Unit 3

Vector Space > Let V top set of Certain objects, which may be vectors, matrices, functions on some other object. Each object is an element of V and is called a vector.

Let t: VXV -> V a binary operation, called vector

· : EXV > V an operation, Called Scalar multiplication

Then (V, +, .) is called a vector space if va, b, c ev, d, B EF. the following peroperties are satisfied.

- a+b ev
- (2) a+6 = b+a
- (3) (a+b)+c = a+(b+c)
- (4) a+0=0=0+a where o is the zero Element inv
- (5) a + (-a) = c
- (6) d.a ev
- $(7) (d+\beta) \cdot \alpha = d \cdot \alpha + \beta \cdot \alpha$
- (8) $(\alpha \cdot \beta) \cdot \alpha = \alpha \cdot (\beta \cdot \alpha)$
- (9) d. (a+b) = d.a + d.b
- (10) 1.a = a where 1 is unity Element in F.

Note that F is the Set of seed numbers on Set of Complex numbers, Called field of Scalars.

- → V= 803 is called a trivial vecitor space.
- Ex (1) V = E Set of real numbers? Is a vector space with usual addition and scalar multiplication over F = IR
- (2) V = E set of all continuous functions ie. f: [a,6] → R]
 V is a vector space over R.

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The same of the sa	is a vector space over F=R.		4
(4)	The state of the s	1.31	
Carrier resignation residence	V = E set of all mxn matrices? Vis a vector show	112	la de la companya de
and any series of the contract	Vis a Vector Space over $F = R$. Here $O = Null materix$	2512	
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(5)	The state of the s	77.2	
	V = P Set of all halve 10 0.		
-	Then Vis not a vector space.		
	1 dist + x" EV	will have a side	
	A = A + A + A + A + A + A + A + A + A +		
	(an + bn) + (a,+b,)x+ + (an + bn))xM	W W.
	is a polynomial of der (n1)	+1.00	
	Voi = pn+2n (V.)	= 5-1	(6)
(6)		10-1-1	
(6)	V = E Set of all polynomials of degree n3		
		33 D.h	
	and usual Scalar multiplication.		
	Then V is not a vector space.		
	: let pn= ao+a,x+_+anxh EV		
	$2n = b_0 + b_1 \alpha + \frac{1}{2} b_n \alpha^n \in V$		
in the second	Then $p_n+q_n = p_n \cdot q_n$ is a polynomial	of de	gill
	$2n \rightarrow pn + 9n \notin V$		
	=) V is not a vector space.		
			O
)	V = [R2 ic. Set of all ordered pairs (>	(, 9) , x,	JEIK.
	Vector addition is defined as		
0	$(2x_1-3x_2, y_1-y_2) = (2x_1-3x_2, y_1-y_2)$	· · · · · · · · · · · · · · · · · · ·	
d	$0 = d(x_1, y_1) = (dx_1, dy_1)$		
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	neck whether vis a vector space on not Over	tek,	
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Solis	$a \pm b \pm b \pm a$
	$(ct \ \alpha = (x, y), b = (x, y)$
	Then $a+b = (x_1, y_1) + (x_2, y_2) = (x_1 - 3x_2, y_1 - y_2)$
	$b+a = (x_2, y_2) + (x_1, y_1) = (2x_2-3x_1, y_2-y_1)$
	Similarly (a+b)+c + a+16+c)
	Section (Section 1980) - ALL CONTRACTOR OF THE SECTION OF THE SEC
	Also 1. $(x_1, y_1) = (x_1, y_1) = (x_1, y_1) + (x_1, y_1)$
	= 1. a ≠ a where 1 is the unity Element in IR.
	→ Vis not a vector space over R
Due	1-1-10 ² 1. C. P. M
	let V=1R2 ic. Set of all ordered pairs.
	$\{\text{et } G = (x, y_1), b = (x_2, y_2) \in V$
	$(1+b) = (x_1, y_1) + (x_2, y_2) = (x_1 x_2, y_1, y_2)$
	and da = $\alpha(x_1, y_1) = (\alpha x_1, \alpha y_1)$
	Then Show that V is not a v.s ofer R.
\rightarrow	Subspace :> let (V,+,.) be a vector space over field F.
	let W be a non-Empty subset of V. i.e. WCV.
	Then W is called a subspace of V if W is a vector
	space under the vector addition '+' and scalar multiplication '-'
	Such a such a such as the form
	Two Step test to Check the Subspace:
	let (V, +,) be a vector space over F
	and W = \$ W \ V
	Then W is subspace of V if
	athew + a, bew
	and da EW + de F, a EW.
	One Step Text:) let (v,+,) be a v.S. over F
	and w # 0, W = V
	Then wis subspace of Vif
	da+BbEW +d,BEE, a,bEW.
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	Ex	Let V= E(x1,x2 xn) ER" 3; F=R	0
		V is a v.s. with usual addition & scalar multiplication.	C.
	6)	let $W = \mathcal{E}(x_1, x_1) x_1 = 03 \subseteq V$	Sis
	The same of the sa	Then W is Subspace of V	Eu
	anamerica variosi in processiones in december	S: let a=(0,x2 xn); b=(0, x2 xn) &W	G
		Then a+b=(0,2x2, 2xn) EW	GF
		and def; da EW.	Cont.
			97
	('2		6
		Then Wis not a subspace of V.	Copie
		∫ ": let d=-1 let a=(x,, -xn) € W	Gra
-		Then $da = -a = -(x_1, x_n)$	C
-		$= (x_1, -x_2, -x_n) \in W$	0
		2 2 (10 1	C
	(3)		5
		Then Wis not a Subspace of Vand	5
		(' let $a = (x_1, x_2, x_n)$; $b = (y_1, y_2, y_n) \in W$	9
		=> \(\chi_2 = \chi_1 + 1\); \(\frac{1}{2} = \frac{1}{2} + 1\).	W
-		Then a+b = (24+41, 22+42, 2n+4n)	77
	340	$\text{thd } \chi_g + \mathcal{Y}_g = (\chi_i + i) + (\mathcal{Y}_i + i)$	0
	ZWORL.	2 × + 4 + (+4)+1	9
		=) W is not a Subspace.	0
		$S \models (x) = m$	0
,	Ex	let V= \(\frac{\rho(\pi)}{a_0 + a_1\pi + \tau + a_m\pi^m} - \rho\lynomials \(\sigma \frac{de_1}{de_1} \leq \frac{m^3}{a_1 a_2 a_3} \)	0
-	4	is a U.S. With usual addition and scalar multiplication	-6
		F=R sometiment and the	-
		Then	-6
	() let W= & polynamials of dy = m / p(o) = 03	-
and (Then wis a Subspace of W	6
		$\int (1 + \beta(x), q(x) \in W \Rightarrow \beta(0) = 0 = q(0)$	4
		$\sqrt{\pi(x)} + 9(x) \in W \oplus (60 + 9(6) = 0$	
		and ap(x) ew as aplo) = 0., def.	6
	11	나는 그는 사람들이 살아보고 있는데 그는 그들은 그는 그는 그는 그는 그는 그는 그는 그는 그를 가는 것이 되었다. 그는 그는 그는 그는 그는 그는 그를 가는 그는 그를 가는 그는 그를 가는 것이 살아보고 있다. 그는 그를 가는 그는 그를 가는 그는 그를 가는 그를 가	- 1 mm

(2) W = E(x) ∈ V P(0) = 13 is not a Subspace : let P(x), q(x) ∈ W ⇒ R(0) = 1 = q(0) Then P(x) + q(x) & W (: P(0) + q(0) = 3 + 1) (3) W = E(x) ∈ V Coefficients are Positive 3 Then W is not a Subspace S: let P(x) = Qo + Q_1 a + 4 gm x ^M ∈ W , Qo, q, Qm > a. let a = 1 ∈ E Then a P(x) = -Qo - Q_1 x		Care 1 220
is not a Subspace : [ct P(x), 9(x) & W = P(0)=1=9(0) Then P(x) + 9(x) & W (: P(0)+9(0)=9+1) (3) W= ERX) \(\text{Coefficients are Positive} \) Then W is not a Subspace S: [et P(x) = 00+0, \at + 4 mx" \(\text{EW} \), \(\text{Oo, a, am} \) [et \(\alpha = 1 \) \(\text{EF} \) Then \(\alpha (x) = -00 - \text{G}_1 x0 mx''' \) \(\text{EW} \) W= \(\text{Set of all mxn yeal Square matrices} \) is a V.S. With Usual modern addition & scalar multiplication \(\text{F=1R} \) (1) \(\text{W} = \text{Set of all uppur Triangular matrices} \) (2) \(\text{W} = \text{Esct of all nxn matrices having real positive Elements} \). Check that \(\text{W} \) is a Subspace of V on not:	(2)	$W = \int_{0}^{\infty} P(x) \in V \mid P(0) = 13$
: [ct P(x), g(x) & W \$\frac{1}{2} P(0) = 1 = g(0)\$ Then P(x) + g(x) & W (\frac{1}{2} P(0) + g(0) = g + 1)\$ (3) W= \(\text{E}(x) \in V \) Coefficients are forthire? Then In is not a Subspace \[\begin{array}{l} \text{Then In is not a Subspace} \] \[\text{Coefficients are forthire?} \] \[\text{Then In is not a Subspace} \] \[\text{Coefficients are forthire?} \] \[Then application of the properties of the		is not a Subspace
Then $P(x) + P(x) \neq W$ (" $P(0) + P(0) = 9 + 1$) (3) $W = ERX \in V$ Coefficients are Positive? Then $W = 1 \in P(x) = 1 \in $	A south the second	$:= [et P(x), 9(x) \in W]$
Then $P(x) + q(x) \neq W$ (: $P(0) + q(0) = 9 + 1$) (3) $W = ERx \in V$ Coefficients are Postfice? Then W is not a Subspace (: let $P(x) = Q_0 + q_1 + q_1 + q_1 + q_2 + q_3 + q_4 + q_4 + q_5 + q_5 + q_5 + q_5 + q_6 + q$	<u> </u>	$\Rightarrow P(0) = 1 = 9(0)$
(3) W= EAX) EV Coefficients are Pashtive? Then W is not a Subspace Size P(x) = 00+0,74+40mx ^m EW, 00,0,0,0mx ^m Det d=1.EF Then dP(x) = -00-0,720mx ^m fW W= ESet of all man year Square motivises? Is a V.S. With usual nation addition & scalar multiplication F=1R (1) W= Eset of all Symmetric matrices? (2) W= Eset of all upper Triangular matrices? (3) W= Eset of all nxn matrices having real positive Elements? Check that W is a Subspace of V or not:		Then $P(x) + g(x) \notin W$ (: $P(0) + g(0) = g + 1$)
(3) W= \(\text{R}(x) \in V \) Coefficients are forthere? Then W is not a Subspace \(\text{C'} \) Let \(\text{P}(x) = \text{A0-t} \alpha_1 \text{Then } \text{Amx}^m \in W \), \(\text{A0, a, an } \) \(\text{An } \) \(\text{Let } \) \(
Then W is not a Subspace Silet P(x) = 00+0,7+ + 4mx ^M EW, 00, 0, 0 an > 0. let d=+GF Then dP(x) = -00-0,x0mx ^m EW W = ESet of all mxn yeal Square matrices I is a V.S. With Usual matrix addition & scalar multiplication. F=1R (1) W = Eset of all Symmetric matrices 3 (2) W = Eset of all upper Triangular matrices 3 (3) W = Eset of all nxn matrices having real positive Elements 3. Check that W is a Subspace of V on not.	(3)	W= EP(x) EV Coefficients our Positive 3
Let R(x) = 00 + 9, 2+ + 4 m x EW, 00, 9, 9 m > 0. let d = + EF Then a(R(x) = -00 - 9, x = -0 m x W & W W = E Set of all mxn yeal Square motivices I is a V.5. With Usual motive addition & scalar multiplication = F=1R (1) W = E Set of all Symmetric matrices I (2) W = E Set of all upper Triangular matrices I (3) W = E Set of all nxn matrices having real positive Elements I Check that W is a Subspace of V on not.		Then W is not a Subspace
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(a) W= Eset of all Symmetric matrices? (b) W= Eset of all upper Triangular matrices? (c) W= Eset of all nxn matrices having real positive Elements? (c) W= Eset of all nxn matrices having real positive Elements? (c) W= Eset of all nxn matrices having real positive Elements?		
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		그리아 그는 그들이 그리아 그리아 그래에 그리아 살아 되었다. 그리아 전쟁에 바다를 보냈다면 하고 있는데 그리아 그리아 그리아 그렇게 되었다.
		이 마이트 아이들 마이트 아이들이 되었다. 아이들 아이들이 아이들이 아이들 때문에 가장 아이들 수 있다면 살아 되었다. 그들은 아이들이 아이들이 아이들이 아이들이 아이들이 아이들이 아이들이 아이
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		(2018) 교기 교기 이 이 이 이 가는 전에 가고 있는 아들이 맛을 하셨습니까? 아들이 바꾸는 바꾸는 바꾸는 사람이 되는 그 아이트 보고 있다.
		나는 사람들이 많아 되었다면 하는 사람들이 하는 사람들이 가득하는 것이 되었다면 하는데
		그들은 항상 이 지역 이번 사람들은 얼마 가장 하는 이번 생각이 되었다. 사람들은 바람들은 바람들은 바람들은 바람들이 되었다. 이번 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은
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