Assignment 1
Linear Algebra

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I. Problem

Find the area of a rectangle $ABCD$ with vertices $A = \begin{pmatrix} -1 \\ \frac{1}{2} \\ 4 \end{pmatrix}$, $B = \begin{pmatrix} 1 \\ \frac{1}{2} \\ 4 \end{pmatrix}$, $C = \begin{pmatrix} 1 \\ -\frac{1}{2} \\ 4 \end{pmatrix}$, $D = \begin{pmatrix} -1 \\ -\frac{1}{2} \\ 4 \end{pmatrix}$.

II. Solution

Area of rectangle = cross product of vectors of adjacent sides

$$\mathbf{A} - \mathbf{D} = \begin{pmatrix} 0 \\ -1 \\ 0 \end{pmatrix} \tag{1}$$

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix} \tag{2}$$

Area = cross product of vectors

$$\|(\mathbf{A} - \mathbf{D}) \times (\mathbf{B} - \mathbf{A})\| \tag{3}$$

$$= \left\| \begin{pmatrix} 0 \\ -1 \\ 0 \end{pmatrix} \times \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix} \right\| \tag{4}$$

$$= \left\| \begin{pmatrix} 0 & -0 & 1 \\ 0 & 0 & 0 \\ -1 & 0 & 0 \end{pmatrix} \times \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix} \right\| \tag{5}$$

$$= 2 \tag{6}$$

Area = 2
Python code link

https://github.com/Swati-Mohanty/EE5600/blob/master/Assignment1/Code/quad_area.py