PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 9

Total Marks : 32

Max. Time : 33 min.

Topic : Mathematical Tools

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.8	(3 marks, 3 min.)	[24, 24]
Multiple choice objective ('–1' negative marking) Q.9	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.10	(4 marks, 5 min.)	[4, 5]

1. Given : $\vec{A} = 2\hat{i} - 3\hat{j}$ and $\vec{B} = 5\hat{i} - 6\hat{j}$

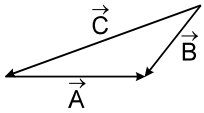
The magnitude of $(\vec{A} + \vec{B})$ is :

(A) $\sqrt{120}$ units (B) $\sqrt{130}$ units (C) $\sqrt{58}$ units (D) $\sqrt{65}$ units

2. Unit vector along $3\hat{i} + 3\hat{j}$ is

(A) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$ (B) $\frac{3\hat{i}+3\hat{j}}{2}$ (C) $\hat{i}+\hat{j}$ (D) $\frac{\hat{i}+\hat{j}}{\sqrt{3}}$

3. For the figure shown.



(A) $\vec{A}+\vec{B}=\vec{C}$ (B) $\vec{B}+\vec{C}=\vec{A}$ (C) $\vec{C}+\vec{A}=\vec{B}$ (D) $\vec{A}+\vec{B}+\vec{C}=0$

4. Parallelogram law of vectors is applicable to the addition of :

(A) Any two vectors (B) Two scalars

(C) A vector and a scalar (D) Two vectors representing same physical quantity.

5. *If* $\vec{A}$ *and* $\vec{B}$ *are two non–zero vectors such that* $|\vec{A}+\vec{B}| = \frac{|\vec{A}-\vec{B}|}{2}$ *and* $|\vec{A}| = 2|\vec{B}|$ then the angle between $\vec{A}$ and $\vec{B}$ is :

(A) 37° (B) 53° (C) $\cos^{-1}(-3/4)$ (D) $\cos^{-1}(-4/3)$

6. Vectors $\vec{A} = \hat{i}+\hat{j}-2\hat{k}$ and $\vec{B} = 3\hat{i}+3\hat{j}-6\hat{k}$ are :

(A) Parallel (B) Antiparallel (C) Perpendicular (D) at acute angle with each other

7. A particle is moving with speed 6 m/s along the direction of $\vec{A} = 2\hat{i}+2\hat{j}-\hat{k}$, then its velocity is :

(A) $(4\hat{i}+2\hat{j}-4\hat{k})$ units (B) $(4\hat{i}+4\hat{j}-2\hat{k})$ units

(C) $(4\hat{i}+4\hat{j}-4\hat{k})$ units (D) $(2\hat{i}+4\hat{j}-2\hat{k})$ units

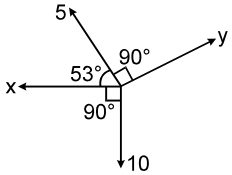
8. If $\vec{P} = \hat{i}+\hat{j}-\hat{k}$ and $\vec{Q} = \hat{i}-\hat{j}+\hat{k}$, then unit vector along $(\vec{P}-\vec{Q})$ is :

(A) $\frac{1}{\sqrt{2}}\hat{i}-\frac{1}{2}\hat{k}$ (B) $\frac{\sqrt{2}\hat{j}-\sqrt{2}\hat{k}}{2}$ (C) $\frac{\hat{j}-\hat{k}}{2\sqrt{2}}$ (D) $\frac{2\hat{j}-2\hat{k}}{4}$

9. If $|\vec{a}+\vec{b}| \geq |\vec{a}-\vec{b}|$ then angle between $\vec{a}$ and $\vec{b}$ may be

(A) 50° (B) 90° (C) 60° (D) 120°

10. Find the magnitude of the unknown forces X and Y if sum of all forces is zero.



Answers Key

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1. (B) **2.** (A) **3.** (C) **4.** (D) **5.** (C)
6. (A) **7.** (B) **8.** (B) **9.** (A), (B), (C)
10. (5, 10)

Hint & Solutions

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1. $(A + B) = 7\hat{i} - 9\hat{j}$

$\therefore \quad |A + B| = \sqrt{49 + 81} = \sqrt{130}$

2. unit vector $= \dfrac{3\hat{i} + 3\hat{j}}{\sqrt{3^2 + 3^2}} = \dfrac{\hat{i} + \hat{j}}{\sqrt{2}}$

3. Apply triangle law of vector addition.

5. $(A^2 + B^2 + 2AB\cos\theta) = \dfrac{1}{4}(A^2 + B^2 - 2AB\cos\theta)$

$\Rightarrow 3A^2 + 3B^2 + 10\,AB\cos\theta = 0$
or $12B^2 + 3B^2 + 10(2B)(B)\cos\theta = 0$
$15B^2 + 20B^2\cos\theta = 0$

$\cos\theta = -\dfrac{3}{4}$

6. Since $B = 3A$, so both are parallel.

7. Velocity = (speed) $\hat{}$

$= 6\dfrac{(2\hat{i} + 2\hat{j} - \hat{k})}{\sqrt{4 + 4 + 1}} = (4\hat{i} + 4\hat{j} - 2\hat{k})$ units.

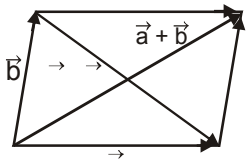
8. $\vec{P} - \vec{Q} = (\hat{i} + \hat{j} - \hat{k}) - (\hat{i} - \hat{j} + \hat{k}) = 2\hat{j} - 2\hat{k}$
$\therefore$ unit vector along

$\vec{P} - \vec{Q} = \dfrac{(\vec{P} - \vec{Q})}{|\vec{P} - \vec{Q}|} = \dfrac{2\hat{j} - 2\hat{k}}{\sqrt{(2)^2 + (-2)^2}}$

$$\therefore \quad \hat{\vec{P}-\vec{Q}} = \frac{(\vec{P}-\vec{Q})}{|\vec{P}-\vec{Q}|} = \frac{2\hat{j}-2\hat{k}}{\sqrt{(2)^2+(-2)^2}}$$

$$= \frac{2\hat{j}-2\hat{k}}{\sqrt{4+4}} = \frac{2\hat{j}-2\hat{k}}{2\sqrt{2}} = \frac{\hat{j}-\hat{k}}{\sqrt{2}}$$

9.

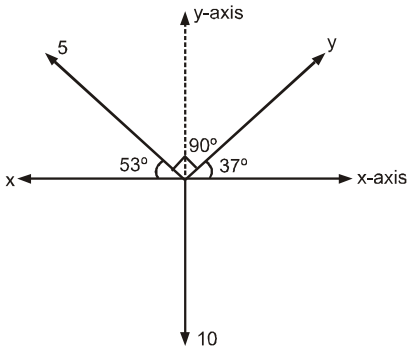


$$|a+b| \geq |a-b|$$

$\Rightarrow$ angle between a & b $\leq 90°$

$\Rightarrow$ a b $\leq 90°$

10.



$\Sigma F = 0$

$\Rightarrow$ (y cos37°$\hat{}$ + y sin37°$\hat{j}$) + (5 cos53°(–$\hat{}$) + 5

sin53°$\hat{j}$) + (x(–$\hat{}$) + 10(–$\hat{j}$)) = 0

$$\Rightarrow \quad \left(\frac{4y}{5}-3-x\right)\hat{i}+\left(\frac{3y}{5}+4-10\right)\hat{j} = 0\hat{i}+0\hat{j}$$

Comparing coefficients of $\hat{}$ & $\hat{j}$ both sides–

$$\frac{4y}{5} - x = 3 \quad \text{.....(i)}$$

$$\frac{3y}{5} = 6 \quad \Rightarrow \quad y = 10$$

Putting 8 – x = 3 $\Rightarrow$ x = 5