Assignment 1
Linear Algebra

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1 Problem

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

2 Solution

Method 1: The adjacent sides of the rectangle are BA and AD (i.e. length and breadth). Area of a rectangle = length * breadth = AD*BA.
AD = A-D
$= \begin{pmatrix} -1 \\ \frac{1}{2} \\ 4 \end{pmatrix}$ - $\begin{pmatrix} -1 \\ -\frac{1}{2} \\ 4 \end{pmatrix} = 1$
Similarly, BA = B-A = 2. Thus, area = 1*2 = 2 sq.units

Method 2: Area of rectangle = cross product of vectors of adjacent sides
Side $\vec{AD} = \vec{A}$ - $\vec{D} = \begin{pmatrix} 0 \\ -1 \\ 0 \end{pmatrix}$ Side $\vec{BA} = \vec{B}$ - $\vec{A} = \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix}$
Area = $\vec{AD}$ X $\vec{BA} = \begin{pmatrix} 0 \\ -1 \\ 0 \end{pmatrix}$ X $\begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix}$
$= \begin{pmatrix} 0 & -0 & 1 \\ 0 & 0 & 0 \\ -1 & 0 & 0 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix} = 2$
Python code link

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