

KABARAK



UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

**FOR THE CERTIFICATE OF PRE - UNIVERSITY
MATHEMATICS**

COURSE CODE: PMATH 021

COURSE TITLE: VECTORS AND GEOMETRY

STREAM: SEMESTER TWO

DAY: MONDAY

TIME: 9.00 – 11.00 A.M.

DATE: 23/03/2009

INSTRUCTIONS:

Attempt **QUESTION ONE** and **ANY OTHER TWO** questions.

PLEASE TURN OVER

QUESTION ONE (30 Marks)

a) Show that addition of vectors is commutative. (3 marks)

b) If $\vec{a} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$ and $\vec{b} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$ find:

(i) $2\vec{a} - \vec{b}$

(ii) $\vec{a} - \vec{b}$. (4 Marks)

c) In a triangle, $\angle A = 4.85^\circ$, $\angle B = 32^\circ$ and $\angle C = 76^\circ$. Find the length of BC . (3 Marks)

d) Find the centre and radius of a circle whose equation is

$$3x^2 + 3y^2 + 6x + 12y + 9 = 0 \quad (4 \text{ Marks})$$

e) Given that θ is an acute angle and $\cos \theta = -\frac{1}{2}$, find $\tan \theta$ and $\sin \theta$ without using mathematical tables or electronic calculators. (5 Marks)

f) A chord subtends an angle of 60° at the centre. If the radius of the circle is 6, calculate:

(i) the length of the minor arc. (2 Marks)

(ii) the area of the minor segment cut off by the chord. (3 Marks)

g) Simplify the following:

(i) $\frac{\sqrt{12}}{\sqrt{3}}$

(ii) $\frac{\sqrt{18}}{\sqrt{2}}$. (6 Marks)

QUESTION TWO (20 Marks)

a) Show that the dot product of two vectors \vec{a} and \vec{b} is given by $\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$ where θ is the angle between them. (5 Marks)

b) Given that $\vec{a} = 2\hat{i} + 3\hat{j}$ and $\vec{b} = 5\hat{i} + \hat{j}$ find:

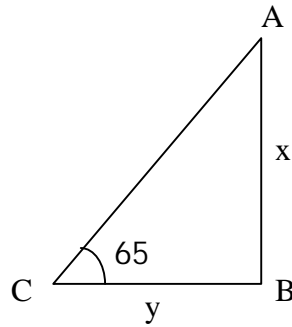
(i) $\vec{a} \cdot \vec{b}$ (2 Marks)

(ii) $|\vec{a}|$ (2 Marks)

(iii) $|\vec{b}|$ (2 Marks)

(iv) the angle between \vec{r} and \vec{s} . (2 Marks)

c) Find α and β in the figure below. (3 Marks)



d) Find the gradient and the y -intercept of:

(i) $2x - y = 7$

(ii) $3x + 2y = 4$ (4 Marks)

QUESTION THREE (20 Marks)

a) In a triangle ABC , $a = 2.5$, $b = 3.6$ and $c = 5.0$. Calculate the angles A and B . (6 Marks)

b) Without drawing the lines, determine which of the following pairs of lines are perpendicular. (3 Marks)

(i) $2x + 3y = 2$
 $12x - 8y = 24$

(ii) $3x + 4y = 3$
 $x - y = 2$

(iii) $x + y = 2$
 $6x - y = 5$

c) Find the length of the arc subtending an angle 250° at the centre of the circle of radius 14 . (Take $\pi = 22/7$) (3 Marks)

d) Two parallel chords of a circle are each 8 long. If the radius of the circle is 5 , what is the perpendicular distance between the chords? (4 Marks)

e) Express the following vectors in terms of \hat{i} and \hat{j} .

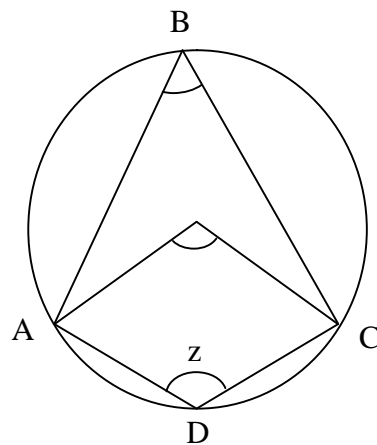
(i) $\begin{pmatrix} 5 \\ -7 \end{pmatrix}$

(ii) (4 Marks)

QUESTION FOUR (20 Marks)

a) Given a triangle, $\angle A = 4.85^\circ$, $\angle B = 32^\circ$, $\angle C = 76^\circ$ find the length of a . (3 Marks)

b) Find the value of x , y and z in the figure below given that O is the centre of the circle and $\angle x = 30^\circ$. (3 Marks)



c) Find the gradient and the line passing through the point (2,1) and: (6 Marks)

(i) perpendicular to $3x + y - 2 = 0$

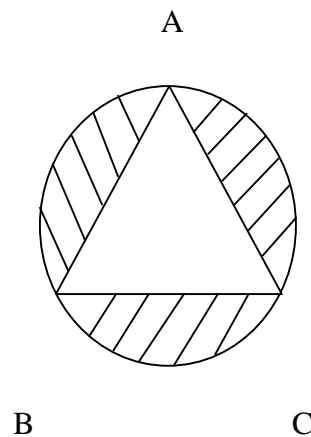
(ii) parallel to $x + 7y - 5 = 0$.

d) An equilateral triangle is inscribed in a circle of radius 10. Calculate: (8 Marks)

(i) the length of a side

(ii) the area of the triangle ΔABC .

(iii) hence find the area of the shaded region.



QUESTION FIVE (20 Marks)

- a) By use of a suitable triangle, determine: (i) $\sin 30^\circ$, (ii) $\cos 30^\circ$, (iii) $\tan 30^\circ$,
(iv) $\sin 60^\circ$, (v) $\cos 60^\circ$, (vi) $\tan 60^\circ$. (8 Marks)
- b) AB and CD are parallel chords, 2 cm apart. If $AB = 8$ cm and $CD = 10$ cm , find the radius of the circle centre O . (6 Marks)
- c) From a point P , the angle of elevation of the top of a tower, 20 m high is 20° . From a point Q on the same level as P and the foot of the tower, the angle of elevation is 26° . Find the distance PQ . (6 Marks)