



## Murang'a University College

(A Constituent College of Jomo Kenyatta University of Agriculture and Technology)

University Examination 2015/2016

School of Pure and Applied Science

Supplementary Examination for the Degree of Bachelor of Science in Mathematics  
and Economics - Year I

AMM 2109: ANALYTICAL GEOMETRY

Date: June/July 2016

2 Hours

Instructions: Attempt Question **One** and any other **Two** Questions.

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### Question One (30 Marks)

- a) Differentiate the terms *Directed distance* and *undirected distance* (2 Marks)
- b) Find the distance between the lines  $3x - 4y = 10$  and  $3x - 4y = -59$  (3 Marks)
- c) Show that the circles  $x^2 + y^2 - 6x + 4y + 2 = 0$  and  $x^2 + y^2 + 8x + 2y - 22 = 0$  are orthogonal (6 Marks)
- d) Find the equation of a circle whose center is the point  $(-1, 4)$  and which passes through the point  $(2, -5)$  (3 Marks)
- e) Find the radius and the coordinates of the center of the circle  $x^2 + y^2 + 8x - 12y - 6 = 0$  (3 Marks)
- f) Find the Cartesian equation of the circle  $r = 3\cos(\theta - \frac{\pi}{3})$  (3 Marks)
- g) Show that  $\coth^{-1}(x) = \frac{1}{2}\ln\left|\frac{x+1}{x-1}\right|$  (4 Marks)
- h) Solve the equation  $7\sinh(x) + 20\cosh(x) - 24 = 0$  (6 Marks)

### Question Two (20 Marks)

- a) Find the equation of a circle whose center lies along the line  $y = 4x - 1$  and which touches the positive axes (4 Marks)
- b) Find the vertex, focus and the directrix of the parabola  $x^2 - 6x + 20y + 49 = 0$  (6 Marks)

- c) Show that the circles  $x^2 + y^2 - 4x - 6y - 3 = 0$  and  $x^2 + y^2 + 2x + 4y - 4 = 0$  intersect hence find the points of intersection. (10 Marks)

**Question Three (20 Marks)**

- a) Prove that  $\tanh^{-1}\left(\frac{x^2-1}{x^2+1}\right) = \ln(x)$  (5 Marks)
- b) Solve the equation  $3\cosh(2x) - 4\sinh(x) = 4$  (7 Marks)
- c) Find the equation of the normal and tangent to the circle  $x^2 + y^2 - 4x - 10y = 0$  at a point  $(7, 3)$  (8 Marks)

**Question Four (20 Marks)**

- a) Find the Cartesian equation of the polar curve  $r\sin\left(\theta - \frac{\pi}{3}\right) = 2$  (3 Marks)
- b) Determine the necessary condition that the line  $y = mx + c$  shall be a tangent to the curve  $2x^2 - y^2 = 1$  (5 Marks)
- c) Find the distance of the point  $(1, 4)$  from the line  $3x - 5y + 7 = 0$  (3 Marks)
- d) Determine the center, vertices, foci, eccentricity and the asymptotes of the hyperbola  $y^2 - 4x^2 - 8x - 4y - 4 = 0$  (9 Marks)

**Question Five (20 Marks)**

- a) Determine the value of  $c$  for which the line  $y = 2x + c$  is tangent to the curve  $3x^2 - y + 7 = 0$  (4 Marks)
- b) Find the center, vertices, foci and the eccentricity of the ellipse  $x^2 + 16y^2 + 96y + 128 = 0$  (8 Marks)
- c) A variable point  $P(x, y)$  moves along the parabola  $y^2 = 2x - 3$ . Find the locus of the midpoint of the line  $AP$  where  $A$  is the point  $(2, 0)$  (4 Marks)
- d) Find the Cartesian equation of a circle of radius 5 units and whose center lies along the ray  $\theta = \frac{\pi}{4}$  at a distance of 9 units from the pole (4 Marks)