MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER
SCHOOL OF SCIENCE AND INFORMATION SCIENCES
UNIVERSITY EXAMINATIONS FOR THE DEGREE OF
BACHELOR OF SCIENCE (MATHEMATICS, PHYSICS & APPLIED STATISTICS WITH COMPUTING)

INSTRUCTIONS

Answer Question **ONE** and ANY other **TWO** Questions

QUESTION ONE (30 marks) Compulsory

a) Given a quadrilateral with vertices at points (2,1), (7,1), (9,3) and (4,3), Show that the middle points of the diagonals intersect. **5mks**

b) Determine the parametric equations of a line through the point P(-1,4) in the direction of the vector $\vec{v}=<1,2>$. **3mks**

c) Show that the equation $x^2 + y^2 - 4x + 10y - 13 = 0$ represents a circle and find its center and radius. **4mks**

d) Find the polar equation of the curve represented by $x^2 + y^2 = 9$. **3mks**

e) Express the rectangular coordinate equation $x^2 + y^2 - z^2 = 1$ in spherical coordinates. **5mks**

f) Show that a curve with polar equation $r = 2\cos\theta$ is a circle, determine its center and radius. **5mks**

g) Find $\dfrac{d^2 y}{dx^2}$ of the parametric equation $y = t^3 - 3t, x = 3t$ **5mks**

QUESTION TWO 20marks

a) Given that l_1 has slope λ, the tangent of the angle from l_1 to l_2 is β, proof that $\dfrac{\lambda+\beta}{1-\lambda\beta}$ represents equation of the slope of l_2 hence find the equation of the line that passes through the point (2,3) and makes an angle of 110^0 with line $5x+y-3=0$. **10mks**

b) Determine the center and the radius of the circle passing through the points A(4,3) B(0,1) and C(1,0). **10mks**

QUESTION THREE 20marks

a) Find the standard equation of the conic $9x^2-4y^2-72x+8y+176=0$ and sketch it. **10mks**

b) Determine whether the planes $x-3y+6z=4$ and $5x+y-z=4$ are perpendicular, parallel or neither. Find the angle of their intersection and the set of parametric equations for the line of intersection. **10mks**

QUESTION FOUR 20marks

a) Find the length of an arch of the cycloid
$x = r(\beta - \sin\beta), y = r(1 - \cos\beta)$ for $0 \leq \beta \leq 2\pi$.
7mks

b) Determine the length of a parabola with equation $y^2 = x$
from (0,0) to (1,1).
7mks

c) Derive the arc length function of the curve
$y = \frac{1}{3}x^3 + \frac{1}{4x}; x > 0$ starting at $P_0(1, \frac{7}{12})$.
6mks

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