

$$\begin{aligned}
 \mathbf{a} \times \mathbf{b} &= \det \begin{bmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 3 \\ 1 & -1 & 2 \end{bmatrix} = \hat{i} \det \begin{bmatrix} \cancel{1} & \hat{j} & \hat{k} \\ \cancel{1} & 2 & 3 \\ \cancel{1} & -1 & 2 \end{bmatrix} - \hat{j} \det \begin{bmatrix} \hat{i} & \cancel{2} & \hat{k} \\ 1 & \cancel{2} & 3 \\ 1 & -1 & \cancel{2} \end{bmatrix} + \hat{k} \det \begin{bmatrix} \hat{i} & \hat{j} & \cancel{3} \\ 1 & 2 & \cancel{3} \\ 1 & -1 & \cancel{2} \end{bmatrix} \\
 &= \hat{i} \{2 \times 2 - 3 \times (-1)\} - \hat{j} \{1 \times 2 - 3 \times 1\} + \hat{k} \{1 \times (-1) - 2 \times 1\} \\
 &= 7\hat{i} + \hat{j} - 3\hat{k}
 \end{aligned}$$