



$$\begin{aligned} \text{Area} &= (a_1 + b_1)(a_2 + b_2) - 2a_1b_2 - a_1a_2 - b_1b_2 \\ &= a_2b_1 - a_1b_2 \end{aligned}$$

Find regardless of the direction of the vectors

$$\text{Area} = |a_2b_1 - a_1b_2|$$

$$[\mathbf{a} \quad \mathbf{b}] = \begin{bmatrix} a_1 & b_1 \\ a_2 & b_2 \end{bmatrix}$$

So if $\mathbf{A} = \begin{bmatrix} a_1 & b_1 \\ a_2 & b_2 \end{bmatrix}$ we define $\det(\mathbf{A}) = a_1b_2 - a_2b_1$