**Unit Vectors and the Cross Product:**

Problems on Quest almost always depend on unit vectors, and cross products of unit vectors. Here is a brief summary. The definition of a vector cross product $\mathbf{A} \times \mathbf{B}$ is that it results in a vector $\mathbf{C}$ which is at right angles to the plane containing the two crossed vectors, and has magnitude $C = AB \sin \theta$, where $\theta$ is the angle between $\mathbf{A}$ and $\mathbf{B}$. The direction of $\mathbf{C}$ is given by a right hand rule: start with the fingers of the right hand aligned with $\mathbf{A}$, and sweep them around so that they align with $\mathbf{B}$. Then your thumb will point along $\mathbf{C}$.

Now see how this works with unit vectors, which are vectors of length 1 that point along $x$, $y$ and $z$. They are correctly written as $\hat{i}$ (along $x$), $\hat{j}$ (along $y$) and $\hat{k}$, along $z$. Using the definition of cross product we just gave, you can instantly see by looking at your right hand that

\[
\hat{i} \times \hat{j} = \hat{k},
\]

\[
\hat{j} \times \hat{k} = \hat{i},
\]

\[
\hat{k} \times \hat{i} = \hat{j}.
\]

Note that because $\mathbf{B} \times \mathbf{A} = -\mathbf{C}$, you can cross the unit vectors “backward,” getting a minus sign (for example $\hat{k} \times \hat{j} = -\hat{i}$).