

# 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

$$\mathbf{A} - \mathbf{D} = \begin{pmatrix} 0 \\ -1 \\ 0 \end{pmatrix} \quad \mathbf{B} - \mathbf{A} = \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix} \quad (1)$$

Area = cross product of vectors

$$\|(\mathbf{A} - \mathbf{D}) \times (\mathbf{B} - \mathbf{A})\| \quad (2)$$

$$= \left\| \begin{pmatrix} 0 \\ -1 \\ 0 \end{pmatrix} \times \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix} \right\| \quad (3)$$

$$= \left\| \begin{pmatrix} 0 & -0 & 1 \\ 0 & 0 & 0 \\ -1 & 0 & 0 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix} \right\| \quad (4)$$

$$= 2 \quad (5)$$

Area = 2

Python code link

[https://github.com/Swati-Mohanty/EE5600/blob/master/Assignment1/Code/quad\\_area.py](https://github.com/Swati-Mohanty/EE5600/blob/master/Assignment1/Code/quad_area.py)