



TECHNICAL UNIVERSITY OF MOMBASA

A Centre of Excellence

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS AND PHYSICS

APRIL 2016 SERIES EXAMINATION

UNIT CODE: AMA 4102 UNIT TITLE: GEOMETRY

SPECIAL/SUPPLEMENTARY EXAMINATION

TIME ALLOWED: 2HOURS

INSTRUCTION TO CANDIDATES:

You should have the following for this examination

- Mathematical tables
- Scientific Calculator

This paper consists of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

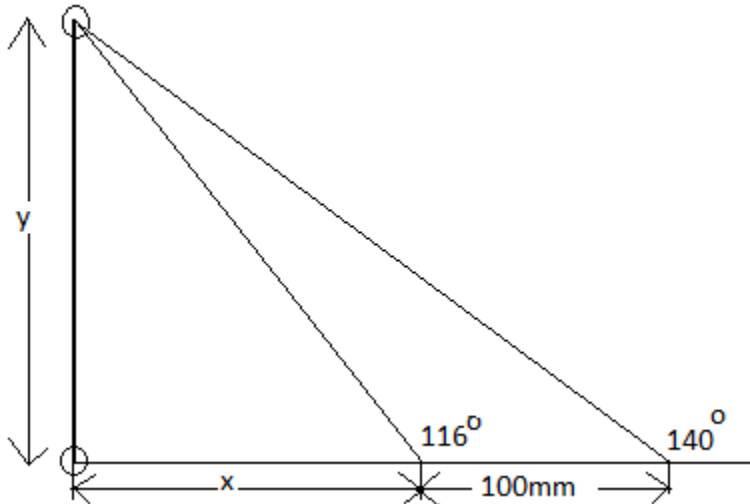
Maximum marks for each part of a question are as shown

QUESTION ONE COMPULSORY (30 MARKS)

- a. If $\sin A = \frac{3}{5}$ and $\cos B = \frac{15}{17}$ where A is obtuse and B is acute, find the exact value of $\sin(A + B)$ (4 marks)
- b. Sketch the curves depicting the following equations

$$x = \sqrt{9 - y^2} \quad (3 \text{ marks})$$

- c. y^2 A constant force of $F = 10i + 2j - k$ newtons displaces an object from $A = 10i + 2j - k$ to $B = 2i - j + 3k$ in metres. Find the work done in Newton meters (4 marks)
- d. State a vector equation of the line passing through the point P(4, 1) and Q(7, -5) (4 marks)
- e. Determine the equation of the tangent to the circle $x^2 + y^2 - 4x - 2y - 8 = 0$ which are parallel to the line $3x + 2y = 0$ (5 marks)
- f. Calculate correct to 3 significant figures, the coordinates x and y to locate the hole center at P as shown in the figure

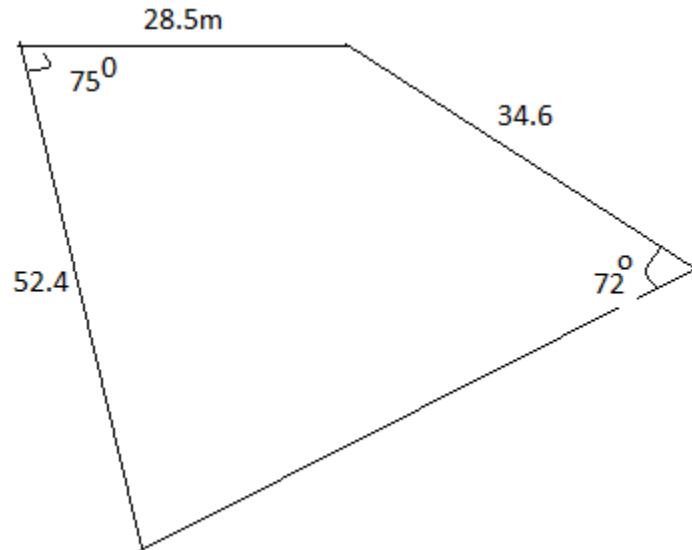


- g. Prove that $\frac{\cos^2 \theta (1 - \sec^2 \theta) \sin \theta}{(1 - \sin^2 \theta) \cos \theta \tan^2 \theta} = -\tan \theta$ (5 marks)

QUESTION TWO (20 MARKS)

- a. A building site is in the form of quadrilateral as shown in the figure. If its area is 1510m^2 . Determine the perimeter of the site

(4 marks)



- b. Find the scalar equation of the straight line with normal $(-6, 4)$ that passes through the point $(-3, -7)$ (4 marks)
- c. Neatly draw the graph of $r = 2\sin 2\theta$ in the range $0 \leq \theta \leq 360^\circ$. Hence write the polar equation into Cartesian form (6 marks)
- d. Find the eccentricity and the semi latus rectum of the ellipse $2x^2 + 3y^2 = 5$ (6 marks)

QUESTION THREE (20 MARKS)

- a. Determine the diameter and circumference of a circle if an arc of length 4.75cm subtends an arc 0.91 rad (2 marks)
- b. A line passes through $(5, -2)$ with direction vector $(2, 6)$
- State the parametric equations of this line (1 marks)
 - What point on the line corresponds to the parameter value $t=3$ (1 marks)
 - Does the point $(1, -8)$ lie on this line? (3 marks)
 - Find the y-intercept and the slope of the line. Then write the equation of the line in the form $y = mx + c$ (3 marks)
- c. A line AB is the diameter of a circle such that the coordinates of A and B are $(-1, 1)$ and $(5, -1)$ respectively.
- Determine the centre and radius of the circle (3 marks)

- ii. Find the equation of the circle (2 marks)
- d. Solve the equation $12\cos^2\theta + \sin\theta = 11$ (5 marks)

QUESTION FOUR (20 MARKS)

- a. Calculate the resultant of $v_1 - v_2 + v_3$
- $V_1 = 22 \text{ units at } 140^\circ$
- $V_2 = 40 \text{ units at } 190^\circ$
- $V_3 = 15 \text{ units at } 290^\circ$ (5 marks)
- b. Find the distance from a point $s(1, 1, 5)$ to the line given by
- $x = 1 + t$
- $y = 3 - t$
- $z = 2t$ (5 marks)
- c. Find an equation in the form $ax + by + c = 0$ for a line which passes through the point of intersection of the lines $x - 3y = 4$ and $3x + y = 2$ being also perpendicular to the line $4x - 3y - 7 = 0$ (6 marks)
- d. Find vector v joining point P and Q where point P has coordinates $(4, -1, 3)$ and point Q has coordinates $(2, 5, 0)$. Also find $|v|$ (4 marks)

QUESTION FIVE (20 MARKS)

- a. (i) Find the equation of a circle center $(-2, 3)$ and radius 4 units (2 marks)
- (ii) Find the equation of a line through the point $(-1, 3, 4)$ and perpendicular to the plane $3x - y - z = 5$ (2 marks)
- b. Discuss the equation stating all the properties of the hyperbola $x^2 - 4y^2 + 2x + 8y - 7 = 0$ hence sketch the curve indicating the asymptotes foci and vertex (6 marks)
- c. If $\sin A = \frac{3}{4}$ and $\csc B = \frac{17}{8}$ where A and B are acute angles, without using mathematical tables or calculator evaluate $\frac{3\sin A + 2\cos A}{\sec B}$ (5 marks)
- d. Four the vector $a = i + 4j - 2k$ and $b = 2i - j + 3k$. Find
- i. axb (3 marks)
- ii. $|axb|$ (2 marks)