# MIDTERM EXAMINATION
# Spring 2010
# (MTH501- Linear Algebra (Session - 3)

**Q1. Find vector and parametric equation of the plane that passes through the origin of $R^3$ and is parallel to the vectors $V_1$= (1, 2, 5) and $V_2$ = (5, 0, 4).**

**Solution:**

As vector equation of the plane passing through origin is $x = t_1 v_1 + t_2 v_2$

Let x = (x, y, z) then this equation can be expressed in component form as

$(x, y, z) = t_1 (1, 2, 5) + t_2 (5,0,4)$

This is the **vector equation of the plane**.

Equating corresponding components, we get

$x = t_1 + 5t_2$, $y = 2t_1$, $z = 5t_1 + 4t_2$

These are the **parametric equations of the plane.**



**Q2. Which of the following is true? If V is a vector space over the field F.(justify your answer)**

$a)\ \{\frac{x+y}{x}\ \varepsilon\ V, y\ \varepsilon\ V\} = V$

$b)\ \{\frac{x+y}{x}\ \varepsilon\ V, y\ \varepsilon\ V\} = VxV$

$c)\ \{\frac{\lambda V}{V}\ \varepsilon\ V, \lambda \varepsilon\ F\} FxV$

**Solution:**

**(b) and (c) both are correct vector space V over a field F is a set V equipped with an operation called (vector) addition, which takes vectors u and v and produces another vector .**

**There is also an operation called scalar multiplication, which takes an element and a vector and produces a vector .**

**Q3.** *let*

$$v_1 = \begin{bmatrix} 1 \\ 0 \\ -2 \end{bmatrix}, v_2 = \begin{bmatrix} -2 \\ 1 \\ 7 \end{bmatrix} \text{and y=} \begin{bmatrix} h \\ -3 \\ -5 \end{bmatrix}$$

for what value$(s)$of h is y in the plane is generated by $v_1$and $v_2$ ?

**Solution:**

we can write in matrix form as

$$\begin{bmatrix} 1 & -2 & h \\ 0 & 1 & -3 \\ -2 & 7 & -5 \end{bmatrix}$$

$$2R_1 + R_3 \longrightarrow R_3{}' \begin{bmatrix} 1 & -2 & h \\ 0 & 1 & -3 \\ 0 & 3 & 2h-5 \end{bmatrix}$$

$$2R_2 + R_1 \longrightarrow R_1{}' \begin{bmatrix} 1 & 0 & h-6 \\ 0 & 1 & -3 \\ 0 & 3 & 2h-5 \end{bmatrix}$$

$$-3R_2 + R_3 \longrightarrow R_3{}' \begin{bmatrix} 1 & 0 & h-6 \\ 0 & 1 & -3 \\ 0 & 0 & 2h+4 \end{bmatrix}$$

for h=2

y is in the plane generated.

**Q8.given A and b ,write the augmented matrix for the linear system that corresponds to the matrix equation Ax=b. then solve the system and write the solution as a vector.**

$$A=\begin{bmatrix}1 & 2 & 1\\ -3 & -1 & 2\\ 0 & 5 & 3\end{bmatrix}, b=\begin{bmatrix}0\\ 1\\ -1\end{bmatrix}$$

**Solution:**

we can write the given ab in the matrix equation form Ax=b

$$Ax=\begin{bmatrix}1 & 2 & 1\\ -3 & -1 & 2\\ 0 & 5 & 3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}=\begin{bmatrix}0\\ 1\\ -1\end{bmatrix}=b$$

*or*

$$\begin{bmatrix}1 & 2 & 1\\ -3 & -1 & 2\\ 0 & 5 & 3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}=\begin{bmatrix}0\\ 1\\ -1\end{bmatrix}$$