**Linear Combinations**

If is the vector in vector space V, then is said to be a linear combination of the vectors in V, if can be expressed in the form where are scalars. These scalars are called the coefficients of linear combinations.

**Example 1:**

Let in . Then can be written as linear combinations of .

**Solution:**

**Example 2:**

Consider the vectors and in . Show that is linear combination of and .

Also prove that is not linear combination of and .

**Solution:**

In order to form linear combination of and . there exist and such that

Equating corresponding components gives:

Solving this system by using Gauss Elimination:

Put value of in (1), we get:

So

That is

So is the linear combination of and .

Similarly, we have to check whether is linear combination of and .

If is linear combination of and . then there must exist and , such that:

This system has no solution. So, no such and exist. So is not the linear combination of and .

**Example 3:**

Which of the following are linear combination of and

1. (2, 2, 2)
2. (3,1,5)
3. (0,4,5)
4. (0,0,0)

**Example 4:**

Express the following as linear combination of

1. (-9, -7,-15)
2. (66,11,6)
3. (0,0,0)
4. (7,8,9)

**Example 5:**

Which of the following is the linear combination of

**Solution:**

Add (1) and (2):

, put in (3)

Add (1) and (5)

Put in (1)

put in (2)

Put in (4)

So is linear combination of A, B and C.

**Polynomials of degree n:**

Let is the set of all polynomials of degree n, form vector space under addition and scalar multiplication defined by:

If k is any scalar then

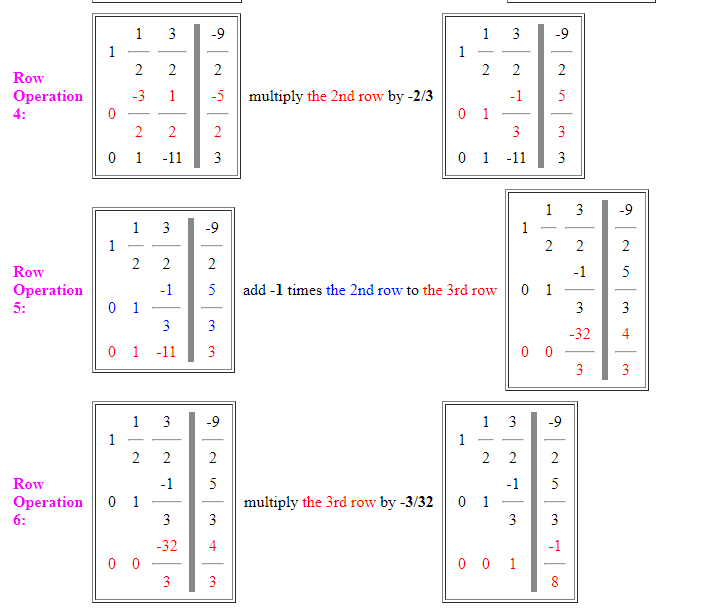
Then is vector space.

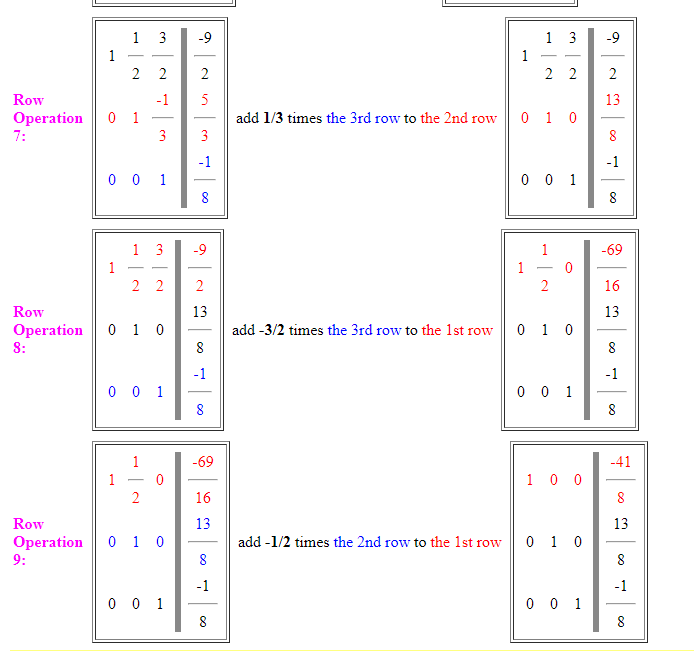
**Example 6:**

In each part the vectors are as linear combination of , and

**Solution:**

Comparing equations on both sides, we get:





As

So is linear combination of