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- Q 1. If  $\vec{A} \times \vec{B} = \vec{C}$ , then which of the following statements is wrong:
- (a)  $\vec{C} \perp \vec{A}$  (b)  $\vec{C} \perp \vec{B}$   
(c)  $\vec{C} \perp (\vec{A} + \vec{B})$  (d)  $\vec{C} \perp (\vec{A} \times \vec{B})$
- Q 2. If two vectors  $2\hat{i} + 3\hat{j} - \hat{k}$  and  $-4\hat{i} - 6\hat{j} - \lambda\hat{k}$  are parallel to each other then value of  $\lambda$  be:
- (a) 0 (b) -2 (c) 3 (d) -4
- Q 3. What is the value of  $(\vec{A} + \vec{B}) \cdot (\vec{A} \times \vec{B}) = ?$
- (a) 0 (b)  $A^2 - B^2$   
(c)  $A^2 + B^2 + 2AB$  (d) None of these
- Q 4. Let  $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ ,  $\vec{B} = \hat{j} - \hat{k}$ . If  $\vec{C}$  is a vector satisfying  $\vec{A} \times \vec{C} = \vec{B}$  and  $\vec{A} \cdot \vec{C} = 3$ , then  $\vec{C}$  is:
- (a)  $\frac{1}{3}(5\hat{i} + 2\hat{j} + 2\hat{k})$  (b)  $\frac{1}{3}(5\hat{i} - 2\hat{j} - 2\hat{k})$   
(c)  $3\hat{i} - \hat{j} - \hat{k}$  (d) None of these
- Q 5. The vector perpendicular to the vectors  $4\hat{i} - \hat{j} + 3\hat{k}$  and  $-2\hat{i} + \hat{j} - 2\hat{k}$  whose magnitude is 9:
- (a)  $3\hat{i} + 6\hat{j} - 6\hat{k}$  (b)  $3\hat{i} - 6\hat{j} + 6\hat{k}$   
(c)  $-3\hat{i} + 6\hat{j} + 6\hat{k}$  (d) None of these
- Q 6. Find  $\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times (\vec{c} + \vec{a}) + \vec{c} \times (\vec{a} + \vec{b}) = ?$
- (a)  $\vec{a} + \vec{b} + \vec{c}$  (b)  $\vec{a} \cdot (\vec{a} + \vec{b} + \vec{c})$   
(c)  $(\vec{a} \cdot \vec{b} \cdot \vec{c}) \times (\vec{a} + \vec{b} + \vec{c})$  (d) zero
- Q 7. Find  $[2\hat{j} \times (3\hat{i} - 4\hat{k})] \cdot [(\hat{i} - 2\hat{k}) \times \hat{k}] = ?$
- (a) 0 (b)  $\hat{i} + \hat{j} - \hat{k}$   
(c)  $2\hat{i} + \hat{j} - 3\hat{k}$  (d) 16
- Q 8. Find  $\hat{i} \cdot (\hat{j} \times \hat{k}) + (\hat{i} \times \hat{k}) \cdot \hat{j} = ?$
- (a)  $2\hat{i} + \hat{j}$  (b) 1  
(c) 0 (d)  $\hat{i} + \hat{j} + \hat{k}$



- Q 9. If  $|\vec{a}| = 13$ ,  $|\vec{b}| = 5$  and  $\vec{a} \cdot \vec{b} = 30$ , then  $|\vec{a} \times \vec{b}| = ?$
- (a) 30  
(b)  $\frac{30}{25}\sqrt{233}$   
(c)  $\frac{30}{33}\sqrt{193}$   
(d)  $\frac{65}{13}\sqrt{133}$

- Q 10. Vector  $\vec{A}$  &  $\vec{B}$  have scalar product 6.00 and their vector product has magnitude +9.00  
What is the angle between these two vectors?
- (a)  $\tan^{-1}(1.5)$   
(b)  $\tan^{-1}(3)$   
(c)  $\tan^{-1}(2)$   
(d)  $\tan^{-1}\left(\frac{2}{3}\right)$

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## Answer Key

Q.1 d	Q.2 b	Q.3 a	Q.4 a	Q.5 c
Q.6 d	Q.7 a	Q.8 c	Q.9 d	Q.10 a


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# Written Solution

**DPP-4 Vectors (Cross product)**

**By Physicsaholics Team**

Solution.1

$$\vec{A} \times \vec{B} = \vec{C}$$

means;  $\vec{C} \perp \vec{A}$   
and  $\vec{C} \perp \vec{B}$

and  $\vec{C}$  is  $\perp$  to plane of  
 $\vec{A}$  &  $\vec{B}$ .

$\therefore \vec{A} + \vec{B}$  is in the plane of  
 $\vec{A}$  &  $\vec{B}$

$$\therefore \vec{C} \perp (\vec{A} + \vec{B})$$

$$\& \vec{C} = \vec{A} \times \vec{B}$$

so)  $\vec{C}$  can't be  $\perp$  to  $\vec{A} \times \vec{B}$

$\therefore \vec{C}$  is equal to  $\vec{A} \times \vec{B}$

Ans.d



Solution.2

$$\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}, \quad \vec{b} = -4\hat{i} - 6\hat{j} - d\hat{k}$$

$$\vec{a} \parallel \vec{b}; \text{ then } \vec{a} \times \vec{b} = 0$$

$$\begin{aligned} \therefore \vec{a} \times \vec{b} &= (2\hat{i} + 3\hat{j} - \hat{k}) \times (-4\hat{i} - 6\hat{j} - d\hat{k}) \\ &= \hat{i}(-3d - 6) + \hat{j}(2d + 4) + \hat{k}(-12 + 12) \end{aligned}$$

$$= \hat{i}(-3d - 6) + \hat{j}(2d + 4) + \hat{k}(0)$$

$$\therefore \vec{a} \times \vec{b} = 0$$

$$\Rightarrow \hat{i}(-3d - 6) + \hat{j}(2d + 4) + \hat{k}(0) = 0$$

$$-3d - 6 = 0 \quad \Rightarrow \quad d = -2$$

$$2d + 4 = 0 \quad \Rightarrow \quad d = -2$$

$$\therefore \boxed{d = -2}$$

Ans.b

Solution.3

$$) \quad (\vec{A} + \vec{B}) \cdot (\vec{A} \times \vec{B}) = ?$$

$$\text{let } \vec{C} = \vec{A} \times \vec{B}$$

then  $\vec{C}$  is  $\perp$  to  $\vec{A}$

$\vec{C}$  is  $\perp$  to  $\vec{B}$

and  $\vec{C}$  is  $\perp$  to  $(\vec{A} + \vec{B})$

$\therefore$  dot product of  $\perp$  vectors  
is zero

$$\therefore (\vec{A} + \vec{B}) \cdot (\vec{A} \times \vec{B})$$

$$= (\vec{A} + \vec{B}) \cdot (\vec{C})$$

$$(\vec{A} + \vec{B}) \cdot (\vec{C}) = \text{zero}$$

Ans.a

### Solution.4

$$\vec{A} = \hat{i} + \hat{j} + \hat{k}$$

$$\vec{B} = \hat{j} - \hat{k}$$

Given;  $\vec{A} \times \vec{C} = \vec{B}$

$$\vec{A} \cdot \vec{C} = 3$$

Let;  $\vec{C} = x\hat{i} + y\hat{j} + z\hat{k}$

$$\therefore \vec{A} \times \vec{C} = \vec{B}$$

$$(\hat{i} + \hat{j} + \hat{k}) \times (x\hat{i} + y\hat{j} + z\hat{k}) = \hat{j} - \hat{k}$$

$$\hat{i}(z-y) + \hat{j}(x-z) + \hat{k}(y-x) = \hat{j} - \hat{k}$$

$$\Rightarrow z-y=0; \quad x-z=1, \quad y-x=-1$$

$$\boxed{y=z}; \quad \boxed{x=1+z}; \quad \boxed{y=x-1}$$

$$4 \vec{a} \cdot \vec{c} = 3$$

$$(\hat{i} + \hat{j} + \hat{k}) \cdot (x\hat{i} + y\hat{j} + z\hat{k}) = 3$$

$$x + y + z = 3$$

$$(1+z) + (z) + z = 3$$

$$3z = 2 \Rightarrow \boxed{z = \frac{2}{3}}$$

$$\Rightarrow x = 1 + \frac{2}{3} = \frac{5}{3} \Rightarrow \boxed{x = \frac{5}{3}}$$

$$\boxed{y = z = \frac{2}{3}}$$

$$\vec{C} = \frac{5}{3}\hat{i} + \frac{2}{3}\hat{j} + \frac{2}{3}\hat{k}$$

$$\vec{C} = \frac{5}{3}\hat{i} + \frac{2}{3}\hat{j} + \frac{2}{3}\hat{k}$$

$$\boxed{\vec{C} = \frac{1}{3}(5\hat{i} + 2\hat{j} + 2\hat{k})}$$

Ans.a



## Solution.5

$$\vec{a} = 4\hat{i} - \hat{j} + 3\hat{k}$$

$$\vec{b} = -2\hat{i} + \hat{j} - 2\hat{k}$$

$$\text{Let } \vec{c} = \vec{a} \times \vec{b}$$

$$\Rightarrow \vec{c} \text{ is } \perp \vec{a}$$

$$\wedge \vec{c} \perp \vec{b}$$

$$\therefore \vec{c} = (4\hat{i} - \hat{j} + 3\hat{k}) \times (-2\hat{i} + \hat{j} - 2\hat{k})$$

$$\vec{c} = \hat{i}(2-3) + \hat{j}(8-6) + \hat{k}(4-2)$$

$$\vec{c} = -\hat{i} + 2\hat{j} + 2\hat{k}$$

$$|\vec{c}| = \sqrt{1^2 + 2^2 + 2^2} = \sqrt{9} = 3$$

$$\hat{c} = \frac{-\hat{i} + 2\hat{j} + 2\hat{k}}{3}$$

$$\vec{d} = 9\hat{c}$$

$$\vec{d} = 9 \left( \frac{-\hat{i} + 2\hat{j} + 2\hat{k}}{3} \right)$$

$$\boxed{\vec{d} = -3\hat{i} + 6\hat{j} + 6\hat{k}}$$

Ans.c

Solution.6

$$\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times (\vec{c} + \vec{a}) + \vec{c} \times (\vec{a} + \vec{b}) = ?$$

$$\vec{a} \times \vec{b} + \vec{a} \times \vec{c} + \vec{b} \times \vec{c} + \vec{b} \times \vec{a} + \vec{c} \times \vec{a} + \vec{c} \times \vec{b}$$

$$\therefore \vec{a} \times \vec{b} = -\vec{b} \times \vec{a} \Rightarrow (\vec{a} \times \vec{b}) + (\vec{b} \times \vec{a}) = 0$$

$$\& \vec{b} \times \vec{c} = -\vec{c} \times \vec{b} \Rightarrow (\vec{b} \times \vec{c}) + (\vec{c} \times \vec{b}) = 0$$

$$\& \vec{a} \times \vec{c} = -\vec{c} \times \vec{a} \Rightarrow (\vec{a} \times \vec{c}) + (\vec{c} \times \vec{a}) = 0$$

$$\therefore (\vec{a} \times \vec{b}) + (\vec{b} \times \vec{c}) + (\vec{b} \times \vec{a}) + (\vec{c} \times \vec{b}) \\ + (\vec{c} \times \vec{a}) + (\vec{a} \times \vec{c})$$

$$= 0 + 0 + 0$$

$$= 0$$

Ans.d

Solution.7

$$[2\hat{j} \times (3\hat{j} - 4\hat{k})] \cdot [(1 - 2\hat{k}) \times \hat{k}]$$

$$\Rightarrow [-6\hat{k} - 8\hat{j}] \cdot (-\hat{j} + 0)$$

$$= (6\hat{k} - 8\hat{j}) \cdot (-\hat{j})$$

$$= 0$$

Ans.a



Solution.8

$$K = \hat{j} \cdot (\hat{j} \times \hat{k}) + (\hat{j} \times \hat{k}) \cdot \hat{j} = ?$$

$$K = \hat{j} \cdot (\hat{j}) + (-\hat{j}) \cdot \hat{j}$$

$$K = 1 + (-1)$$

$$K = 1 - 1$$

$$\boxed{K = 0}$$

Ans.c



Solution.9

$$|\vec{a}| = 13, |\vec{b}| = 5; \vec{a} \cdot \vec{b} = 30$$

$$\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$$

$$30 = (13)(5) \cos \theta$$

$$\cos \theta = \frac{6}{13}$$

$$\sin \theta = \frac{\sqrt{13^2 - 6^2}}{13}$$

$$\sin \theta = \frac{\sqrt{133}}{13}$$

$$|\vec{a} \times \vec{b}| = |\vec{a}| |\vec{b}| \sin \theta$$

$$|\vec{a} \times \vec{b}| = (13)(5) \left( \frac{\sqrt{133}}{13} \right)$$

$$|\vec{a} \times \vec{b}| = 5 \sqrt{133}$$

or

$$|\vec{a} \times \vec{b}| = \frac{65 \sqrt{133}}{13}$$

Ans.d

Solution.10

$$\vec{A} \cdot \vec{B} = |\vec{A}| |\vec{B}| \cos \theta = 6 \quad \text{--- (1)}$$

$$|\vec{A} \times \vec{B}| = |\vec{A}| |\vec{B}| \sin \theta = 9 \quad \text{--- (2)}$$

$$\frac{(2)}{(1)} = \frac{\sin \theta}{\cos \theta} = \frac{9}{6}$$

$$\tan \theta = \frac{3}{2}$$

$$\tan \theta = 1.5$$

$$\theta = \tan^{-1}(1.5)$$

Ans.a

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