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**18/SCI01/047**

**MAT 204**

**What is a linear transformation?**

A **linear transformation**, T:U→VT:U→V, is a function that carries elements of the vector space UU (called the **domain**) to the vector space VV (called the **codomain**), and which has two additional properties

1. T(u1+u2)=T(u1)+T(u2)T(u1+u2)=T(u1)+T(u2) for all u1,u2∈Uu1,u2∈U
2. T(αu)=αT(u)T(αu)=αT(u) for all u∈Uu∈U and all α∈C

4 2 1

3 1 -1

2 0 1

4 3 0

6 1 -1

5 2 -4

0 1 3

-1 0 2

4 -2 1

A =

B =

C =

3 3 0

2 1 -1

1 3 -1

0 1 3

1 0 2

4 2 1

E =

D =

1. **LINEAR TRANSFORMATION OF A , IF VEXTOR x = (a,b,c)**

A = x =

a

b

c

0 1 3

-1 0 2

4 -2 1

1

0

-2

3

2

1

0

-1

4

T(x)= a + b + c

0

-a

4a

b

0

-2b

3c

2c

c

+ +

T(x) =

0 + b + 3c

-a + 0 + 2c

4a - 2b + c

a

b

c

b + 3c

-a + 2c

4a - 2b + c

Hence the transformation of gives;

1. **LINEAR TRANSFORMATION OF B , IF VEXTOR x = (a,b,c)**

4 2 1

3 1 -1

2 0 1

a

b

c

B = x =

2

1

0

1

-1

1

4

3

2

T(x)= a + b + c

2b

b

0

4a

3a

2a

c

-c

c

+ +

4a + 2b + c

3a + b - c

2a + 0 + c

T(x) =

a

b

c

4a + 2b + c

3a + b - c

2a + c

Hence the transformation of gives;

1. **LINEAR TRANSFORMATION OF C , IF VEXTOR x = (a,b,c)**

C = x =

a

b

c

4 3 0

6 1 -1

5 2 -4

3

1

2

4

6

5

0

-1

-4

T(x)= a + b + c

4a

6a

5a

3b

b

2b

0

-c

-4c

+ +

4a + 3b + 0

6a + b - c

5a + 2b - 4c

T(x) =

Hence the transformation. Gives

a

b

c

4a + 3b

6a + b - c

5a + 2b - 4c

1. **LINEAR TRANSFORMATION OF D , IF VEXTOR x = (a,b,c)**

0 1 3

1 0 2

4 2 1

D = x =

a

b

c

1

0

2

0

1

4

3

2

1

T(x)= a + b + c

b

0

2b

0

a

4a

3c

2c

c

+ +

0 + b + 3c

a + 0 + 2c

4a + 2b + c

T(x) =

a

b

c

b + 3c

a + 2c

4a + 2b + c

Hence the transformation of gives;

1. **LINEAR TRANSFORMATION OF E , IF VEXTOR x = (a,b,c)**

3 3 0

2 1 -1

1 3 -1

E = x =

a

b

c

3

1

3

3

2

1

0

-1

-1

T(x)= a + b + c

3a

2a

a

3b

b

3b

0

-c

-c

+ +

3a + 3b + 0

2a + b - c

a - 3b - c

a

b

c

Hence the transformation of gives;

3a + 3b + 0

2a + b - c

a - 3b - c