

$$\begin{aligned}
 \hat{\boldsymbol{j}} \times \hat{\boldsymbol{i}} &= \det \begin{bmatrix} \hat{\boldsymbol{i}} & \hat{\boldsymbol{j}} & \hat{\boldsymbol{k}} \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} = \hat{\boldsymbol{i}} \det \begin{bmatrix} \cancel{\hat{\boldsymbol{i}}} & \hat{\boldsymbol{j}} & \hat{\boldsymbol{k}} \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} - \hat{\boldsymbol{j}} \det \begin{bmatrix} \hat{\boldsymbol{i}} & \cancel{\hat{\boldsymbol{j}}} & \hat{\boldsymbol{k}} \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} + \hat{\boldsymbol{k}} \det \begin{bmatrix} \hat{\boldsymbol{i}} & \hat{\boldsymbol{j}} & \cancel{\hat{\boldsymbol{k}}} \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} \\
 &= \hat{\boldsymbol{i}} (1 \times 0 - 0 \times 0) - \hat{\boldsymbol{j}} (0 \times 0 - 0 \times 1) + \hat{\boldsymbol{k}} (0 \times 0 - 1 \times 1) = -\hat{\boldsymbol{k}}
 \end{aligned}$$