

32. We consider all possible products and then simplify using relations such as  $\hat{i} \times \hat{i} = 0$  and the important fundamental products

$$\begin{aligned}\hat{i} \times \hat{j} &= -\hat{j} \times \hat{i} &= \hat{k} \\ \hat{j} \times \hat{k} &= -\hat{k} \times \hat{j} &= \hat{i} \\ \hat{k} \times \hat{i} &= -\hat{i} \times \hat{k} &= \hat{j} .\end{aligned}$$

Thus,

$$\begin{aligned}\vec{a} \times \vec{b} &= \left( a_x \hat{i} + a_y \hat{j} + a_z \hat{k} \right) \times \left( b_x \hat{i} + b_y \hat{j} + b_z \hat{k} \right) \\ &= a_x b_x \hat{i} \times \hat{i} + a_x b_y \hat{i} \times \hat{j} + a_x b_z \hat{i} \times \hat{k} + a_y b_x \hat{j} \times \hat{i} + a_y b_j \hat{j} \times \hat{j} + \cdots \\ &= a_x b_x (0) + a_x b_y (\hat{k}) + a_x b_z (-\hat{j}) + a_y b_x (-\hat{k}) + a_y b_j (0) + \cdots\end{aligned}$$

which is seen to simplify to the desired result.