

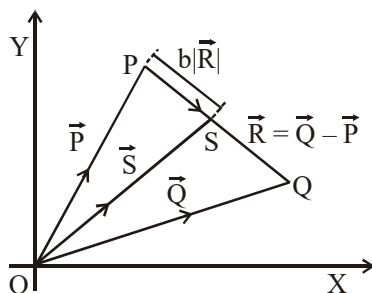
VECTOR

1. Two vectors \vec{A} and \vec{B} are defined as $\vec{A} = a\hat{i}$ and $\vec{B} = a(\cos\omega t\hat{i} + \sin\omega t\hat{j})$, where a is a constant and $\omega = \pi/6 \text{ rad s}^{-1}$. If $|\vec{A} + \vec{B}| = \sqrt{3}|\vec{A} - \vec{B}|$ at time $t = \tau$ for the first time, the value of τ , in seconds, is _____.

[JEE(Advanced) 2018]

2. Three vectors \vec{P} , \vec{Q} and \vec{R} are shown in the figure. Let S be any point on the vector \vec{R} . The distance between the points P and S is $b|\vec{R}|$. The general relation among vectors \vec{P} , \vec{Q} and \vec{S} is :

[JEE(Advanced) 2017]



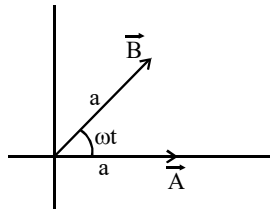
- (A) $\vec{S} = (1-b)\vec{P} + b^2\vec{Q}$ (B) $\vec{S} = (b-1)\vec{P} + b\vec{Q}$ (C) $\vec{S} = (1-b)\vec{P} + b\vec{Q}$ (D) $\vec{S} = (1-b^2)\vec{P} + b\vec{Q}$

SOLUTIONS

1. **Ans. (2.00)**

Sol. $|\vec{A} + \vec{B}| = 2a \cos \frac{\omega t}{2}$

$|\vec{A} - \vec{B}| = 2a \sin \frac{\omega t}{2}$



So

$2a \cos \frac{\omega t}{2} = \sqrt{3} \left(2a \sin \frac{\omega t}{2} \right)$

$\tan \frac{\omega t}{2} = \frac{1}{\sqrt{3}}$

$\frac{\omega t}{2} = \frac{\pi}{6} \Rightarrow \omega t = \frac{\pi}{3}$

$\frac{\pi}{6} t = \frac{\pi}{3} \quad t = 2.00 \text{ sec}$

2. **Ans. (C)**

Sol. Let vector from point P to point S be \vec{C}

$\Rightarrow \vec{C} = b|\vec{R}|\hat{R} = b|\vec{R}|\left(\frac{\vec{R}}{|\vec{R}|}\right)$

$= b\vec{R} = b(\vec{Q} - \vec{P})$

from triangle rule of vector addition

$\vec{P} + \vec{C} = \vec{S}$

$\vec{P} + b(\vec{Q} - \vec{P}) = \vec{S} \Rightarrow \vec{S} = (1-b)\vec{P} + b\vec{Q}$