

COSMOS 2022, Computational Lab 10

[01] We went through a lot Wednesday morning. Read the notes so you can absorb it more slowly! Ask questions!

[02] We discussed the matrix

$$\mathcal{R}_x = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

that reflects a vector about the x axis. Is there any way to regard \mathcal{R}_x as a rotation? That is, is there a choice of θ you could make in the general form of a rotation matrix

$$R = \begin{pmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{pmatrix}$$

which would give you \mathcal{R}_x ? Draw some pictures of what \mathcal{R}_x does to different vectors and discuss whether you should expect to be able to view a reflection as a particular type of rotation.

[03] Write down the matrix \mathcal{R}_y that reflects a vector about the y axis.

[04] Without doing any math, draw of a vector \vec{v} and then reflect it first about the x axis and then reflect the result about the y axis. What vector do you end up with? Now analyze the problem mathematically by computing the product $\mathcal{R}_y \mathcal{R}_x$. Does it look the way you expect from your picture?

[05] (**hard!**) Write down the matrix which reflects a vector around an arbitrary line $y = mx$ (not just the x and y axes).