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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATIONS, 2022/2023 ACADEMIC YEAR
SECOND YEAR,SECOND SEMESTER, END OF SEMESTER EXAMINATIONS
BACHELOR OF EDUCATION (ARTS)

KMA 2101:BASIC MATHS AND ANALYTICAL GEOMETRY

Date: 15th December 2022
Time: 8.30am-10.30am

INSTRUCTION TO CANDIDATES:
ANSWER QUESTION ONE(COMPULSORY AND ANY OTHER TWO QUESTIONS
QUESTION ONE(30 MARKS)

a. Find the equation of the line that passes through the point (2, -5) and making an angle of 45° with the positive x-axis. (3 Marks)

b. Find the equation of the ellipse with center at (2,3), focus at (5,3) and corresponding vertex at (7,3). (4 Marks)

c. Change $3x^2 + 6x + 3y^2 - 12y - 33 = 0$ to standard form and give the radius of the circle and coordinates of the centre. (4 Marks)

d. Given the lines 7x-4y=0 and 3x-11y+5=0. Compute the acute angle made by the two intersecting line. (3 Marks)

e. Show that $x^2 - 4y - 4x = 0$ is an equation of a parabola and sketch it. (4 Marks)

f. Find the equation of the sphere with center (1,1,2) and passes through the point (2,4,6). (4 marks)

g. Sketch the hyperbola represented by the equation $81x^2 - 144y^2 - 11664 = 0$. (4 Marks)

h. Given a triangle has vertices (1,1), (-1, 2) and (-2, -1), compute its area. (4 Marks)

QUESTION TWO (20 MARKS)

a. Find the equation of the circle that passes through the points (1,2), (3,-4) and (5,-6). (5 Marks)

b. Show that $2x^2 + 2y^2 - x + 3y - 15 = 0$ is an equation of a circle. Find the center and radius of the circle. (5 Marks)

c. Find the equation of the circle which passes through the points (-2,3), (1,4) and its centre is on the line 6x+8y=10 (5 Marks)

d. Determine the equation of the tangent to the circle $x^2 + y^2 - 2y + 6x - 7 = 0$ at the point

e. $(-2, 5)$. (5 Marks)

QUESTION THREE (20 MARKS)

a. Find the equation of the ellipse whose foci are (-3, -1) and (-3,7) and whose major axis has length 16. (4 Marks)

b. i. Show that $10x^2 - 20x + 18y^2 - 108y + 82 = 0$ is an equation of an ellipse. (2 Marks)

Hence find:

ii. the lengths of the semi-major and semi-minor and coordinates of the vertices. (2 Marks)

iii. Coordinates of the foci (2 Marks)

iv. the length and coordinates of the latera recta (2 Marks)

v. the eccentricity (1 Mark)

c. An architectural design for the president's office calls for it to be an elliptical-shaped oval office a major axis of 60 feet and a minor axis of 40 feet. Write an equation that models the shape of the office. (3 Marks)

d. The Museum hall has a whispering chamber. Its dimensions are 36 feet wide by 86 feet long.

i) Model an equation that represents the outline of the room. (3 Marks)

ii) If two staffs standing at the foci of this room can hear each other whisper, how far apart are the staff? (1 Marks)

QUESTION FOUR (20 MARKS)

a. Find an equation of the sphere which passes through (4,-1,2), (0,-2,3), (1,-5,-1) and (2,0,1) (6 Marks)

b. Show that $x^2 + 2x + y^2 - 2y + z^2 - 6z = 0$ is an equation of a sphere and hence find its centre and radius. (4 Marks)

c. An arched underpass has the shape of a parabola. A road passing under the arch is 20 feet wide and the maximum height of the arch if 15 feet. Write an equation for the parabolic arch. (5 Marks)

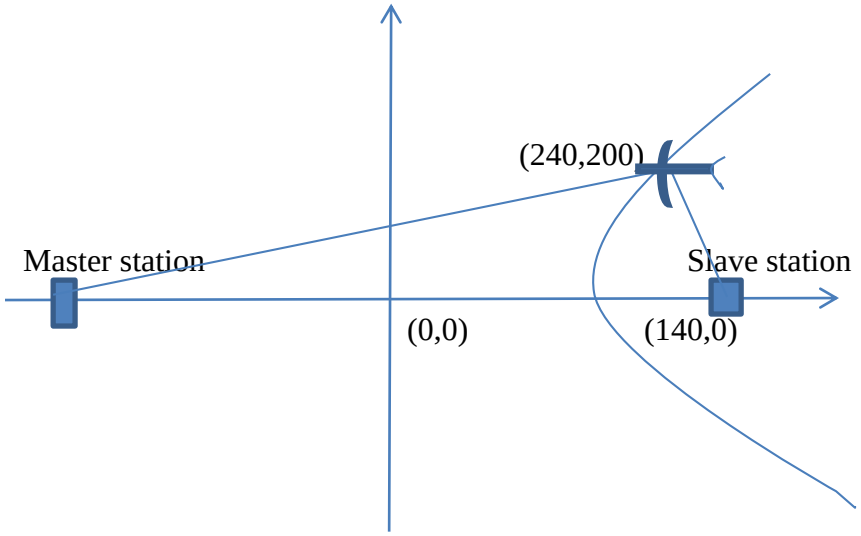
d. A cable TV receiving dish is in the shape of paraboloid of revolution. Find the location of the receiver which is placed at the focus, if the dish is 24 inches across at the opening and 8 inches deep. (5 Marks)

QUESTION FIVE (20 MARKS)

a. Given the equation $4x^2 - 16x - 9y^2 + 18y - 29 = 0$, find;

i. the lengths of the semi-major and semi-minor and coordinates of the vertices. (4 Marks)
ii. coordinates of the foci (2 Marks)
iii. the length and coordinates of the latera recta (4 Marks)
iv. the equations of the asymptotes (2 Marks)
v. Sketch the curve (2 Marks)

b. Write an equation that models the following hyperbola depicted for an aircraft guided by a navigation system that employs hyperbolic tracking.



(6 Marks)