Dot Product a] [d] = a.d + b.e + c.f Two sectors of same dimentions Project one of the vectors on the other and then take the product of this projected length and the length of the vector. This value is the dot product. $\overrightarrow{\nabla} \cdot \overrightarrow{w} = l(\text{projection } \overrightarrow{q} \overrightarrow{v}) \cdot l(\overrightarrow{v}) = \overrightarrow{w} \cdot \overrightarrow{v}$ $= l(\text{projection } \overrightarrow{q} \overrightarrow{w}) \cdot l(\overrightarrow{v}) = \overrightarrow{w} \cdot \overrightarrow{v}$ Here sequence doesn't matter V.W >0 > y Jew are in same directions VW=0 > y J' W V W 20 > y J' W are in opposite directions DUALITY & are in opposite auterions

[x y] (=) [x] Vector

Matrix [y] Vector

Linear transformation > Dual vector

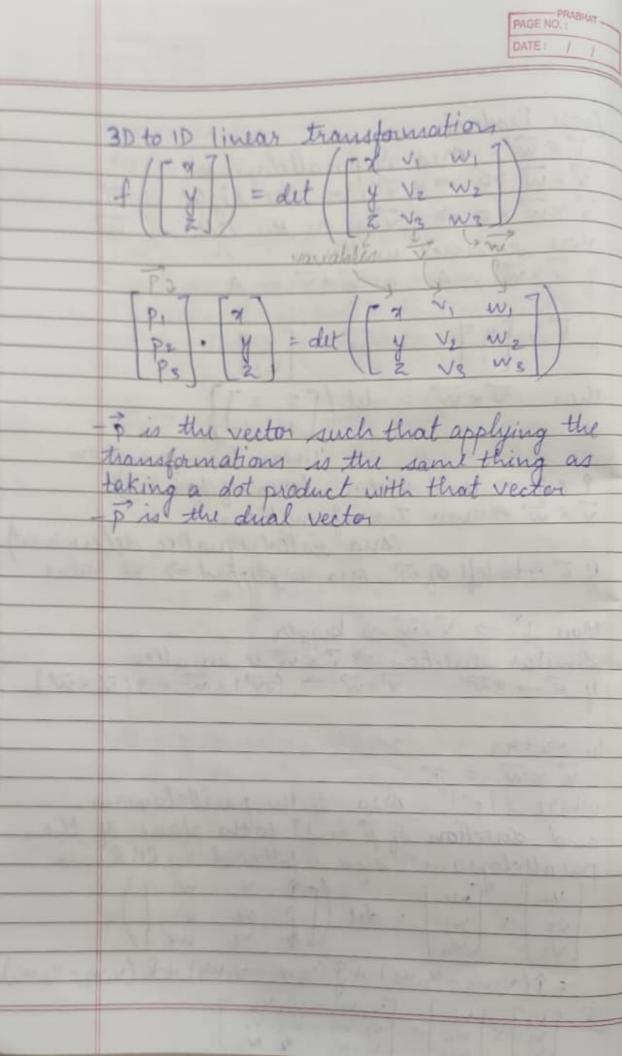
Dotting two vectors together is a way to translate
one of them into the world of transformations

[x, f[x2] = [x, y] [x2] = x, x2 + y, y2

[y, f[y2] = [x, y] [x2] = x, x2 + y, y2

2D to 1D linear transformation is the same as taking a dot product with that vector

PAGE NO. 1 Cross Product VXW = Area of parallelogram VXW >0 > 4 Vis on the right of W Here sequence matters $\overrightarrow{V} \times \overrightarrow{W} = A$ $\overrightarrow{V} \times \overrightarrow{W} = -A$ B V = [3] , W = [2]. then VXW = det (3 2 7 linear transformation 12) > unit vector (area &//gm =1 y v is to left of w. Area is flipped > -ve value More I' ⇒ V×w is bigger Similar direction ⇒ V×w is smaller y V → 3 V V×w ⇒ (3V)×w = 3(V×w) In vectors (what adually cross product is) where $l(\vec{p})$ = Area of the parallelogram and direction of \vec{p} is I' to the plane of the parallelogram. Sign is followed by RHR IN V2 X W2 = det = ((V2W3-V2W2) +) (V3W, -V, W3) + R (V, W2-V2W1) $\begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} \times \begin{bmatrix} W_1 \\ W_2 \\ W_3 \end{bmatrix} = \begin{bmatrix} V_2 \cdot W_3 - V_1 \\ V_3 \cdot W_1 - V_2 \end{bmatrix}$ (V, . W2 - W2 . W2



Cramer's Rull Applicable only when det(A) \$ 0 10 One Imput, one Output 4 TIV). T(W) = V. W for all V and W ie If a transformation leaves all the basis vectors perpendicular to each other and with unit length then that is called onthonormal These are rotation matrices : rigid motion then #=

PAGE NO. Any way to translate between vectors and ste The two special vectors I and I are called the basis vectors - We consider a standard grid for our condinate system

- However, space has no grid changes, basis vectors will also change.

- For all coordinate systems, origin coincides consider the new grid as the transformation of our grid New grid A [7] [7]

Our language

New language

Our language

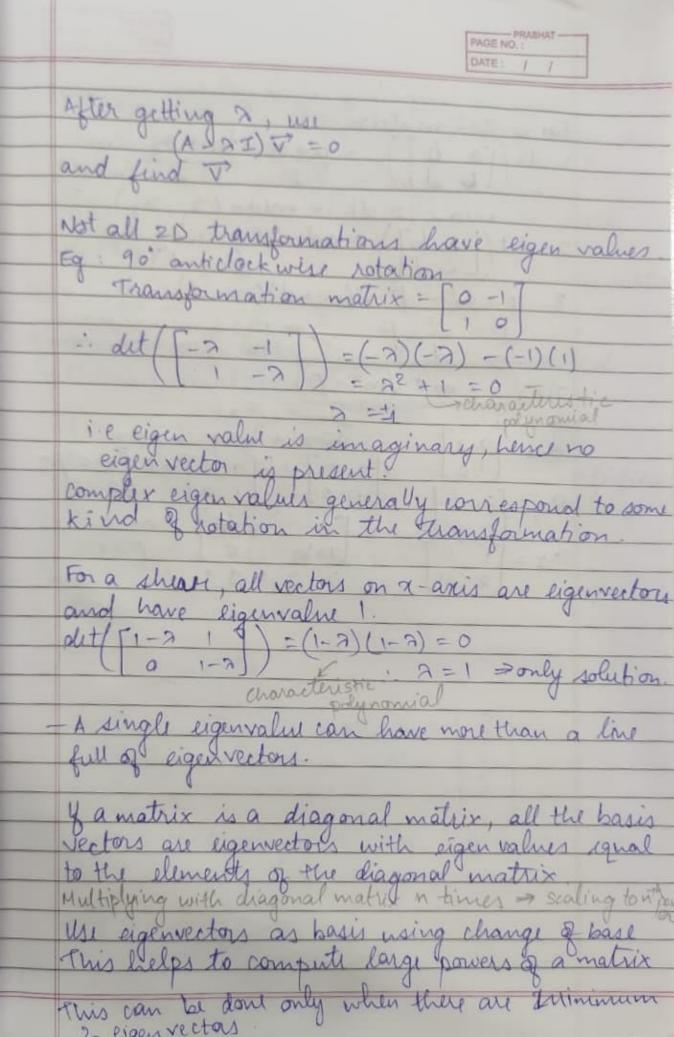
New language To get our grid back use inverse

New grid - > our grid

[2 -17-1 [30] - 1 [30] New language & Our language Liverse change written written in our new language

How to translate a matrix 1. Start with any vector in new language 2. Translate it to our language using change of basis matrix This gives years in our tanguage 3. Apply transformation to our language to what you get from the 1st 2 steps by multiply the transformation matrix on the left This tolls where the vector lands but 4. To this, apply the inverse change of hasis matrix multiplying it on the ly Transformed vector in our language same vector in our language vector in new language matrix our language V > Transforma The empathy the shift in perspective

given vector is to scale it by some PAGE NO. : DATE: 1 I The scaling factor is called eigenvalue. Eigenvectors and Eigenvalue the vector and Eigenvalue the vector is spen during a transformation is called eigenvector. It just gets stretched or squished in an eigenvector is stretched or squished is called the eigenvalue of that vector is eigenvalue of that vector. It is the vector is flip. In 3D, for a rotation, eigenvector is the axis of rotation.
The eigenvalue will be I as rotation does not stretch or squish anything. transformation Figurector (const) Matrix-vector product AV gives the same result as scaling the eigenvector v by some I Avaling by $\lambda \Leftrightarrow Matrix multiplication by [200] = 200 [0$



PAGE NO TRABIL DATE Thick for computing eigen values For a 2x2 matrix, 1 == 1 1 07

PAGE NO.:

Functions can be treated the same way as we do to vectors They can be added or scaled i.e they can be linearly transformed from one function to another. Eg derivative is an example of transformation These linear transformations are called linear transformations transformation is linear if two properties, called additivity and scaling Additivity L(V+W) = L(V) + L(W) (cv) = ck(v Derivative is linear For Polynamials, x2+3x+5 bo (x) = 72

PAGE NO PRABHAT duivatives of each 0100 -- Tosis vertors 0 d (193+592+49+5) = 392+109+4, 0 ---0 2-5 0 0 Linear Algebra Functions Dot products Figen vectors linear operators inner pladucts Eigenfunctions All the vectorish things in maths like arrows or lists of numbers or functions are together called vector spaces. The rules for vector addition and scaling are called 'Axioms' the able to with linear algebra applications.

Agioms (Rules for vectors addition Fand scaling

3. There is a vector O such that 0+V=V faall ?