



FreeExams.co.ke

**UNIVERSITY EXAMINATIONS  
2022/2023 ACADEMIC YEAR  
FIRST YEAR SECOND SEMESTER  
MAIN EXAMINATION**

**FOR THE DEGREE OF BACHELOR OF EDUCATION AND  
BACHELOR OF SCIENCE**

**COURSE CODE: MAA 122**

**COURSE TITLE: ELEMENTARY APPLIED MATHEMATICS**

**DATE: 12/04/23 TIME: 9 AM -11 AM**

---

**INSTRUCTIONS TO CANDIDATES**

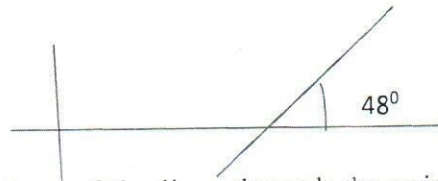
Answer Question ONE and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

### QUESTION ONE (30 MARKS)

- a) Differentiate between a vector and a scalar and give examples. (4 marks)
- b) Calculate the gradient of the straight line shown: (3 marks)



- c) Find equations of the lines through the point (1,2) parallel and Perpendicular to the line  $3x+4y=7$ . (6 marks)
- d) Two straight lines  $my=2$  and  $x-my=3$  are perpendicular. Find the possible values of  $m$ . (5 marks)
- e) The line through point  $A(3,-3)$  and  $B(x,y)$  has the equation  $5x-y-18=0$ . Find the equation of the line through  $A$  and is perpendicular to  $AB$ . (3 marks)
- f) A line  $L_1$  makes an angle of  $45^\circ$  with the positive direction of the  $x$ - axis. Another line  $L_2$  makes an angle of  $153.43^\circ$  with the positive direction of the  $x$ -axis. The two lines intersect at the point  $(4,m)$ . Given that  $L_1$  passes through the point  $(2,0)$ . Find:
- The value of  $m$  (2 marks)
  - The equation of  $L_1$ . (3 marks)
  - The point where  $L_2$  intersects with the  $x$ -axis. (4 marks)

### QUESTION TWO (20 MARKS)

- a) Define the median of a triangle. (2 marks)
- b) Triangle  $ABC$  has vertices  $A(4,-9)$ ,  $B(10,2)$  and  $C(4,-4)$ . Find the equation of the median from  $A$ . (4 marks)
- c) Triangle  $ABC$  has vertices at  $A(3,-5)$ ,  $B(4,3)$  and  $C(7,2)$ . Find the equation of the altitude from  $A$ . (3 marks)
- d) Two points  $A(2,3)$  and  $B(4,7)$  lie on a straight line. Find the equation of the perpendicular bisector of  $AB$ . (5 marks)
- e) Write the equation of the circle with the centre at the origin and radius  $r$ . (2 marks)
- f) Give the general equation of a circle. (2 marks)
- g) Write the equation of a circle with the centre  $(a,b)$  and radius  $r$  (2 marks)

**QUESTION THREE (20 MARKS)**

- a) Find the equation of the circle passing through the points A (1, 3), B (2, 2) and C (5, 7). (10 marks)
- b) Find the centre and radius of a circle passing through the points P (2, 1), Q (0, 5) and R (-1, 2). (10 marks)

**QUESTION FOUR (20 MARKS)**

- a) Determine the magnitude of the vector  $\langle 3, -5, 10 \rangle$  (2 marks)
- b) Find the unit vector in the same direction as  $\vec{w} = \langle -5, 2, 1 \rangle$  (3 marks)
- c) Given  $\vec{A} = 2\mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$  and  $\vec{B} = \mathbf{i} + \mathbf{j} + 5\mathbf{k}$ . Find :
- i.  $\vec{A} \cdot \vec{B}$  (2 marks)
- ii. The angle between  $\vec{A}$  and  $\vec{B}$ . (5 marks)
- d) If  $\vec{a} = \langle 2, 1, -1 \rangle$  and  $\vec{b} = \langle -3, 4, 1 \rangle$ . Compute the following:
- i.  $\vec{a} \times \vec{b}$  (3 marks)
- ii.  $\vec{b} \times \vec{a}$  (3 marks)
- e) Express the equation  $x=1$  in polar coordinates. (2 marks)

**QUESTION FIVE (20 MARKS)**

- a) A stone is projected vertically upwards with a velocity of  $30 \text{ ms}^{-1}$  from the ground. Calculate:
- i. The time it takes to reach the maximum height. (2 marks)
- ii. The maximum height. (2 marks)
- iii. The velocity with which it lands on the ground. (3 marks)
- b) A 325kg motorcycle is moving at 140km/h in the south. Find its momentum. (2marks)
- c) Find the area of the region bounded by the curve  $r=3+2\cos\theta$  (3 marks)
- d) Find the line through the points  $P_1(-3,1,-4)$  and  $P_2(4,4,-6)$  in :
- i. Parametric form. (3 marks)
- ii. Symmetric form. (3 marks)
- e) Find the equation of the plane perpendicular to the vector  $\vec{n}=(2,4,8)$  (2 marks)