KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2013/2014 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF SCIENCE IN ECON/MATH

MATHS 111: VECTOR GEOMETRY

DAY: TUESDAY **DATE: 12/8/2014**

TIME: 9:00AM – 11:00AM **STREAM: Y1S1**

Instructions:

Attempt question one and any other two question.

Question 1 (30 marks)

1. (a) Differentiate between a vector and a scalar giving an example of each case (2mks)

(b). Let u = 4i + 5j + 2k and v = 2i – j + 3k

Find each of the following

(i) 2u – v (2mks)

(ii) $2|u + v|$ (3mks)

(c). If c is a scalar and v a vector show that for any vectors in $\Re^3$ & $\Re^2$ then

$||cv|| = ||c||\ ||v||$ (4mks)

(d). If v = (2,2,1), find the length of v and hence the acute vector in opposite direction of v: (4mks) (e). Let m be the mid point of a line segment PQ. Let O be a point not on the line PQ. Show that:

$\overrightarrow{OM} = ½\ \overrightarrow{OP} + ½\ OQ$ (4mks)

(f). Let u and v be two vectors In $\Re^2$ & $\Re^3$. Let θ be the angle between u and v then show that: u.v = ||u|| ||v|| cos θ and hence If u = (3,1,2) and v = (1,4,3) find the angle between u & v: (5mks)

(g). Find the angle between two planes x + 2y –z = 6 and 3x + 2y – z = 7

(3mks)

(h). Find the equation of a plane with normal vector n = (1,2,3) containing the point (2,-1,5) (3mks)

Question 2 (20 marks)

2. (a) Show that for any set of vectors **u** & **v** then **u x v = -v x u** (4mks)

(b) Find a vector orthogonal to both **u** = (1,3,2) and **v** (4,01): (3mks)

(c) A triangle ABC has vertices on A(1,2,2) B(3,4,5) and C(5,6,4). Find its area.

(5mks)

(d) A parallelopipe has vectors on its edges as following **u** = (2,3,1) **v** = (3,4,3) and **w** = (4,5,6). Find its volume: (5mks)

(e) For **U** = 2i + j – k, **V**=3i + 2j + k. Find **U x V** (3mks)

Question 3 (20 marks)

3. (a). Given two vectors In $\Re^n$ **u** and **v**. show that

$$u.v = \frac{1}{4}\left(|u + v|^2 - |u - v|^2\right)$$ (4mks)

(b) Let u = (1,2,-5) v = (3,-1,2) and w = (2,0,3). Find each of the following.

(i) (2u + v). w (3mks)

(ii) (u – 3v). w (3mks)

(c) Find the cosine of angle between u(1,2,3) and v(3,-2,1) (4mks)

(d) Determine the value of a so that A = 2i + aj + k and B = 4i – 2j - 2k are perpendicular: (3mks)

(e) Find the projection of A = i – 2j + k on vector B = 4i – 4j + 7k (3mks)

Question 4 (20 marks)

4. (a). Given a set of vector **u** = 2i + j + k and **v** = 3i – 2j – k

Find (i) **u** x **v** (2mks)

(ii)The sine of the angle between **u** and **v** (5mks)

(b) Show that **a** = i + 2j + 3k, **b** = 4i + 5j +6k and **c** = 7i + 8j + 9k all lie on the same plane: (5mks)

(c) State and prove the distributive Law of cross products: (4mks)

(d) If 2x + 4y – 5z is an equation of a plane. Find the normal vector and a point on this plane: (4mks)

Question 5 (20 marks)

5. (a). Find a unit vector parallel to a resultant vector $r_1 = 2i + 4j - 5k$,

$r_2 = I + 2j + 3k$ (4mks)

(b). Show if $i + 2j + 3k = u$ and $3i + j + k = v$ are orthogonal. (4mks)

(c) Write a parametric equation for a plane whose Cartesian equation is

$X + 2y - z = 7$ (4mks)

(d). $2x + 4y - 5z = 11$. Is an equation of a plane. Find the normal vector and a point on this plane (4mks)

e). Find the volume of a parallelopipe determine by the vectors (-1,2,3), (2,-1,1), (3,-2,3) (4mks)