

**KABARAK**



**UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**2009/2010 ACADEMIC YEAR**

**BRIDGING CERTIFICATE COURSE IN MATHEMATICS**

**COURSE CODE: BMATH 002**

**COURSE TITLE: VECTORS AND GEOMETRY**

**STREAM: BRIDGING**

**DAY: THURSDAY**

**TIME: 9.00 – 11.00 A.M.**

**DATE: 10/12/2009**

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**INSTRUCTIONS TO CANDIDATES:**

**Answer Question ONE and any other TWO questions.**

**PLEASE TURN OVER**

### QUESTION ONE (30 MARKS)

- (a) Given that vector  $\vec{A} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ ,  $\vec{B} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$  and  $\vec{C} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$ , find
- (i)  $\vec{A} + \vec{B}$
  - (ii)  $\vec{B} + \vec{C}$
  - (iii)  $\vec{A} + (\vec{B} + \vec{C})$  **(6 marks)**
- (b) Determine the equation of a line that passes through  $A(5, 7)$  and  $B(4, 9)$  in the form  $y = mx + c$  **(3 marks)**
- (c) In a triangle PQR,  $\angle P = 60^\circ$ ,  $QR = 10$  cm and  $PR = 4$  cm. Find  $\angle Q$ . **(2 marks)**
- (d) Given that  $2x^2 + 2y^2 + 4x + 8y + 6 = 0$  is an equation of a circle, determine its centre and radius. **(5 marks)**
- (e) Determine the length of an arc of a circle radius 14 cm which subtends an angle of  $49.5^\circ$  **(3 marks)**
- (f) Given that  $\vec{OP} = 3i + 4j$ , express  $OP$  as a column vector and determine its modulus. **(3 marks)**
- (g) Simplify  $\frac{\sqrt{x^2-16}}{x}$  given that  $x = 4 \sec \theta$  **(4 marks)**
- (h) A chord AB subtends an angle of  $60^\circ$  at the centre O. If the radius of the circle is 10 cm, calculate;
- (i) The length of the major Arc AB. **(2 marks)**
  - (ii) The area of the minor segment cut off by AB (*take*  $\pi = 3.14$ )

### QUESTION TWO (20 MARKS)

- (a) Given that  $\vec{A} = 2i + 3j$  and  $\vec{B} = 5i + j$ , find
- (i)  $\vec{B} \cdot \vec{A}$
  - (ii)  $|\vec{A}|$
  - (iii)  $|\vec{B}|$
  - (iv) The angle between  $\vec{A}$  and  $\vec{B}$  **(5 marks)**
- (b) State and prove the ratio theorem. **(5 marks)**

- (c) Draw a line segment AB and show the position of X on AB such that AX:XB is
- (i) 4:7
  - (ii) -2:5
  - (iii) 3:-1
- (3 marks)**

(d) Verify that  $\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A}$  **(5 marks)**

(e) Given that  $\vec{A} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ ,  $\vec{B} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$  and  $\vec{C} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

Find;

- (i)  $\vec{A} + \vec{B}$
  - (ii)  $\vec{B} + \vec{C}$
- (2 marks)**

### QUESTION THREE (20 MARKS)

- (a) Express the following ratios in terms of acute angles and hence find their values;
- (i)  $\sin 390^\circ$
  - (ii)  $\cos 160^\circ$
  - (iii)  $\tan 320^\circ$
- (6 marks)**

(b) Show that;

- (i)  $\tan 45^\circ = 1$
  - (ii)  $\sin 45^\circ = \frac{1}{\sqrt{2}}$  using a suitable triangle.
- (4 marks)**

(c) Show that  $\sec \theta + \operatorname{cosec} \theta \cot \theta = \sec \theta \operatorname{cosec}^2 \theta$  **(4 marks)**

(d) State the gradient and y – intercept of the following lines;

- (i)  $8y + 24x = 8$  **(2 marks)**
- (ii)  $6y - 30x + 6 = 0$  **(2 marks)**
- (iii)  $3y = 7 + 6x$  **(2 marks)**

### QUESTION FOUR (20 MARKS)

(a) Determine the equation of a circle that circumscribe the triangle with vertices  $A(1, 0)$ ,  $B(2, 1)$  and  $C = (0, 2)$  **(5 marks)**

(b) A line  $L_1$  is  $9x - 6y - 18 = 0$ . Determine the equation of a line.

- (i)  $L_2$  which is perpendicular to  $L_1$  and passes through  $(6, -3)$  **(4 marks)**
- (ii)  $L_3$  which is parallel to  $L_1$  and passes through  $(9, -3)$  **(4 marks)**

(c) A point P divides AB internally in the ratio 2:5, taking any point as the origin, find the position vector of P in terms of  $\mathbf{a}$  and  $\mathbf{b}$  the position vectors of A and B respectively.

**(4 marks)**

(d) A chord is 4 cm away from the centre of a circle of radius 5 cm. Calculate its length

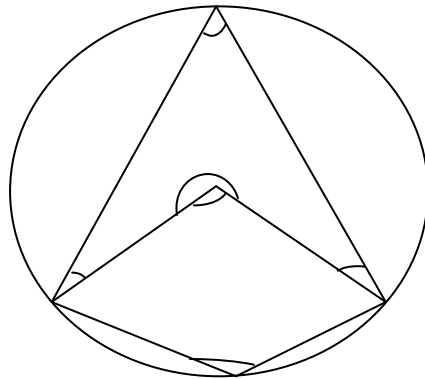
**(3 marks)**

**QUESTION FIVE (20 MARKS)**

(a) Show that  $\frac{(\sin \theta + \cos \theta)^2}{\sin \theta \cos \theta} = 2 + \sec \theta \operatorname{cosec} \theta$

**(3 marks)**

(b) In the figure below, O is the centre of the circle. Using the angles provided, find a, b, c and d.



**(4 marks)**

(c) Without drawing the lines, determine which of the following pairs of axes are perpendicular;

(i)  $y = 8x + 7$ ,  $y = \frac{1}{8}x + 3$

(ii)  $y = 3x + 7$ ,  $y = -\frac{1}{3}x$

(iii)  $y = \frac{2}{7}x - 1$ ,  $y = \frac{-2}{7}x - \frac{1}{2}$

(iv)  $y = \frac{3}{2}x - 1$ ,  $y = -\frac{2}{3}x - 4$

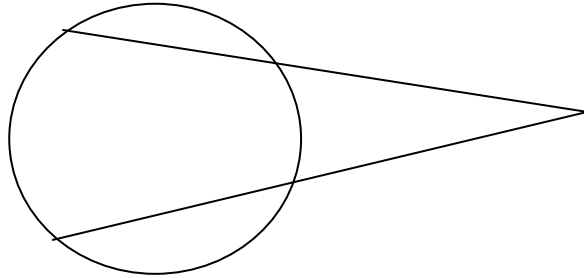
**(4 marks)**

(d) In a triangle PQR,  $p = 2.5$  cm,  $q = 3.6$  cm and  $r = 5.0$  cm. Calculate the angles P and R.

**(4 marks)**

- (e) In the figure below, chord PQ and RS intersect externally at A. If  $PQ = 13$  cm,  $RS = 8$  cm and AQ is 1 cm shorter than AS, determine the lengths of AQ and AS.

**(3 marks)**



- (f) Express the following in terms of  $\tan 80^\circ$

(i)  $\tan 620^\circ$

(ii)  $\tan 460^\circ$

**(2 marks)**