BSc Software Design (Game & Web Dev)
Year 1
Maths Tutorial (Vectors)

Q.1. For each of the following pairs of vectors, calculate:

(i) $\langle \vec{u}, \vec{v} \rangle$.
(ii) the cosine of the angle between $\vec{u}$ and $\vec{v}$.
(iii) $\vec{u} \times \vec{v}$.
(iv) the unit vector perpendicular to both $\vec{u}$ and $\vec{v}$.

(a) $\vec{u} = -5\hat{i} + 8\hat{j}$ and $\vec{v} = 2\hat{i} + 9\hat{j}$.
(b) $\vec{u} = 4\hat{i} + 9\hat{j}$ and $\vec{v} = \sqrt{2}\hat{i} - 5\hat{j}$
(c) $\vec{u} = -7\hat{i} + 3\hat{j} - 6\hat{k}$ and $\vec{v} = -\hat{i} + 6\hat{j}$
(d) $\vec{u} = \pi\hat{i} + \sqrt{5}\hat{j} - 7\hat{k}$ and $\vec{v} = 4\hat{i} - 2\hat{j} + \hat{k}$

Q.2. For each of the following pairs of vectors, $\vec{u}$ and $\vec{v}$:

(i) show that $\vec{w} = \vec{u} \times \vec{v}$ is mutually orthogonal to both $\vec{u}$ and $\vec{v}$.
(ii) show that the magnitude of $\vec{w}$ can be determined using the formula $\|\vec{u} \times \vec{v}\| = \|\vec{u}\| \|\vec{v}\| \sin(\theta)$.

(a) $\vec{u} = 2\hat{i} + 5\hat{j} - 6\hat{k}$ and $\vec{v} = -\hat{i} + 2\hat{j} - \hat{k}$.
(b) $\vec{u} = -7\hat{i} + 3\hat{j} - 6\hat{k}$ and $\vec{v} = 4\hat{i} - 2\hat{j} + \hat{k}$.
(c) $\vec{u} = 5\hat{i} - \hat{j} + 4\hat{k}$ and $\vec{v} = \hat{i} + \hat{j} + 3\hat{k}$.