KIX 1001: ENGINEERING MATHEMATICS 1

Tutorial 4: Vector Algebra I

1. Graphical interpretation and the effect of scalar multiplication

(i) For the position vector $\underset{\sim}{a} = \langle 2,4 \rangle$, compute $3\underset{\sim}{a}$, $\frac{1}{2}\underset{\sim}{a}$, and $-2\underset{\sim}{a}$. Sketch all four vectors on the same axis system. Discuss the effect of scalar multiplication on the magnitude and direction of the original vector.

(ii) Determine if the sets of vectors are parallel or not.

a. $\underset{\sim}{a} = \langle 2,4,-1 \rangle$, $\underset{\sim}{b} = \langle -6,-12,3 \rangle$

b. $\underset{\sim}{a} = \langle 4,10 \rangle$, $\underset{\sim}{b} = \langle 2,-9 \rangle$

(iii) Find unit vector that has the same direction as $\underset{\sim}{u} = \langle -5,2,1 \rangle$

2. Let *A*(1,3,5) and *B*(4,6,2). Find the point *C* so that it is located on the line segment *AB* which divides *AB* into two segments which are in the ratio 1: 3.

3. Find the following equation of line for the line *L* passing through the point *P*(3,1, -2) and *Q*(-2,7, -4).

(i) vector equation,

(ii) parametric equation, and

(iii) Cartesian equation

4. Let *ABCD* be a parallelogram.
If *A*(3,2, -5), *B*(4,1,0) and *C*(1,1,4) are three vertices of parallelogram. Find point *D*.

5. Let $\overrightarrow{OP} = \underset{\sim}{i} + 3\underset{\sim}{j} - 7\underset{\sim}{k}$ and $\overrightarrow{OQ} = 5\underset{\sim}{i} - 2\underset{\sim}{j} + 4\underset{\sim}{k}$

(i) Find the unit vector in the direction of $\overrightarrow{PQ}$

(ii) Find the direction cosines of $\overrightarrow{PQ}$

(iii) Find the vector of magnitude 5 in the direction of $\overrightarrow{QP}$ in polar form

6. Let *A*(1,2) and *B*(3,4)

(i) Find the vector equation of the line *L* passing points *A* and *B*

(ii) Sketch the line for $t = 0{:}\ 1{:}\ 5$ and indicate its direction and initial point.

7. If a unit vector $\vec{a}$ makes angles $\pi/3$ with *i*, $\pi/4$ with *j* and acute angle θ with *k* then find θ and hence components of $\vec{a}$.

8. If $\vec{a}$ is a unit vector and $(\vec{x} - \vec{a}).(\vec{x} + \vec{a}) = 8$, then find $|\vec{x}|$.