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ASSIGNMENT

1. Define a Vector Space?

A vector space is a collection of objects called vectors which may be added together and multiplied by numbers, called scalars. Scalars are often taken to be real numbers, but here are also vector spaces with scalar multiplication by complex numbers, rational numbers, or generally any field.

 1 1 1 A

1. α 1 + β 2 +ɣ 5 = B

 1 3 8 C

α + β + ɣ =A-------(equ1)

α +2β + 5ɣ = B -----(equ2)

α + 3β + 8ɣ = C------(equ3)

From equ1

 α = A – β - ɣ-----(equ4)

From (equ4)

Put in 2 & 3

In Equ 2: α +2β + 5ɣ = B

(A – β - ɣ ) +2β + 5ɣ = B

A – β - ɣ +2β + 5ɣ = B

A + β + 4ɣ = B

 β + 4ɣ = B ­–A------(equ5)

In Equ3: α + 3β + 8ɣ = C

 (A – β - ɣ ) + 3β + 8ɣ = C

 A – β - ɣ + 3β + 8ɣ = C

 A + 2β + 7ɣ = C

 2β + 7ɣ = C- A ------(equ6)

Combine equ 5 & 6

 β + 4ɣ = B ­–A \* 2

 2β + 7ɣ = C- A \* 1

 2β + 8ɣ = 2(B- A)

 - 2β + 7ɣ = C- A

 ɣ = 2( B - A ) – (C - A)

 ɣ = 2 B - A – (C - A)

 ɣ = 2 B - 2A – C + A

 ɣ = 2 B - A – C or –A + 2B –C

From (equ6) : 2β + 7ɣ = C- A

 2β + 7(2 B - A – C ) = C – A

 2β + 14B - 7A –7 C = C – A

 2β + 14B = C+ 7 C - A + 7A

 2β + 14B = 8 C + 6A

 2β = 8 C + 6A -14B

 Divide through by 2

 β = 4C + 3A -7B

 β = 3A -7B + 4C

From equ 4 : α = A – β - ɣ

 α = A – (3A -7B + 4C) – (2 B - A – C )

 α = A – 3A +7B - 4C – 2 B + A + C

 α = – A +5B - 3C

1. αU1 + βU2 + ɣU3  = 0

 1 3 0 **0**

 α 2 +β 2 + ɣ 0 = **0**

 3 1 1 **0**

 : α + 3β = 0 ----------(equ1)

 2α + 2β = 0----------(equ2)

 3α + 3β + ɣ = 0-------(equ3)

From (equ1)

 α = - 3β-----(equ4)

Put equ 4 in 2 & 3

Equ2: 2α + 2β = b

 2(- 3β) + 2β = 0

 -6β+ 2β = 0

 -4β = 0

 β= 0

Since β = 0

Put in equ 4

 α = - 3β

 α = - 3(0)

 α = 0

Put α & β in equ 3

 3(0) + 0 + ɣ = 0

 ɣ = 0

Spanning:

 αU1 + βU2 + ɣU3  = (a,b,c)

 1 3 0 **a**

 α 2 +β 2 + ɣ 0 = **b**

 3 1 1 **c**

 : α + 3β = A ----------(equ1)

 2α + 2β = B----------(equ2)

 3α + β + ɣ = C-------(equ3)

From (equ1)

 α = A- 3β-----(equ4)

Put equ 4 in 2 & 3

Equ2: 2(A- 3β) + 2β = B

 2A- 6β + 2β = B

 - 4β= B-2A

 β= $\frac{-B-2A}{4}$

 β= $\frac{-B+2A}{4}$

 β= $\frac{2A-B}{4}$

Put β in equ 3: 3α + 3β + ɣ = C

 3(A- 3β) + β + ɣ = C

 3A- 9β + β + ɣ = C

 - 8β + ɣ = C – 3A

 -8($\frac{2A-B}{4}$) + ɣ = C – 3A

 -2(2A – B) + ɣ = C – 3A

 -4A – 2B + ɣ = C – 3A

 ɣ = C – 3A + 4A -2 B

 ɣ = C +A -2 B

 ɣ = A -2 B + C

α = A- 3β

 α = A- 3 ($\frac{2A-B}{4}) $

 α = A- ($\frac{6A-3B}{4}) $

α = ($\frac{4A-6A+3B}{4}) $

α = ($\frac{-2A+3B}{4}) $

Since, the vectors spans R3 and are also linearly independent, then the vectors are bases of R3