Matgeo-2.7.11

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Question

Q 2.7.11. Find the area of the triangle with vertices $A = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$, $B = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$, $C = \begin{pmatrix} -3 \\ -5 \end{pmatrix}$.

Solution

$$A = \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}, \quad B = \begin{pmatrix} -4 \\ 6 \\ 0 \end{pmatrix}, \quad C = \begin{pmatrix} -3 \\ -5 \\ 0 \end{pmatrix}. \tag{1}$$

$$\mathbf{AB} = B - A = \begin{pmatrix} -5 \\ 7 \\ 0 \end{pmatrix}, \qquad \mathbf{AC} = C - A = \begin{pmatrix} -4 \\ -4 \\ 0 \end{pmatrix}. \tag{2}$$

$$\mathbf{AB} \times \mathbf{AC} = \begin{pmatrix} 0 \\ 0 \\ (-5)(-4) - (7)(-4) \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 48 \end{pmatrix}. \tag{3}$$

$$\therefore \ \text{Area} = \frac{1}{2} \|\mathbf{AB} \times \mathbf{AC}\| = \frac{1}{2} \cdot 48 = 24. \tag{4}$$

Plot

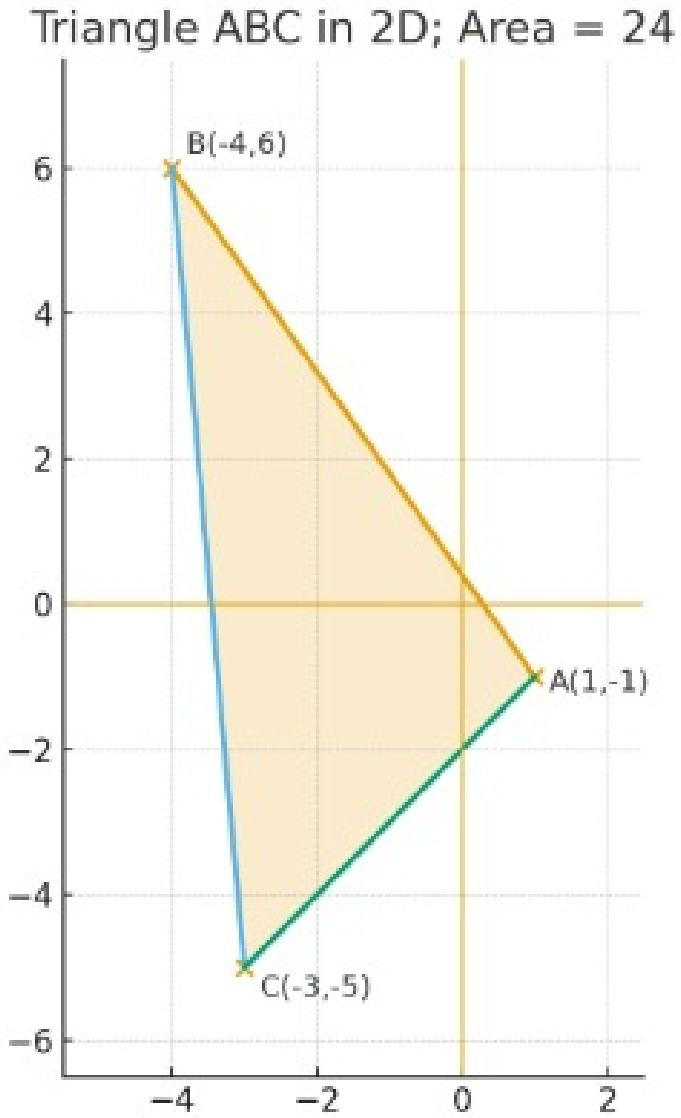

Figure: Triangle ABC with $A(1,-1)$, $B(-4,6)$, $C(-3,-5)$; area $= 24$.