# MAT 216

# Problem Sheet - 1:

**Solve the following Problems:**

1. Find two equations for $c$ & $d$ where the linear combination $cv + dw$ equals $b$ and

$$v = \begin{pmatrix} 2 \\ -1 \end{pmatrix}, \quad w = \begin{pmatrix} -1 \\ 2 \end{pmatrix} \quad \& \quad b = \begin{pmatrix} 1 \\ 0 \end{pmatrix}.$$

2. Using component form notation for vectors:

(i) Sketch the vector $\vec{v} = (2, -1)$ starting at $P = (3, 2)$ and find its magnitude.

(ii) Find the component form of the vector $\vec{w}$ whose initial point is $R = (-3, -2)$ and terminal point is $S = (-1, 2)$.

(iii) Sketch the vector $\vec{u} = (2, -1, 3)$ starting at the point $Q = (1, 1, 1)$ and find its magnitude.

3. Let $v_1 = (0, 1, -1)$, $v_2 = (-1, 0, 1)$, $v_3 = (1, -1, 0)$, $v_4 = (3, 2, -5)$, $v_5 = (1, 1, 1)$ be the vectors.

(i) Show that $v_3$ is a linear combination of $v_1$ & $v_2$.

(ii) Verify that $v_4$ is a linear combination of $v_1$ & $v_3$.

(iii) Verify that $v_4$ is a linear combination of $v_1$ & $v_2$.

4. Let $u = \begin{pmatrix} 5 \\ 3 \\ -4 \end{pmatrix}$, $v = \begin{pmatrix} -1 \\ 5 \\ 2 \end{pmatrix}$, $w = \begin{pmatrix} 3 \\ -1 \\ -2 \end{pmatrix}$. Find the following:

(i) $5u - 2v$,

(ii) $-2u + 4v - 3w$.

5. Let $v_1 = (1,1,1)$, $v_2 = (1,2,3)$, $v_3 = (2,-1,1)$, $v_4 = (1,-2,5)$ be the vectors.

   (iv)   Show that $v_4$ is a linear combination of $v_1$, $v_2$ & $v_3$ .

6. Let $u = (5,4,1)$, $v = (3,-4,1)$, $w = (1,-2,3)$ , Which pair of vectors are perpendicular.

7. Find the vector $u$ identified with the directed line segment $\overrightarrow{PQ}$ for the points:

   (i)    $P(1,-2,4)$ & $Q(6,1,-5)$ in $\Re^3$,

   (ii)   $P(2,3,-6,5)$ & $Q(7,1,4,-8)$ in $\Re^4$ .