EE3900: Assignment-1

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Download all python codes from

https://github.com/Rahul27n/EE3900/blob/main/ Assignment_1/Assignment_1.py

and latex-tikz codes from

https://github.com/Rahul27n/EE3900/blob/main/ Assignment_1/Assignment_1.tex

1 QUESTION: VECTORS Q2.27

Find the area of a parallelogram whose adjacent sides are determined by the vectors:

$$a = \begin{pmatrix} 1 \\ -1 \\ 3 \end{pmatrix} \text{ and } b = \begin{pmatrix} 2 \\ -7 \\ 1 \end{pmatrix}.$$

2 SOLUTION

The area of the required parallelogram is defined as:

$$||\mathbf{a} \times \mathbf{b}|| \tag{2.0.1}$$

where

$$\mathbf{a} \times \mathbf{b} = \begin{pmatrix} 0 & -a_3 & a_2 \\ a_3 & 0 & -a_1 \\ -a_2 & a_1 & 0 \end{pmatrix} \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$$
 (2.0.2)

since cross product of two vectors is determined by spanning a vector into skew symmetric matrix. Therefore,

$$\mathbf{a} \times \mathbf{b} = \begin{pmatrix} 0 & -3 & -1 \\ 3 & 0 & -1 \\ 1 & 1 & 0 \end{pmatrix} \begin{pmatrix} 2 \\ -7 \\ 1 \end{pmatrix} = \begin{pmatrix} 20 \\ 5 \\ -5 \end{pmatrix}$$
 (2.0.3)

Thus, the desired area is

$$||\mathbf{a} \times \mathbf{b}|| = \sqrt{(20)^2 + (5)^2 + (-5)^2}$$
 (2.0.4)

$$= 15\sqrt{2} \tag{2.0.5}$$