



**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

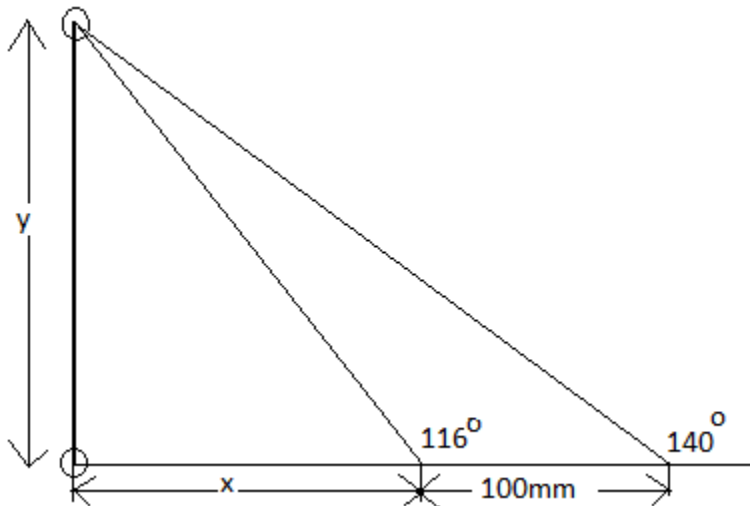
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### QUESTION ONE COMPULSORY (30 MARKS)

- 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

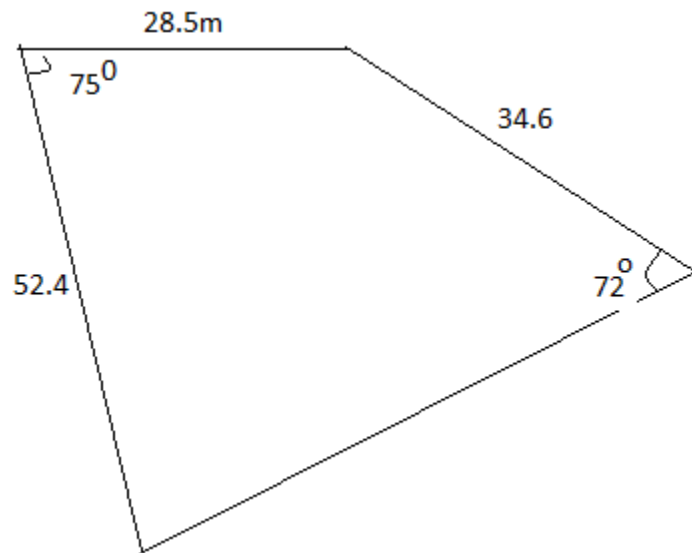


- g. Prove that  $\frac{\cos^2 \theta (1 - \sec^2 \theta) \sin \theta}{(1 - \sin^2 \theta) \cos \theta \tan^2 \theta} = -\tan \theta$  (5 marks)

## QUESTION TWO (20 MARKS)

- a. A building site is in the form of quadrilateral as shown in the figure. If its area is  $1510\text{m}^2$ . 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)