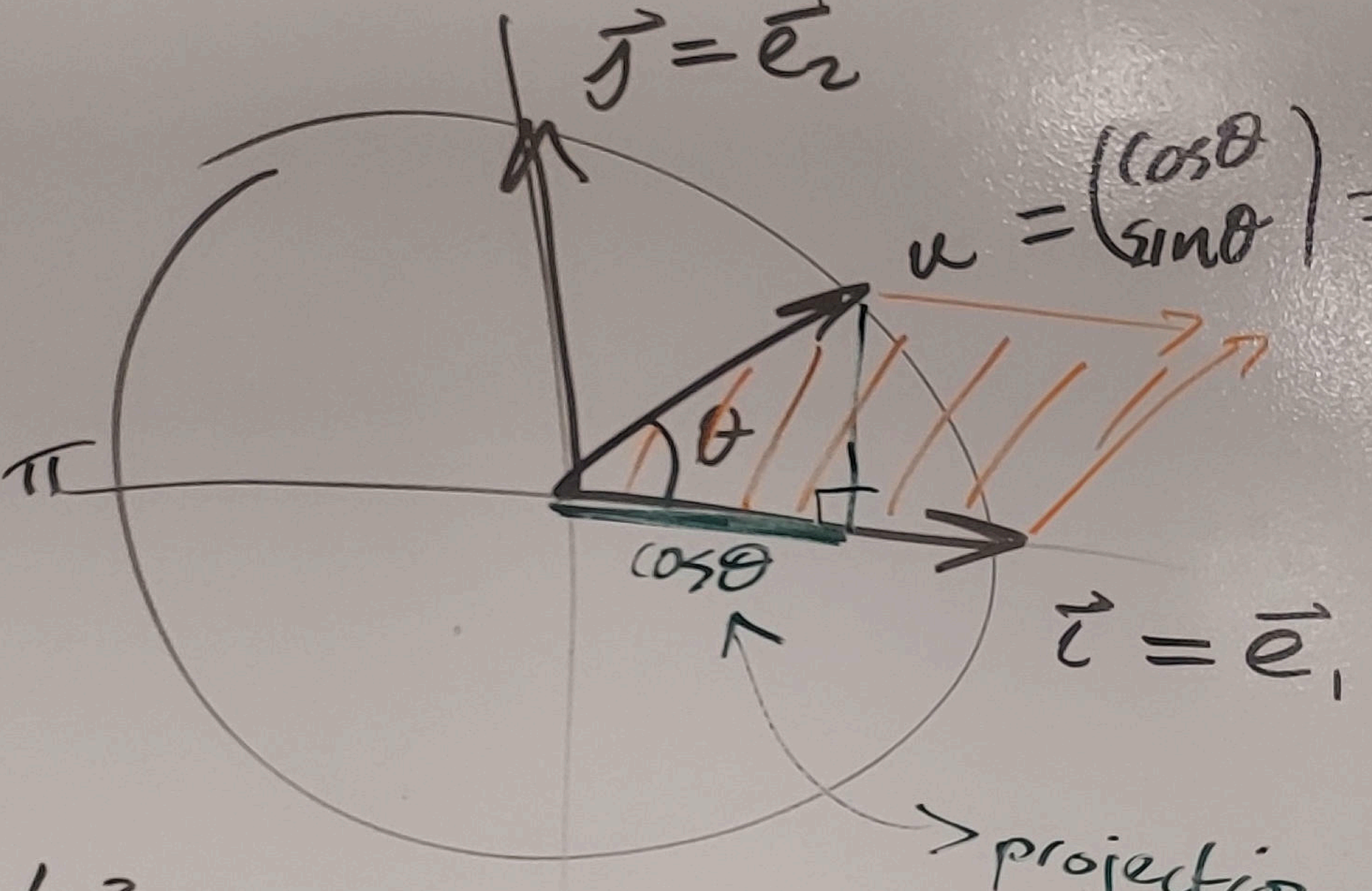
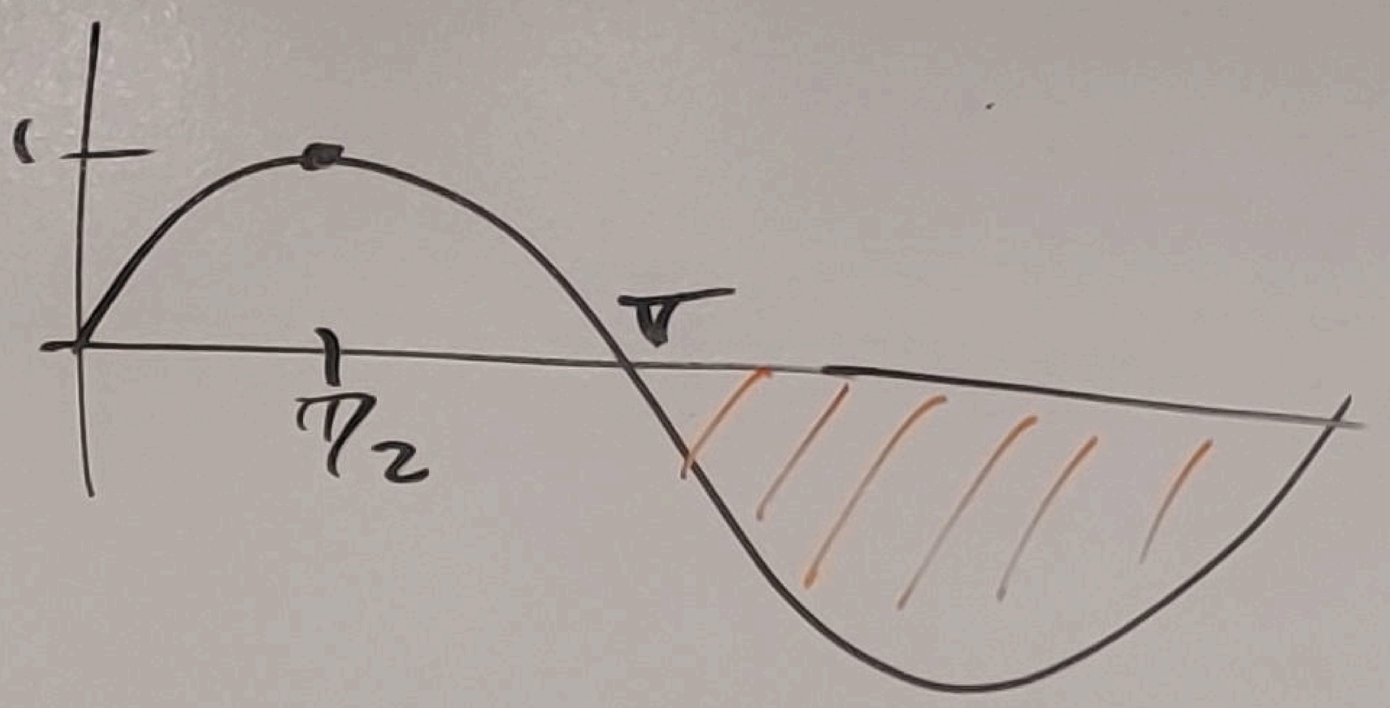


$$u = \begin{pmatrix}\cos\theta \\ \sin\theta\end{pmatrix} = (\cos\theta)e_1 + (\sin\theta)e_2$$

area $= \sin\theta$



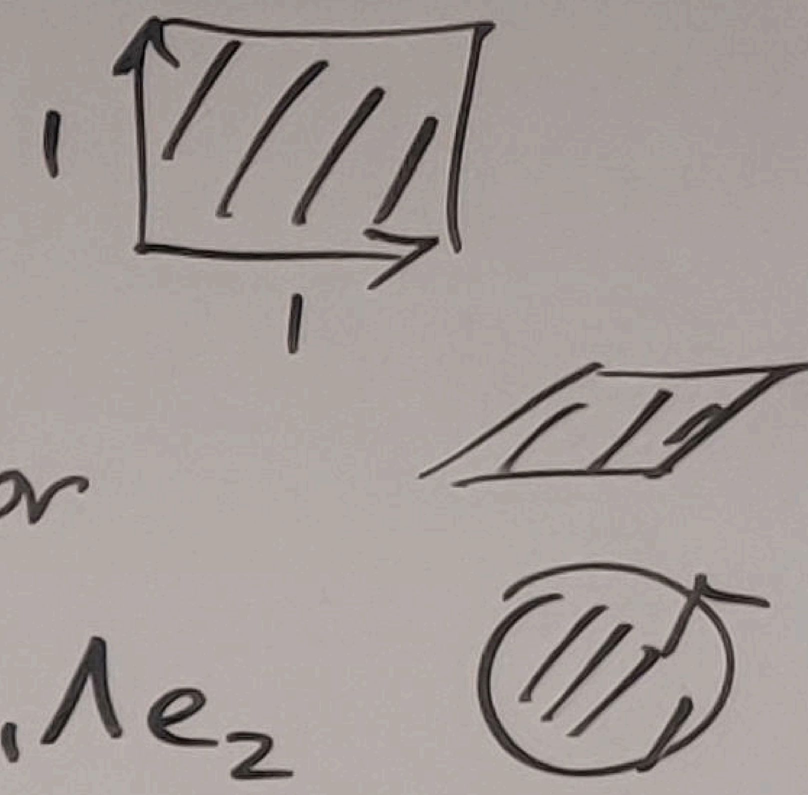
define: $\vec{u} \wedge \vec{v}$ = area of ▱ (directed) +/−

wedge product

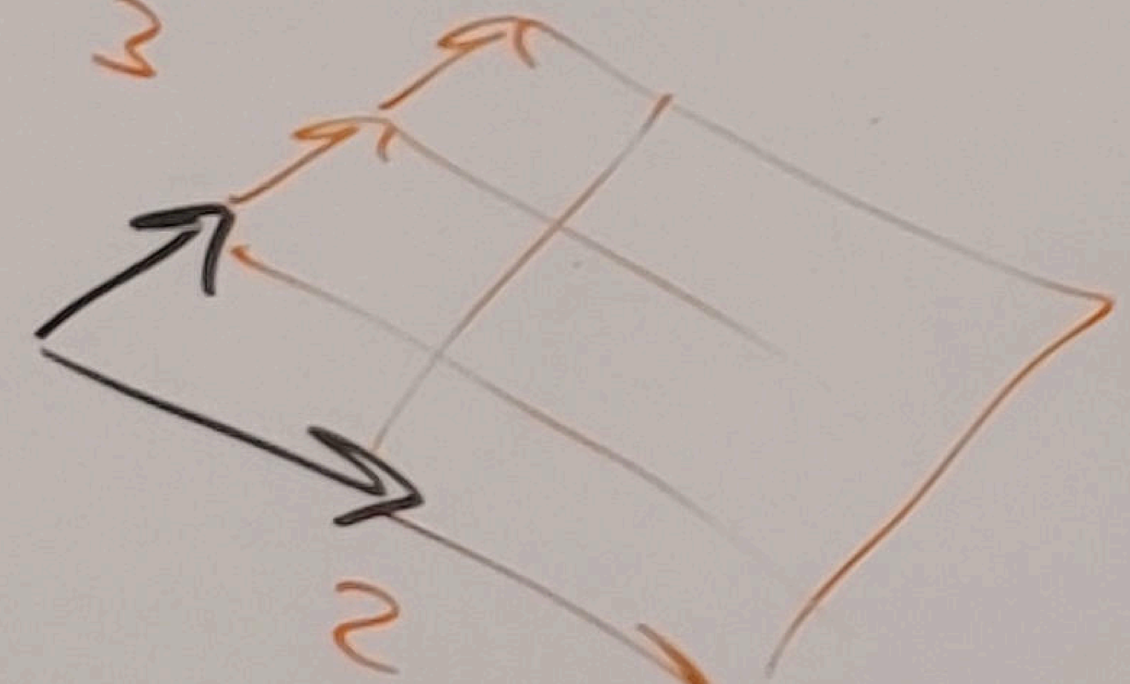
$$e_1 \wedge e_1 = 0 = e_2 \wedge e_2$$

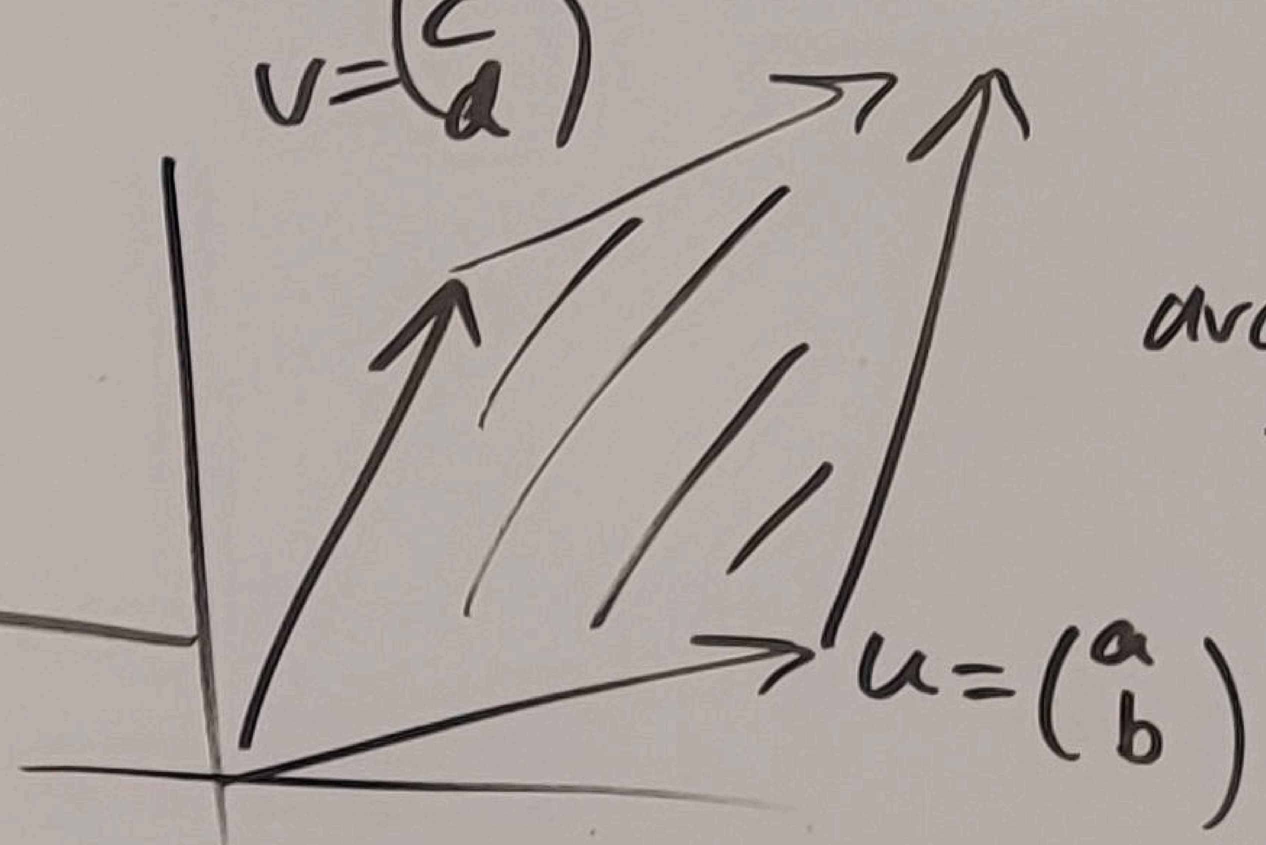
$e_1 \wedge e_2$ — unit bivector

$$e_2 \wedge e_1 = -e_1 \wedge e_2$$



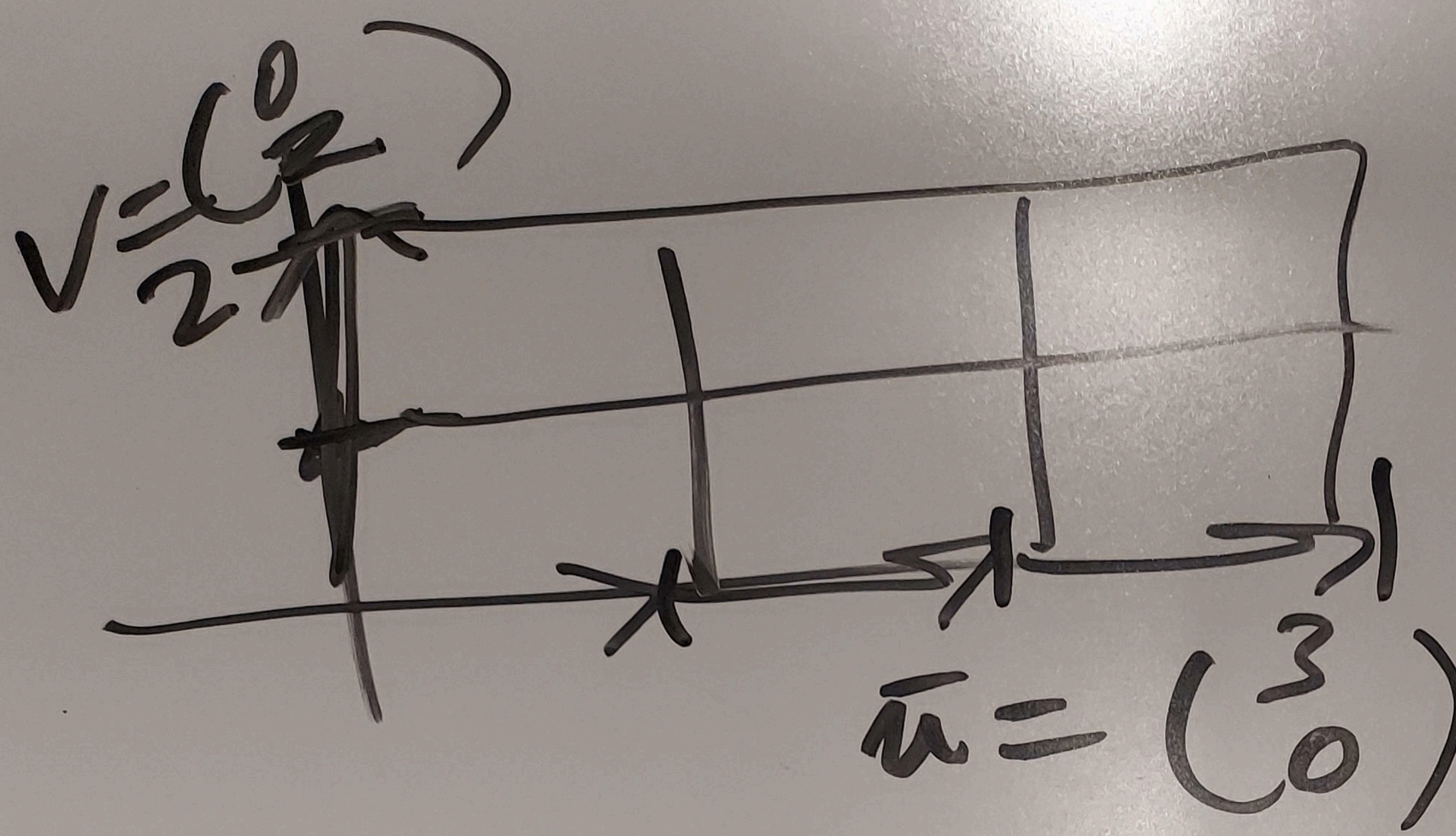
$$\begin{pmatrix}3\\4\end{pmatrix} = 3\vec{i} + 4\vec{j}$$
$$= 3e + 4e_2$$





area of ▱ $= ad - bc$

$$u \wedge v = (ae_1 + be_2) \wedge (ce_1 + de_2)$$
$$= (ae_1 \wedge ce_1) + (ae_1 \wedge de_2) + (be_2 \wedge ce_1) + (be_2 \wedge de_2)$$
$$= ac(e_1 \wedge e_1) + ad(e_1 \wedge e_2) + bc(e_2 \wedge e_1) + bd(e_2 \wedge e_2)$$
$$= (ad - bc)\, e_1 \wedge e_2$$



$$\bar{u} \wedge \bar{v} = (3e_1 + 0e_2) \wedge (0e_1 + 2e_2)$$

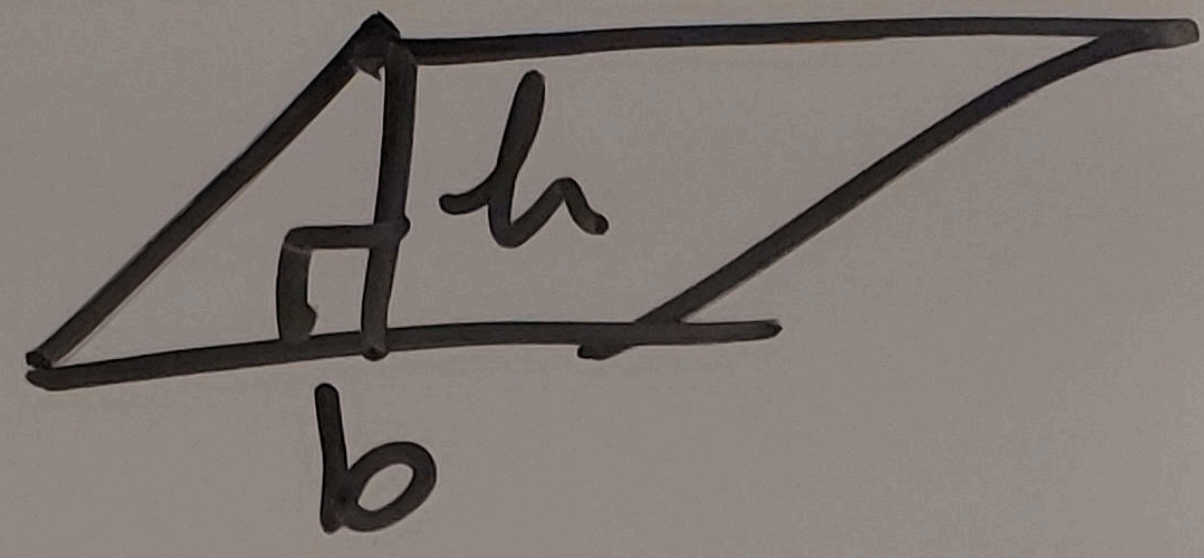
$$= 6\, e_1 \wedge e_2$$

$$\begin{pmatrix} a \\ b \end{pmatrix} \wedge \begin{pmatrix} c \\ d \end{pmatrix} = \begin{vmatrix} a & c \\ b & d \end{vmatrix} e_1 \wedge e_2$$

$$= (ad - bc)\, e_1 \wedge e_2$$

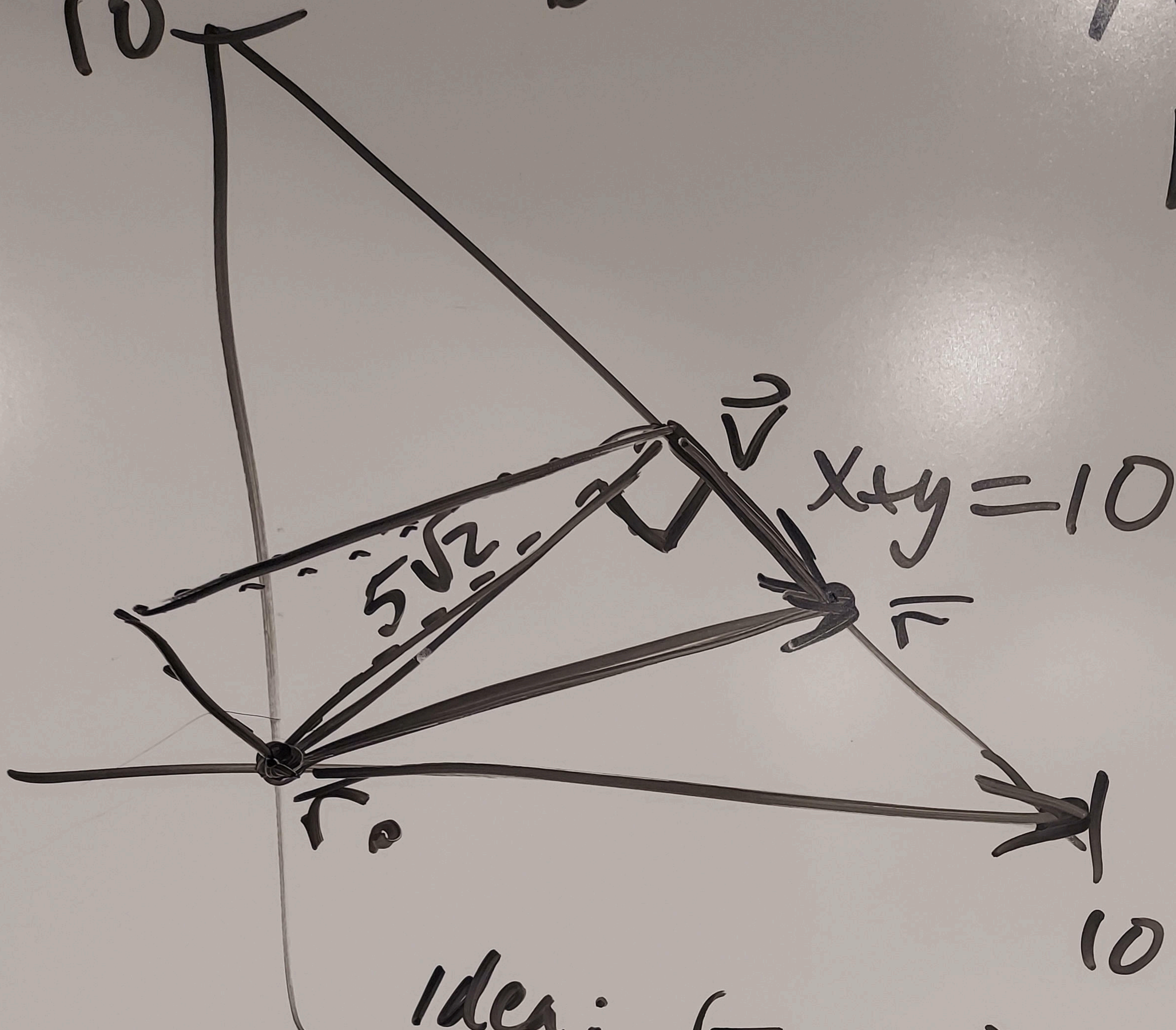
$$\bar{v} \wedge \bar{u} = -6\, e_1 \wedge e_2$$

$(= -\bar{u} \wedge \bar{v}$
antisymmetric $)$



$A = bh$

$h = \frac{A}{b}$



Idea: $(\bar{r} - \bar{r}_0) \wedge v =$ area ▱

divide by base to get height (distance)

$\bar{V} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$

$\bar{u} = \bar{r} - \bar{r}_0 = \begin{pmatrix} 10 \\ 0 \end{pmatrix}$

$$d = \frac{|u \wedge v|}{|v|} = \frac{10}{\sqrt{2}}$$