KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF ECONOMICS & MATHEMATICS

COURSE CODE: MATH 111

COURSE TITLE: **VECTOR GEOMETRY**

STREAM: **Y1S1**

DAY: **MONDAY**

TIME: **11.00 – 1.00 P.M.**

DATE: **15/12/2008**

INSTRUCTIONS TO CANDIDATES:

1. Answer Question **ONE** and any other **TWO** Questions

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

(a) Distinguish between coplanar vectors and resultant vectors. **(4 mks)**

(b) Using vectors show that

Sin (A – B) = Sin A Cos B – Cos A Sin B **(6 mks)**

(c) Find the angle between the plane

$2x + 3y + 6z = 12$ and the line

$x = 4 + 2t,\ \ y = 3 + 2t$ and $z = 2 - t$ **(4 mks)**

(d) Show that;

$$x \to X\ \left|\vec{A}\, X\, \vec{B}\right|^2 + \left|\vec{A} \cdot \vec{B}\right|^2 = \left|\vec{A}\right|^2 \left|\vec{B}\right|^2$$ **(4 mks)**

(e) Find the work done by forces

$\vec{F}_1 = \vec{2i} + \vec{3j} - \vec{6k}$ and $\vec{F}_2 = \vec{i} + \vec{4j} - \vec{k}$ in displacing an object from (1, 5, 4) to point (3, 8, 9) **(3 mks)**

(f) A triangle is defined by the point A(0, 1, 0), B(1, 0, 1) and C(0, 1, 4)

Find the area of the triangle and a unit a vector perpendicular to the plane containing the triangle. **(4 mks)**

(g) Find the angle between the planes $x + 2y + 6z = 8$ and $2x + 4y + z = -4$ **(5 mks)**

QUESTION TWO (20 MARKS)

(a) Show that the diagonals of a parallelogram bisect each other. **(6 mks)**

(b) Prove that $\left[\left(\vec{a} + \vec{b} + \vec{c}\right) X \left(\vec{b} + \vec{c}\right) \cdot \vec{c} = \vec{a} \cdot \left(\vec{b}\ X\ \vec{c}\right)\right]$ **(4 mks)**

(c) Find a unit vector perpendicular to the plane containing the points (1, 4, 1) (0, 6, 3) and (3, 2, 4) using dot product method **(8 mks)**

(d) Determine whether the points A(0, 2, 5) B(1, 6, 3) and C(4, 8, 1) are collinear. **(2 mks)**

QUESTION THREE (20 MKS)

(a) Prove that the medians of a triangle bisect each other in the ration 2:1 **(8 mks)**

(b) Determine the projection of

$$\vec{b} = 2\vec{j} + 4\vec{j},\ \vec{k} \text{ onto } \vec{a} + \vec{i} - 2\vec{k}$$

Interpret the result. **(4 mks)**

(c) Find the distance between the point (0, 4, 6) and the line passing through (3, 4, 6) and (0, 3, 2) **(5 mks)**

QUESTION FOUR (20 MKS)

(a) Derive the formula for determining the volume of a parallelepiped. **(5 mks)**

(b) A parallelogram has vertices (0, 0, 0), (6, 1, 1), (8, 5, 2) and (2, y, x)

(i) Find the value of x and y **(2 mks)**

(ii) Find the area of the parallelogram **(2 mks)**

(c) Derive the formula for determining the position vector of the centroid of a triangle. Use it to find the position vector of the centroid of a triangle with points A (2, 4, 7) B(3, -4, 0) and C (4, 0, 2). **(4 mks)**

(d) Prove the law of cosines. **(4 mks)**

QUESTION FIVE (20 MARKS)

(a) Find the equation of a plane that contains the points A(2, 5, 1), B(0, 2, 1) and C(3, 6, 2) **(5 mks)**

(b) Find a vector that is parallel to the line of intersection. **(7 mks)**

$$3x - 6y - 2z = 15$$

$$2x + y - 2z = 5$$

Hence find the parametric equation of the line parallel to the line of intersection.

(8 mks)

(c) Calculate

$$\left(2\vec{i}+3\vec{j}+\vec{k}\right) \text{x} \left(2\vec{i}+\vec{j}\right) \text{x} \left(\vec{j}+3\vec{k}\right)$$ **(3 mks)**

(d) Determine whether the vectors are coplanar

$\vec{a} = 2\vec{i}+3\vec{j}+4\vec{k}$ $\quad$ $\vec{r} = 7\vec{i}-6\vec{j}+14\vec{k}$

$\vec{b} = \vec{i}-4\vec{j}+2\vec{k}$ **(4 mks)**