

EE112 – Engineering Mathematics II

Problem Set 5

Due by 5pm on Friday, 9 March 2018

1. For the vectors

$$\begin{aligned}\vec{A} &= 3\hat{i}, & \vec{B} &= 2\hat{i} - \hat{j} + \hat{k}, \\ \vec{C} &= -4\hat{i} + 5\hat{k}, & \vec{D} &= 0.5\hat{i} - 1.5\hat{j} + 6\hat{k},\end{aligned}$$

compute the following:

- (a) $\vec{A} \times \vec{C}$ and $\vec{B} \times \vec{D}$;
 - (b) $\vec{D} \cdot (\vec{B} \times \vec{C})$ and $(\vec{B} \times \vec{A}) \cdot \vec{C}$;
 - (c) $(\vec{A} \times \vec{B}) \times \vec{C}$ and $\vec{B} \times (\vec{A} \times \vec{D})$;
2. Multiplication of scalars (numbers) is “associative”, which means that if we multiply three numbers x , y and z together, we can do the pairwise multiplication of them in any order we choose, namely,

$$x(yz) = (xy)z.$$

Show that the cross product is **not** associative, namely, for any three vectors \vec{A} , \vec{B} and \vec{C} , $\vec{A} \times (\vec{B} \times \vec{C})$ is generally **not** the same vector as $(\vec{A} \times \vec{B}) \times \vec{C}$.

3. Show that for any four vectors \vec{A} , \vec{B} , \vec{C} and \vec{D} ,

$$(\vec{A} \times \vec{B}) \cdot (\vec{C} \times \vec{D}) = (\vec{A} \cdot \vec{C})(\vec{B} \cdot \vec{D}) - (\vec{A} \cdot \vec{D})(\vec{B} \cdot \vec{C}).$$