

3. For two vectors A and B, $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ is always true when

i. $|\vec{A}| = |\vec{B}| \neq 0$

ii. $\vec{A} \perp \vec{B}$

iii. $|\vec{A}| = |\vec{B}| \neq 0$ and A and B are parallel or anti parallel

iv. when either |A| or |B| is zero.

Sol. (b, d) According to the problem, $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$

$$\Rightarrow \sqrt{|\vec{A}|^2 + |\vec{B}|^2 + 2|\vec{A}||\vec{B}|\cos\theta} = \sqrt{|\vec{A}|^2 + |\vec{B}|^2 - 2|\vec{A}||\vec{B}|\cos\theta}$$

$$\Rightarrow |\vec{A}|^2 + |\vec{B}|^2 + 2|\vec{A}||\vec{B}|\cos\theta = |\vec{A}|^2 + |\vec{B}|^2 - 2|\vec{A}||\vec{B}|\cos\theta$$

$$\Rightarrow 4|\vec{A}||\vec{B}|\cos\theta = 0$$

$$\Rightarrow |\vec{A}||\vec{B}|\cos\theta = 0$$

$$\Rightarrow |\vec{A}| = 0 \text{ or } |\vec{B}| = 0 \text{ or } \cos\theta = 0$$

i.e. $\theta = 90^\circ$

When $\theta = 90^\circ$, we can say that $\vec{A} \perp \vec{B}$