QUESTION
If $\mathbf{a} = \mathbf{j} + \mathbf{k}$ and $\mathbf{b} = 2\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ find the component of $\mathbf{a}$ in the direction of $\mathbf{b}$.

ANSWER
$\mathbf{a} = (0, 1, 1),\ \mathbf{b} = (2, -1, 2)$
The component of $\mathbf{a}$ in the direction of $\mathbf{b}$ is $\mathbf{a}.\hat{\mathbf{b}}$

$$\begin{aligned} \mathbf{a}.\hat{\mathbf{b}} &= (0,1,1)\frac{(2,-1,2)}{\sqrt{2^2+(-1)^2+2^2}} \\ &= \frac{1}{3}(0,1,1).(2,-1,2) \\ &= \frac{1}{3}(0-1+2) = \frac{1}{3} \end{aligned}$$