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 θ 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 $\widehat{\mathbf{i}}$ (along x), $\widehat{\mathbf{j}}$ (along y) and $\widehat{\mathbf{k}}$, along z. Using the definition of cross product we just gave, you can instantly see by looking at your right hand that

$$\widehat{\mathbf{i}} \times \widehat{\mathbf{j}} = \widehat{\mathbf{k}}.$$

$$\widehat{\mathbf{j}} \times \widehat{\mathbf{k}} = \widehat{\mathbf{i}}.$$

$$\widehat{\mathbf{k}} \times \widehat{\mathbf{i}} = \widehat{\mathbf{j}}.$$

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