30. We consider all possible products and then simplify using relations such as $\hat{\mathrm{i}} \cdot \hat{\mathrm{k}} = 0$ and $\hat{\mathrm{i}} \cdot \hat{\mathrm{i}} = 1$. Thus,

$$\begin{aligned}
\vec{a} \cdot \vec{b} &= \left(a_x \,\hat{\mathrm{i}} + a_y \,\hat{\mathrm{j}} + a_z \,\hat{\mathrm{k}}\right) \cdot \left(b_x \,\hat{\mathrm{i}} + b_y \,\hat{\mathrm{j}} + b_z \,\hat{\mathrm{k}}\right) \\
&= a_x b_x \,\hat{\mathrm{i}} \cdot \hat{\mathrm{i}} + a_x b_y \,\hat{\mathrm{i}} \cdot \hat{\mathrm{j}} + a_x b_z \,\hat{\mathrm{i}} \cdot \hat{\mathrm{k}} + a_y b_x \,\hat{\mathrm{j}} \cdot \hat{\mathrm{i}} + a_y b_j \,\hat{\mathrm{j}} \cdot \hat{\mathrm{j}} + \cdots \\
&= a_x b_x (1) + a_x b_y (0) + a_x b_z (0) + a_y b_x (0) + a_y b_j (1) + \cdots
\end{aligned}$$

which is seen to reduce to the desired result (one might wish to show this in two dimensions before tackling the additional tedium of working with these three-component vectors).