41. (3)

$$\vec{F} = F\cos 45°\hat{i} + F\sin 45°(-\hat{j})$$
$$\Rightarrow \vec{F} = 50\sqrt{2}\hat{i} - 50\sqrt{2}\hat{j}N$$

42. (4)

The angle made by resultant (R) of the forces P and Q with P is given by $tan\theta = \frac{Q sin\alpha}{P+Q cos\alpha}$

When $\theta = 90°$, then $tan 90° = \infty$

$\therefore P + Q cos\alpha = 0$ or $cos\alpha = -\frac{P}{Q}$ or

$$\alpha = cos^{-1}\left(-\frac{P}{Q}\right)$$

43. (4)

Let $\vec{P}$ and $\vec{Q}$ be two vectors. Then according to question $|\vec{P} + \vec{Q}| = 17$ *or* $P + Q = 17$

$|\vec{P} - \vec{Q}| = 7$ or $P - Q = 7$

On adding and subtracting the equations (i) and (ii) we get $P = 12; Q = 5$

Magnitude of resultant is given by

$$R = [P^2 + Q^2 + 2PQcos\theta]^{1/2}$$

Given, $\theta = 90°$, $\therefore R = [P^2 + Q^2]^{1/2}$

Substituting the values of P and Q , we get $R = 13$

44. (2) $R_{net} = R + \sqrt{R^2 + R^2}$

$$= R + \sqrt{2}R = R(\sqrt{2} + 1)$$

45. (1)

In each of the options (b), (c) and (d), there is one force which is greater than sum of other two forces. hence resultant force cannot be zero for these.

46. (3)

$cos^2\alpha + cos^2\beta + cos^2\gamma = 1$

$(1 - sin^2\alpha) + (1 - sin^2\beta) + (1 - sin^2\gamma) = 1$

or $sin^2\alpha + sin^2\beta + sin^2\gamma = 3 - 1 = 2$

47. (3)

Given, $A = 4\hat{i} - 3\hat{j} + \hat{k}$

$$|A| = \sqrt{A_x^2 + A_y^2 + A_z^2}$$
$$= \sqrt{(4)^2 + (-3)^2 + (1)^2} = \sqrt{26}$$

$\therefore$ Unit vector, $\hat{A} = \frac{A}{|A|} = \frac{4\hat{i}-3\hat{j}+\hat{k}}{\sqrt{26}}$

48. (2) $\vec{C} + \vec{A} = \vec{B}$.

The value of C lies between $A - B$ and $A + B$

$$\therefore |\vec{C}| < |\vec{A}|$$

or $|\vec{C}| < |\vec{B}|$

49. (1) Resultant $\vec{R} = \vec{P} + \vec{Q} + \vec{P} - \vec{Q} = 2\vec{P}$

The angle between $\vec{P}$ and $2\vec{P}$ is zero.

50. (3)

$$\hat{R} = \frac{\vec{R}}{|R|} = \frac{\hat{i} + \hat{j}}{\sqrt{1^2 + 1^2}} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$$

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