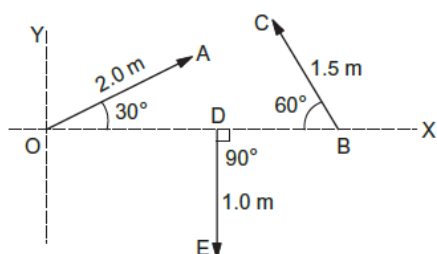




## SANGHARSH ASSIGNMENT VECTOR-5

P

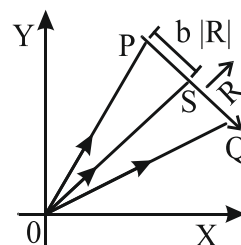
1. If  $\vec{A} = 2\vec{i} - 3\vec{j} + 7\vec{k}$ ,  $\vec{B} = \vec{i} + 2\vec{k}$  and  $\vec{C} = \vec{j} - \vec{k}$  find  $\vec{A} \cdot (\vec{B} \times \vec{C})$
2. Find the maximum or minimum values of the function  $y = x + \frac{1}{x}$  for  $x > 0$ .
3. Evaluate  $\int_0^t A \sin \omega t \, dt$  where  $A$  and  $\omega$  are constants.
4. The velocity  $v$  and displacement  $x$  of a particle executing simple harmonic motion are related as  $v \frac{dv}{dx} = -\omega^2 x$ .  
At  $x = 0$ ,  $v = v_0$ . Find the velocity  $u$  when the displacement becomes  $x$ .
5. The charge flown through a circuit in the time interval between  $t$  and  $t + dt$  is given by  $dq = e^{-t/\tau} dt$ , where  $\tau$  is a constant. Find the total charge flown through the circuit between  $t = 0$  to  $t = \tau$ .
6. A vector  $\vec{A}$  makes an angle of  $20^\circ$  and  $\vec{B}$  makes an angle of  $110^\circ$  with the  $X$ -axis. The magnitudes of these vectors are 3 m and 4 m respectively. Find the resultant.
7. Add vectors  $\vec{A}$ ,  $\vec{B}$  and  $\vec{C}$  each having magnitude of 100 unit and inclined to the  $X$ -axis at angles  $45^\circ$ ,  $135^\circ$  and  $315^\circ$  respectively.
8. Refer to figure. Find (a) the magnitude, (b)  $x$  and  $y$  components and (c) the angle with the  $X$ -axis of the resultant of  $\vec{OA}$ ,  $\vec{BC}$  and  $\vec{DE}$ .



9. Two vectors have magnitudes 3 unit and 4 unit respectively. What should be the angle between them if the magnitude of the resultant is (a) 1 unit, (b) 5 unit and (c) 7 unit.
10. Two vectors have magnitudes 2 m and 3 m. The angle between them is  $60^\circ$ . Find (a) the scalar

product of the two vectors, (b) the magnitude of their vector product.

11. Prove that  $\vec{A} \cdot (\vec{A} \times \vec{B}) = 0$ .
12. A curve is represented by  $y = \sin x$ . If  $x$  is changed from  $\frac{\pi}{3}$  to  $\frac{\pi}{3} + \frac{\pi}{100}$ , find approximately the change in  $y$ .
13. The electric current in a charging  $R$ - $C$  circuit is given by  $i = i_0 e^{-t/RC}$  where  $i_0$ ,  $R$  and  $C$  are constant parameters of the circuit and  $t$  is time. Find the rate of change of current at (a)  $t = 0$ , (b)  $t = RC$ , (c)  $t = 10 RC$ .
14. Find the area bounded under the curve  $y = 3x^2 + 6x + 7$  and the  $X$ -axis with the ordinates at  $x = 5$  and  $x = 10$ .
15. Find the area bounded by the curve  $y = e^{-x}$ , the  $X$ -axis and the  $Y$ -axis.
16. 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  $\omega = \pi/6 \text{ rad s}^{-1}$ . If  $|\vec{A} + \vec{B}| = \sqrt{3} |\vec{A} - \vec{B}|$  at time  $t = \tau$  for the first time, the value of  $\tau$ , in second is .....  
**[JEE ADV. 2018]**
17. 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 point  $P$  and  $S$  is  $b |\vec{R}|$  and  $\vec{R} = \vec{Q} - \vec{P}$ . The general relation among vectors  $\vec{P}$ ,  $\vec{Q}$  and  $\vec{S}$  is



**[JEE ADV. 2017]**

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



## ANSWER KEY

1. 0
2. at  $x = 1$ ,  $y$  is  $y = 2$
3.  $\frac{A}{\omega}(1 - \cos \omega t)$
4.  $v = \sqrt{v_0^2 - \omega^2 x^2}$ .
5.  $\tau \left( 1 - \frac{1}{e} \right)$
6. (5 m at  $73^\circ$  with  $X$ -axis)
7. (100 unit at  $45^\circ$  with  $X$ -axis)
8. (a) 1.6 m (b) 0.98 m and 1.3 m respectively  
(c)  $\tan^{-1}(1.32)$
9. (a)  $180^\circ$  (b)  $90^\circ$  (c) 0
10. (a)  $3 \text{ m}^2$  (b)  $3\sqrt{3} \text{ m}^2$
11. ?
12. (0.0157)
13. (a)  $\frac{-i_0}{RC}$  (b)  $\frac{-i_0}{RCe}$  (c)  $\frac{-i_0}{RCe^{10}}$
14. (1135)
15. (1)
16. ?
17.  $\vec{S} = (1 - b)\vec{P} + b\vec{Q}$