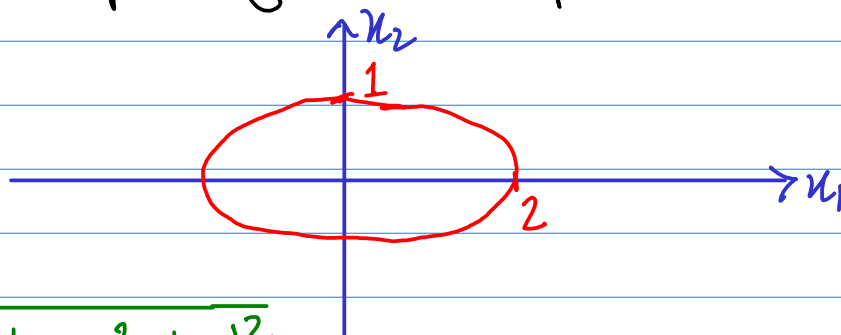


Some Misc Questions

10/18

1. Norm that defines a unit ball with the shape of an ellipse i.e.:



Ans: $\sqrt{|2x_1|^2 + |x_2|^2}$

2. Given the following CSR representation of a 4×4 sparse matrix:

$$A : [5 \ 8 \ 3 \ 6]$$

$$IA : [0 \ 0 \ 2 \ 3 \ 4]$$

$$JA : [0 \ 1 \ 2 \ 1]$$

Construct a dense representation

Ans.

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 5 & 8 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 6 & 0 & 0 \end{bmatrix}$$

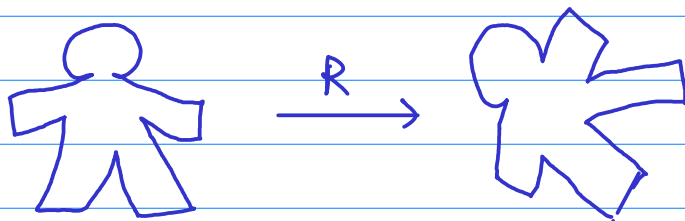
3. For the above CSR repr. write a python code that describes the Ax matrix-vector multiplication.

Ans. iterate i over size of A :

iterate k over $IA[i], JA[i]$:

$$B[i] += A[k] * x[JA[k]]$$

4. Condition number of rotation operations



eg:
$$R = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$$

Ans. R is orthogonal (i.e. $RR^T = I \Rightarrow R^T = R^{-1}$)
Orthogonal matrices.

$$\max_{\|x\|_2=1} \|Rx\|_2 = \sqrt{(Rx)^T(Rx)} = \sqrt{x^T R^T R x} = \sqrt{x^T x} = \|x\|_2$$

$$\therefore \|R\|_2 = 1$$