KABARAK UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COURSE CODE: **MATH 111**

COURSE TITLE: **VECTOR GEOMETRY**

STREAM: **Y1S1**

DAY: **TUESDAY**

TIME: **9.00 – 11.00 A.M.**

DATE: **24/03/2009**

INSTRUCTIONS:

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

PLEASE TURN OVER

Question one (30 Marks)

a) Define the following terms: (3 Marks)

(i) Unit vector.

(ii) Collinear vectors.

(iii) Coplanar vectors.

b) $(2,-1,3)$, $(8,5,-6)$ and R$(4,1,0)$ are the vertices of a triangle. Show that $\vec{\ } = 3\ \vec{\ }$ and the direction cosines of $\vec{\ }$ are $\frac{}{\sqrt{}}, \frac{}{\sqrt{}}, -$. (5 Marks)

c) Find the unit vector perpendicular to the plane containing the vectors $\vec{\ } = 2\hat{\ } + \hat{\ } -$ and $\vec{\ } = -3\hat{\ } + 4\hat{\ } +$. (4 Marks)

d) Given $\vec{\ } = 3\hat{\ } - 4\hat{\ } - 5$ and $\vec{\ } = 2\hat{\ } - 3\hat{\ } +$ find:

(i) $2\vec{\ } - 3\vec{\ }$. (1 Mark)

(ii) the projection of $\vec{\ }$ along $\vec{\ }$. (3 Marks)

e) Prove that $3\hat{\ } - 2\hat{\ } +$, $\hat{\ } - 3\hat{\ } + 5$ and $2\hat{\ } + \hat{\ } - 4$ form a right angled triangle.

(4 Marks)

f) Find the total work done when two forces $= 2\hat{\ } + 3\hat{\ }$ and $= 6\hat{\ } + 7\hat{\ } + 4$ displaces an object from point $(1,4,6)$ to $(3,8,5)$. (4 Marks)

g) Show that:

(i) $\vec{\ } - \vec{\ } \cdot \vec{\ } + \vec{\ } = \vec{\ } - \vec{\ }$.

(ii) $\vec{\ } - \vec{\ } \times \vec{\ } + \vec{\ } = 2\vec{\ } \times \vec{\ }$. (6 Marks)

Question Two (20 Marks)

a) Show that the quadrilateral with vertices at $(5,2,0)$, $(2,6,1)$, $(2,4,7)$, and D$(5,0,6)$ is a parallelogram and then find its area. Is it a rectangle? (6 Marks)

b) Find the angle between the planes given by $2\ \ = -\ \ + 4$ and $3\ \ = 2\ \ + 2\ . + 8$

(4 Marks)

c) Determine whether the three vectors $\vec{\ } = (1,4,-7)$, $\vec{\ } = (2,-1,4)$, and $\vec{\ } = (0,-9,18)$ lie on the same plane or not. (6 Marks)

d) Show that $\vec{\ } \times \vec{\ } \times \vec{\ } + \vec{\ } \times \vec{\ } \times \vec{\ } + \vec{\ } \times \vec{\ } \times \vec{\ } = 0$. (4 Marks)

Question Three (20 Marks)

a) Find the angle between the lines $\vec{\ } = 4\hat{\ } - \hat{\ } + \quad \hat{\ } + 2\hat{\ } - 2 \quad$ and

$\vec{\ } = \hat{\ } - \hat{\ } + 2 \quad - \quad 2\hat{\ } + 4\hat{\ } + 4 \quad$. (4 Marks)

b) A plane moves Northward at $40 \quad /h$. There is a wind that is blowing at $15 \quad /h \ 30$ east of North. Determine:

(i) The resultant velocity of the plane.

(ii) The direction of the plane. (7 Marks)

Question Four (20 Marks)

a) Find the equation of a plane that contains the points $(3,4,2)$, $(6,2,0)$ and $(1,4,1)$.

(6 Marks)

b) Prove that $\vec{\ } \cdot (\vec{\ } + \vec{\ }) = \vec{\ } \cdot \vec{\ } + \vec{\ } \cdot \vec{\ }$. (4 Marks)

c) Find the area of the triangle having vertices $\ (1,3,2)$, Q$(2,-1,1)$, and $\ (-1,2,3)$.

(5 Marks)

d) State and prove the triangle inequality. (5 Marks)

Question Five (20 Marks)

a) Using vectors prove the cosine rule. (5 Marks)

b) Write the equation of the line that passes through the points $(2,-1,3)$ and $(1,4,-3)$ in:

(i) the vector form.

(ii) the parametric form.

(iii) the symmetric form.

(iv) Where does the line intersect the -plane? (7 Marks)

c) Given two vectors $\vec{\ } = \quad \hat{\ } + \quad \hat{\ } + \quad$ and $\vec{\ } = \quad \hat{\ } + \quad \hat{\ } + \quad$ derive their dot product.

(3 Marks)

d) Find the intersection of the line with the parametric equations $\ = 2 + 3 \ ,\quad = -3 + 5 \ ,$ $\ = 4 - 6 \ $ and the plane $2 \ - 3 \ - 3 \ = 4$. (5 Marks)