks]**
2. Derive an expression for  in orthogonal curvilinear coordinates **[4mks]**

**QUESTION TWO (20 MARKS)**

1. Prove the Frenet-Serret formulas,
2.  (ii)  (iii)  **[12 mks]**

1. The position vector **r** for a space curve is given by . Find
2. The unit tangent   **[3mks]**
3. The principal normal ,curvature  and radius of curvature  [5mks]

**QUESTION THREE (20 MARKS)**

1. Evaluate  where  and S is that part of the plane  which is located in the first octant. **[10mks]**
2. Verify Green’s theorem in the plane for  where C is the closed curve of the region bounded by and  **[10mks]**



**QUESTION FOUR (20 MARKS)**

1. Verify Stoke’s theorem for  where S is the upper half surface of the sphere  and C is its boundary. Let R be the projection of S on the xy plane. **[10mks]**
2. Determine the transformation from cylindrical to rectangular coordinates. **[4mks]**
3. Prove that a cylindrical coordinates system is orthogonal **[6mks]**

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