doubtnut
India's Number 1 Education App

PHYSICS

BOOKS - MARVEL PHYSICS (HINGLISH)

VECTORS

Multiple Choice Questions Standard Level

1. Which one of the following is a scalar quantity ?

A. Velocity

B. Acceleration

C. Speed

D. Momentum

Answer: C

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2. Which one of the following is a vactor quantity ?

A. Mass

B. Density

C. Electric Current

D. Impulse

Answer: D

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3. Which one of the following quantities is a scalar ?

A. Force

B. Electric field

C. Electrostatic potential

D. Linear momentum

Answer: C

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4. The magnitude of a vector cannot be :

A. Zero

B. One

C. Positive

D. Negative

Answer: D

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5. You are given two vectors $\vec{A}$ and $\vec{B}$. Which one of the following operation cannot be performed ?

A. Addition

B. Subtraction

C. Multiplication

D. Division $\frac{\vec{A}}{\vec{B}}$

Answer: D

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6. Which one of the following is not a characteristics of displacement ?

A. As it is a vector, it has magnitude, direction and a unit

B. It may be positive, negative or zero

C. The magnitude of displacement is equal to the shortest distance between the initial and final positions of the particle

D. A number of displacements are added or subtracted algebraically

Answer: D

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7. What is the magnitude of the sum of the vectors $\overrightarrow{P} = 3\hat{I}$ and $\overrightarrow{Q} = 4\hat{j}$?

A. 3

B. 4

C. 5

D. 7

Answer: C

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8. A vector is represented by $\overrightarrow{P} = 3$ hat I $+$ hat j $+ 2$ hat k`. What is its length in the XY plane ?

A. 2

B. $\sqrt{5}$

C. $\sqrt{10}$

D. $\sqrt{15}$

Answer: C

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9. If two vectors $\overrightarrow{A}_1 = \hat{i} - 3\hat{i} + 5\hat{k}$ and $\overrightarrow{A}_2 = \hat{i} - 3\hat{j} + a\hat{k}$ are equal, then the value of a is

A. $+5$

B. -5

C. -3

D. 2

Answer: B

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10. The (x,y,z) co -ordinates of two points A and B are give respectively as (0,3,- 1) and (-2,6,4) The displacement vector from A to B is given by

A. $-2\hat{i}+3\hat{j}+3\hat{k}$

B. $2\hat{i}-3\hat{j}-5\hat{k}$

C. $-2\hat{i}+6\hat{j}+4\hat{k}$

D. $-2\hat{i}+3\hat{j}+5\hat{k}$

Answer: D

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11. Which one of the following vector equations is wrong ?

A. $\vec{P} + \vec{Q} = \vec{R}$

B. $\vec{P} - \vec{Q} = \vec{R}$

C. $\vec{P} + Q = \vec{R}$

D. $\vec{P} = \vec{R} - \vec{Q}$

Answer: C

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12. The magnitude of vectors $\vec{A}, \vec{B}$ and $\vec{C}$ are 3, 4 and 5 units respectively. If $\vec{A} + \vec{B} = \vec{C}$, the angle between $\vec{A}$ and $\vec{B}$ is

A. $\frac{\pi}{2}$

B. $\frac{\pi}{4}$

C. $\tan^{-1}\left(\frac{7}{5}\right)$

D. $\cos^{-1}(0.6)$

Answer: A

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13. 3 forces acting on a particle are given by

(1) $\left(2\hat{i}+3\hat{j}-2\hat{k}\right)N$

(2) $\left(3\hat{i}+\hat{j}-3\hat{k}\right)N$

(3) $\left(-5\hat{i}-2\hat{j}+\hat{k}\right)N$ The particle will move in

A. X - Y plane

B. Y - Z plane

C. X - Z plane

D. Along X-axis

Answer: B

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14. A particle has a displacement of 12 m towards east and 6 m towards north and then 8 m vertically upwards. The magnitude of the sum of these displacements is

A. zero

B. 12 m

C. 15.62 m

D. 18.3 m

Answer: C

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15. What is the angle between A and the resultant of $\left(\vec{A}+\vec{B}\right)$ and $\left(\vec{A}-\vec{B}\right)$?

A. $\tan^{-1}\left(\frac{A}{B}\right)$

B. $\tan^{-1}\left(\frac{B}{A}\right)$

C. $\tan^{-1}\left(\frac{A+B}{A-B}\right)$

D. zero

Answer: D

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16. The component of vector $A = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$ and the directioin of $\hat{i} - \hat{j}$ is

A. $A_x - A_y + A_z$

B. $A_x + A_y + A_z$

C. $A_x - A_y$

D. $\frac{A_x - A_y}{\sqrt{2}}$

Answer: D

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17. Three vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are such that $\vec{A} = \vec{B} + \vec{C}$ and their magnitude are 5,4 and 3 respectively. Find the angle between $\vec{A}$ and $\vec{C}$

.

A. $\theta = \sin^{-1}\frac{3}{4}$

B. $\theta = \sin^{-1}\frac{4}{5}$

C. $\theta = \sin\frac{2}{3}$

D. $\theta = \sin^{-1}\frac{1}{2}$

Answer: B

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18. A plumb line is suspended from a celling of a car moving with horizontal acceleration of a. What will be the angle of inclination with

vertical?

A. $\tan^{-1}\left(\frac{g}{a}\right)$

B. $\tan^{-1}\left(\frac{a}{g}\right)$

C. $\sin^{-1}\left(\frac{a}{g}\right)$

D. $\cos^{-1}\left(\frac{a}{g}\right)$

Answer: B

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19. What is the anlge between a vector $\vec{A} = 4\hat{i} + 3\hat{j} + 5\hat{k}$ and the x-axis ?

A. $\cos^{-1}\left(\frac{3}{5}\right)$

B. $\cos^{-1}\left(\frac{2\sqrt{2}}{5}\right)$

C. $\cos^{-1}\left(\frac{3}{\sqrt{5}}\right)$

D. $\cos^{-1}\left(\frac{2}{5}\right)$

Answer: B

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20. If the resultant of n forces of different magnitudes acting at a point is zero, then the minimum value of n is

A. 4

B. 2

C. 3

D. 1

Answer: C

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21. Can the resultant of two vectors be zero ?

A. No

B. Yes, when the two vectors are equal in magnitude and direction

C. Yes, when the two vectors are equal in magnitude but opposite in direction

D. Yes, when the two vectors are equal in magnitude and making an anlge of $\frac{2\pi}{3}$ with each other

Answer: C

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22. The angle subtended by vector $\vec{A} = 4\hat{i} + 3\hat{j} + 12\hat{k}$ with the x-axis is :

A. $\sin^{-1}\left(\frac{3}{13}\right)$

B. $\sin^{-1}\left(\frac{4}{13}\right)$

C. $\cos^{-1}\left(\frac{4}{13}\right)$

D. $\cos^{-1}\left(\frac{3}{13}\right)$

Answer: C

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23. Two vectors of equal magnitudes having a sum of resultant equal to either of them, than the angel between them will be

A. 50°

B. 60°

C. 75°

D. 120°

Answer: D

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24. Two forces each of magnitude 2N, act at an angle of 60°. What is the magnitude of the resultant force ?

A. $\sqrt{2}N$

B. $\sqrt{6}N$

C. $\sqrt{8}N$

D. $\sqrt{12}N$

Answer: D

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25. Two equal forces (P each) act at a point inclined to each other at an angle of 120°. The magnitude of their resultant is

A. $\frac{P}{2}$

B. $\frac{P}{4}$

C. P

D. 2P

Answer: C

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26. Which one of the following is a correct statement ? If $\vec{P}$ and $\vec{Q}$ are two non zero vectors of different magnitudes, then

A. $\vec{P} \times \vec{Q} = \vec{Q} \times \vec{P}$

B. $\vec{P} \cdot \vec{Q} = -\vec{Q} \cdot \vec{P}$

C. $\vec{P} + \vec{Q} = \vec{Q} + \vec{P}$

D. $\vec{P} - \vec{Q} = \vec{Q} - \vec{P}$

Answer: C

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27. A force $\overrightarrow{F}_1$ of magnitude 9 N makes an angle of 30° with the X-axis. Another force $\overrightarrow{F}_2$ of magnitude 12 N, makes an angle of 120° with the X-axis. What is the magnitude of the resultant force ?

A. 7.5 N

B. 10 N

C. 12.5 N

D. 15 N

Answer: D

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28. The maximum value of the magnitude of the resultant of two vectors $\overrightarrow{P}$ and $\overrightarrow{Q}$ is 24 units and the minimum value of the magnitude of their resultant is 4 units. What is the ratio of the magnitudes of the vectors $\overrightarrow{P}$ and $\overrightarrow{Q}$?

A. $\frac{3}{4}$

B. $\frac{4}{5}$

C. $\frac{6}{5}$

D. $\frac{7}{5}$

Answer: D

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29. The magnitude of the resultant $\vec{R}$ of two forces $\vec{P}$ and $\vec{Q}$ is $20\,\mathrm{N}$. $\vec{R}$ make an angle of 30° with $\vec{P}$ and an angle of 60° with $\vec{Q}$. What are the magnitudes of $\vec{P}$ and $\vec{Q}$?

A. $P = 10N, Q = 10\sqrt{3}N$

B. $P = 10\sqrt{3}N, Q = 20N$

C. $P = 20N, Q = 20\sqrt{3}N$

D. $P = 10\sqrt{3}N, Q = 10N$

Answer: D

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30. Three forces $\vec{F}_1 = 5\hat{i} + 6\hat{j} + 7\hat{k}, \vec{F}_2 = -3\hat{i} - 2\hat{j} - 2\hat{k}$ and $\vec{F}_3 = -2\hat{i} - 4\hat{j} - 3\hat{k}$ act on a body. What is the direction of the resultant force acting on the body ?

A. Along Y axis

B. Along Z axis

C. Along X axis

D. In the XY plane making an angle of 30° with the X axis

Answer: B

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31. If $\vec{A} = \vec{B} + \vec{C}$, and the magnitude of $\vec{A}, \vec{B}$ and $\vec{C}$ are $5, 4$ and 3 units respectively. the angle between $\vec{A}$ and $\vec{C}$ is

A. $\theta = \cos^{-1}\left(\frac{2}{5}\right)$

B. $\cos^{-1}\left(\frac{3}{5}\right)$

C. $\theta = \cos^{-1}\left(\frac{4}{5}\right)$

D. $\cos^{-1}\left(\frac{3}{4}\right)$

Answer: B

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32. The sum of the magnitudes of two vectors P and Q is 18 and the magnitude of their resultant is 12. If the resultant is perpendicular to one of the vectors, then the magnitudes of the two vectors are

A. 5,13

B. 8,10

C. 7,11

D. 12,6

Answer: A

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33. What is the angle between two forces of equal magnitude P, if the magnitude of their resultant is $\frac{P}{2}$?

A. $\cos^{-1}\left(\frac{5}{8}\right)$

B. $\cos^{-1}\left(-\frac{7}{8}\right)$

C. $\cos^{-1}\left(-\frac{3}{8}\right)$

D. $\cos^{-1}\left(\frac{3}{5}\right)$

Answer: B

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34. Which one of the following cannot be the resultant of the vectors of magnitude 5 and 10 ?

A. 7

B. 8

C. 5

D. 2

Answer: D

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35. The magnitude of vector $\vec{A}$, $\vec{B}$ and $\vec{C}$ are respectively 12,5 and 13 unit and $\vec{A} + \vec{B} = \vec{C}$ then the angle between $\vec{A}$ and $\vec{B}$ is

A. π

B. 0

C. $\frac{\pi}{2}$

D. $\frac{\pi}{4}$

Answer: C

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36. What is the magnitude of a vector obtained by addition of two vectors, $6\hat{i} + 7\hat{j}$ and $3\hat{i} + 4\hat{j}$?

A. $\sqrt{160}$

B. $\sqrt{136}$

C. $\sqrt{202}$

D. $\sqrt{13.2}$

Answer: C

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37. Two vectors $\vec{A}_1$ and $\vec{A}_2$ each of magnitude A are inclinded to each other such that their resultant is equal to $\sqrt{3}A$. What is the magnitude of the resultant of $\vec{A}_1$ and $-\vec{A}_2$ is

A. 2A

B. $\sqrt{3}A$

C. $\sqrt{2}A$

D. A

Answer: D

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38. Resultant of two vectors $\vec{A}$ and $\vec{B}$ is of magnitude P, If $\vec{B}$ is reversed, then resultant is of magnitude Q. What is the value of $P^2 + Q^2$?

A. $2\left(A^2 + B^2\right)$

B. $2\left(A^2 - B^2\right)$

C. $A^2 - B^2$

D. $A^2 + B^2$

Answer: A

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39. The resultant of two forces acting an anlge of 120° is 10 kg wt and is perpendicular to one of the forces. That force is

A. $10\sqrt{3}$ kg wt

B. $20\sqrt{3}$ kg wt

C. 10 kg wt

D. $\frac{10}{\sqrt{3}}$ kg wt

Answer: D

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40. The resultant of $\vec{A} \times \vec{0}$ will be equal to

A. A

B. unit vector

C. zero vector

D. zero

Answer: C

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41. The maximum number of components into which a vector in space can be resolved is

A. Two

B. Three

C. Four

D. Any number

Answer: D

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42. Two vectors $\vec{A}$ and $\vec{B}$ are such that $\vec{A} + \vec{B} = \vec{A} - \vec{B}$, then

A. $\vec{A} \times \vec{B} = 0$

B. $\vec{A} \cdot \vec{B} = 0$

C. $\vec{A} = 0$

D. $\vec{B} = 0$

Answer: A,B,D

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43. With respect to a rectangular Cartesian co-ordinate system, three vectors are expressed as $\vec{a} = 4\hat{i} - \hat{j}$, $\vec{b} = -3\hat{i} + 2\hat{j}$, $\vec{c} = -\hat{k}$ where $\hat{i}, \hat{j}, \hat{k}$ are unit vectors, along the x, y and z-axes respectively. The unit vector $\hat{r}$ along the direction of the sum of these three vectors is given by

A. $\hat{r} = \frac{1}{\sqrt{3}}\left(\hat{i} + \hat{j} - \hat{k}\right)$

B. $\hat{r} = \frac{1}{\sqrt{2}}\left(\hat{i} + \hat{j} - \hat{k}\right)$

C. $\hat{r} = \frac{1}{3}\left(\hat{i} + \hat{j} - \hat{k}\right)$

D. $\hat{r} = \frac{1}{\sqrt{3}}\left(\hat{i} + \hat{j} + \hat{k}\right)$

Answer: A

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44. One of the rectangular components of a force of 40 N is $20\sqrt{3}N$. What is the other rectangular component ?

A. 10 N

B. 20 N

C. 30 N

D. 25 N

Answer: B

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45. What is the angle between $\hat{i}+\hat{j}$ and $\hat{i}$?

A. 15°

B. 30°

C. 45°

D. 60°

Answer: C

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46. If a unit vector is represented by $0.4\hat{i} + 0.7\hat{j} + c\hat{k}$ then the value of c is

A. $\sqrt{0.25}$

B. $\sqrt{0.30}$

C. $\sqrt{0.35}$

D. $\sqrt{0.40}$

Answer: C

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47. If $\hat{n}$ is a unit vector in the direction of the vector $\vec{A}$, them :

A. $n \times A$

B. $\vec{A} \times A$

C. $\frac{\vec{A}}{A}$

D. $\frac{A}{\vec{A}}$

Answer: C

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48. Given :

$\vec{A} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = -\hat{i} - \hat{j} - \hat{k}$ What is the angle between $\left(\vec{A} - \vec{B}\right)$ and $\vec{A}$?

A. 0°

B. 75°

C. 90°

D. 60°

Answer: A

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49. Three vector $\vec{A}, \vec{B}, \vec{C}$ satisfy the relation $\vec{A} \cdot \vec{B} = 0$and $\vec{A} . \vec{C} = 0$. The vector $\vec{A}$ is parallel to

A. $\vec{B}$

B. $\vec{C}$

C. $\vec{B} \times \vec{C}$

D. $\vec{B} \cdot \vec{C}$

Answer: C

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50. The work done by a force is defined by $W = \vec{F} \cdot \vec{S} \cdot$ It is found that the work done is zero, even if $\vec{F}$ and $\vec{s}$ are not equal to zero. From this we conclude that

A. $\vec{F}$ and $\vec{S}$ are acting in the same direction

B. $\vec{F}$ and $\vec{S}$ are acting in the opposite direction

C. $\vec{F}$ and $\vec{s}$ are acting at right angles

D. $\vec{F}$ and $\vec{s}$ are acting at an angle of 60°

Answer: C

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51. A particle has a displacement of $\vec{s} = \hat{i} + 2\hat{j} + \hat{k}$ metre under the action of a force $\vec{F} = 3\hat{i} - 2\hat{j} + 5\hat{k}$. What is the work done ?

A. 4 J

B. 5 J

C. 3 J

D. 8 J

Answer: A

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52. The angle between two vectors $\vec{P}$ and $\vec{Q}$ of magnitudes 3 and 5 units is 60°. What is the dot product of the two vectors ?

A. 6.5

B. 7.5

C. 8.5

D. 3.5

Answer: B

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53. The vector projection of a vector $3\hat{i} + 4\hat{k}$ on y-axis is

A. 4

B. 3

C. 0

D. 2

Answer: C

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54. Given : $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = \hat{i} + \hat{j}$. What is the component of vector $\vec{A}$ along the vector $\vec{B}$?

A. $\frac{7}{\sqrt{2}}$

B. $\frac{5}{\sqrt{2}}$

C. $\frac{3}{\sqrt{2}}$

D. $\frac{1}{\sqrt{2}}$

Answer: B

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55. A particle moves with a velocity $v = \left(5\hat{i} - 3\hat{j} + 6\hat{k}\right) ms^{-1}$ under the influence of a constant force $F = \left(10\hat{i} + 10\hat{j} + 20\hat{h}\right) N$, the instantaneous power applied to the particle is.

A. 200 W

B. 140 W

C. 100 W

D. 75 W

Answer: B

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56. The conditions under which the vector $\vec{P} + \vec{Q}$ and $\vec{P} - \vec{Q}$ will be at right angles to each other is

A. $\vec{P} \cdot \vec{Q} = 0$

B. $\vec{P} \times \vec{Q} = 0$

C. $|P| = |Q|$

D. $\vec{P} \cdot \vec{Q} = 1$

Answer: C

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57. Work done by a force in displacing a body is an example of

A. vector product

B. scalar product

C. addition of vectors

D. division of vectors

Answer: B

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58. What is the angle between two vectors $\vec{P} = 2\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{Q} = -3\hat{i} + 6\hat{k}$.

A. 0°

B. 45°

C. 60°

D. 90°

Answer: D

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59. A student was asked to find the work done by taking the dot product of $\vec{r}$ and $\vec{F}$. Instead of that he found out the cross product $\vec{r} \times \vec{F}$. Which physical quantity will be represented by $\vec{r} \times \vec{F}$?

A. Energy

B. Linear momentum

C. Torque

D. Impulse

Answer: C

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60. What is the angle between two vectors $\vec{P} = 2\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{Q} = -3\hat{i} + 6\hat{k}$.

A. 0°

B. 45°

C. 60°

D. 90°

Answer: D

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61. If $\vec{P} = a_1\hat{i} + a_2\hat{j}$ and $\vec{Q} = b_1\hat{i} + b_2\hat{j}$ are perpendicular to each other, then

A. $a_1b_1 = a_2b_2$

B. $\frac{a_1}{a_2} = -\frac{b_2}{b_1}$

C. $a_1a_2 = b_1b_2$

D. $\frac{a_1}{b_1} = \frac{a_2}{b_2}$

Answer: B

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62. If $\vec{A} = \hat{i} + 7\hat{j} + \hat{k}$ and $\vec{B} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ then the component of $\vec{A}$ along $\vec{B}$ is

A. $\frac{20}{\sqrt{23}}$

B. $\frac{27}{\sqrt{29}}$

C. $\frac{\sqrt{29}}{27}$

D. $\frac{22}{\sqrt{23}}$

Answer: B

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63. A body constrained to move in y direction is subjected to a force given by $\vec{F} = \left(-2\hat{i} + 15\hat{j} + 6\hat{k}\right)$ N . What is the work done by this force in moving the body through a distance of $10m$ along y-axis ?

A. 160 J

B. 190 J

C. 150 J

D. 20 J

Answer: C

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64. The angles between the two vectors $\overrightarrow{A} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ and $\overrightarrow{B} = 3\hat{i} + 4\hat{j} - 5\hat{k}$ will be

A. 180°

B. 45°

C. 90°

D. 0°

Answer: C

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65. An engine exerts a force $F = \left(20\hat{i} - 3\hat{j} + 5\hat{k}\right)$ N and moves with velocity $v = \left(6\hat{i} + 20\hat{j} - 3\hat{k}\right) ms^{-1}$. The power of the engine (in watt) is

A. 45 W

B. 10 W

C. 75 W

D. 20 W

Answer: A

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66. A force $\left(3\hat{i} + 4\hat{j}\right)$ acts on a body and displaces it by $\left(3\hat{i} + 4\hat{j}\right) m$. The work done by the force is

A. 25 J

B. 20 J

C. 16 J

D. 8 J

Answer: A

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67. A particle moves with a velocity of $6\hat{i} - 4\hat{j} + 3\hat{k}m/s$ under the application of a constant force $\overrightarrow{F} = 20\hat{i} + 15\hat{j} - 5\hat{k}N$. What is the instantaneous power applied to the particle ?

A. 25 J/s

B. 35 J/s

C. 45 J

D. 8 J

Answer: C

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68. A force $\vec{F} = \left(2\hat{i} + 2\hat{k}\right)$ N displaces a body by an amount $\vec{S} = \left(2\hat{i} + 2\hat{j}\right)$ m in 8 s. What is the power developed ?

A. 0.25 W

B. 0.75 W

C. 1.25 W

D. 0.5 W

Answer: D

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69. $\vec{P}$ and $\vec{Q}$ are two perpendicular vectors. If $\vec{P} = 5\hat{i} + 7\hat{j} - 3\hat{k}$ and $\vec{Q} = 2\hat{i} + 2\hat{j} - a\vec{k}$ then the value of a is

A. -5

B. -7

C. $+8$

D. -8

Answer: D

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70. What is the angle between two vectors $2\vec{i}+3\vec{j}+\vec{k}$ and $-3\vec{i}+6\vec{k}$?

A. 60°

B. 0°

C. 45°

D. 90°

Answer: D

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71. Under a force $\left(10\hat{i}-3\hat{j}+6\hat{k}\right)$ newton a body of mass 5 kg moves from position $\left(6\hat{i}+5\hat{j}-3\hat{k}\right)$ m to position $\left(10\hat{i}-2\hat{j}+7\hat{k}\right)$m. deduce the work done.

A. 0

B. 61 J

C. 121 J

D. 100 J

Answer: C

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72. What is the work done when a force $\overrightarrow{F}=2\hat{i}+3\hat{j}-5\hat{k}$ units acts on a body, producing a displacement $\overrightarrow{S}=2\hat{i}+4\hat{j}+3\hat{k}$ units ?

A. zero units

B. 30 units

C. 1 unit

D. 45 units

Answer: C

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73. What is the anlge between $\vec{P} \times \vec{Q}$ and $\vec{Q} \times \vec{P}$ is

A. zero

B. $\frac{\pi}{2}$

C. π

D. $\frac{3\pi}{2}$

Answer: C

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74. If $\left|\vec{P} \times \vec{Q}\right| = PQ$ then the angle between $\vec{P}$ and $\vec{Q}$ is

A. zero

B. 90°

C. 45°

D. any angle between 0 and 180°

Answer: B

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75. If $\left|\vec{P} \times \vec{Q}\right| = PQ$ then the angle between $\vec{P}$ and $\vec{Q}$ is

A. zero

B. 30°

C. 45°

D. 90°

Answer: C

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76. The magnitude of the vector product of two vectors is $\sqrt{3}$ times their scalar product. The angle between the two vectors is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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77. Two vectors $\vec{P}$ and $\vec{Q}$ of the same type with tails at a point O are inclined at angle θ. The diagonal of the parallelogram, drawn with $\vec{P}$ and $\vec{Q}$ as adjacent sides, represents their resultant. Then the area of the parallelogram is given by

A. $\vec{P} \cdot \vec{Q}$

B. $\vec{P} + \vec{Q}$

C. $\vec{P} \times \vec{Q}$

D. $\left|\vec{P} \times \vec{Q}\right|$

Answer: D

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78. You are given two vectors $\vec{P} = 2\hat{i} - 3\hat{j} - \hat{k}$ and $\vec{Q} = -6\hat{i} + 9\hat{j} + 3\hat{k}$ From their vector product, we find that

A. $\vec{P} \perp \vec{Q}$

B. $\vec{P} \mid\mid \vec{Q}$

C. Angle between $\vec{P}$ and $\vec{Q}$ is 30°

D. Angle between $\vec{P}$ and $\vec{Q}$ is 60°

Answer: B

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79. If $\vec{A} \cdot \vec{B} = 0$ and $\vec{A} \times \vec{C} = 0$, then the angle between B and C is

A. 0

B. 45°

C. 90°

D. 60°

Answer: C

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80. The linear velocity of a particle on a rotating body is given by $\vec{v} = \vec{\omega} \times \vec{r}$ where $\vec{\omega}$ is the angular velocity and $\vec{r}$ is the radius vector. What is the value of |v| if $\vec{\omega} = \hat{i} - 2\hat{j} + 2\hat{k}$ and $\vec{r} = 4\hat{j} - 3\hat{k}$?

A. $\sqrt{23}$ units

B. $\sqrt{29}$ units

C. $\sqrt{35}$ units

D. $\sqrt{47}$ units

Answer: B

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81. The torque of the force $\vec{F} = \left(2\hat{i} - 3\hat{j} + 4\hat{k}\right)N$ acting at the point $\vec{r} = \left(3\hat{i} + 2\hat{j} + 3\hat{k}\right)m$ about the origin be

A. $-17\hat{i}+6\hat{j}+13\hat{k}N-m$

B. $17\hat{i}-6\hat{j}-13\hat{k}N-m$

C. $10\hat{i}+8\hat{j}-3\hat{k}N-m$

D. $-8\hat{i}+10\hat{j}+3\hat{k}N-m$

Answer: B

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82. O is the centre of an equilateral triangle ABC. $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$ are the three forces acting along the sides AB, BC and AC as shown in the figure. What should be the magnitude of $\vec{F}_3$ so that the total torque about O is zero ?

A. $\frac{F_1+F_2}{2}$

B. F_1-F_2

C. $2(F_1 + F_2)$

D. $F_1 + F_2$

Answer: D

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83. If $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$, then the angle between $A \to B$ is

A. $\pi/4$

B. $\pi/2$

C. $\pi/3$

D. π

Answer: D

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84. If $\vec{a}$ and $\vec{b}$ are two vectors then the value of $\left(\vec{a}+\vec{b}\right)\times\left(\vec{a}-\vec{b}\right)$ is

A. $\vec{a}\times\vec{b}$

B. $-2\left(\vec{b}\times\vec{a}\right)$

C. $\vec{b}\times\vec{a}$

D. $2\left(\vec{b}\times\vec{a}\right)$

Answer: D

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Multiple Choice Questions Higher Level

1. A scalar quantity

A. can never have negative values

B. must be dimensionless

C. has magnitude and direction and it can be added algebraically to another scalar of the same type

D. does not vary from point to point in space

Answer: C

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2. Which pair of the following forces will never give resultant force of $2N$?

A. 1 N and 3 N

B. 2 N and 2 N

C. 1 N and 1 N

D. 1 N and 4 N

Answer: D

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3. Two statements are made regarding three non-zero vectors $\vec{A}, \vec{B}$ and $\vec{C}$ having different magnitudes :

(1) Any two of these vectors can be combined to give a zero vector.

(2) The three vectors can be combined to give a zero vector. Then,

A. Statements (1) and (2) are always true

B. Statements (1) and (2) are always wrong

C. Statement (1) is always wrong but 2 may be true

D. Statements (1) and (2) may be true

Answer: C

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4. The position vector of a particle is $\vec{r} = a\cos\omega t i + a\sin\omega t j$, the velocity of the particle is

A. directed towards the origin

B. directed away from the origin

C. parallel to the position vector

D. perpendicular to the position vector

Answer: D

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5. A vector $\vec{B}$ which has a magnitude 8.0 is added to a vector $\vec{A}$ which lies along the x-axis. The sum of these two vector is a third vector which lies along the y-axis and has a magnitude that is twice the magnitude of $\vec{A}$. Find the magnitude of $\vec{A}$

A. $\frac{16}{\sqrt{2}}$

B. $\frac{12}{\sqrt{5}}$

C. $\frac{6}{\sqrt{5}}$

D. $\frac{8}{\sqrt{5}}$

Answer: D

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6. Two points P and Q in space have the co-ordinates (2,4,4) and (-2,-3,7) respectively. What is the magnitude of the vector $\overrightarrow{PQ}$?

A. $\sqrt{50}$ units

B. $\sqrt{62}$ units

C. $\sqrt{74}$ units

D. $\sqrt{91}$ units

Answer: C

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7. Two vectors $\vec{P}$ and $\vec{Q}$ are inclinded to each other at 60°. The magnitude of $\vec{P}$ and $\vec{Q}$ are 10 and 15 units respectively. What is the angle (α) made by their resultant $\vec{R}$ with $\vec{P}$?

A. $\alpha = \tan^{-1}(0.5)$

B. $\alpha = \tan^{-1}(0.6134)$

C. $\alpha = \tan^{-1}(0.7422)$

D. $\alpha = \tan^{-1}(0.92)$

Answer: C

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8. Two vectors acting in the opposite directions have a resultant of 10 units. If they act at right angles toeach other, then the resultant is 50 units. Calculate the magnitude of two vectors.

A. $F_1 = 40N, F_2 = 30N$

B. $F_1 = 30N, F_2 = 40N$

C. $F_1 = 50N, F_2 = 40N$

D. $F_1 = 100N, F_2 = 60N$

Answer: A

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9. Two vectors $\vec{P}$ and $\vec{Q}$ are given by

$\vec{P} = 3\hat{i} + 4\hat{j} + 5\hat{k}$

$\vec{Q} = 2\hat{i} + 2\hat{j} + 3\hat{k}$

What are the direction cosines of the vector $\left(\vec{P} - \vec{Q}\right)$?

A. $\frac{1}{3}, \frac{2}{3}, \frac{2}{3}$

B. $\frac{2}{3}, \frac{1}{3}, \frac{2}{3}$

C. $\frac{2}{5}, \frac{3}{5}, \frac{4}{5}$

D. $\frac{2}{3}, \frac{4}{3}, \frac{5}{3}$

Answer: A

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10. The resultant of two forces P and Q makes an angle of 30° with P. What is the angle between P and Q, if the magnitude of the resultant is equal to $Q\sqrt{3}$?

A. 30°

B. 45°

C. 60°

D. 75°

Answer: C

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11. Three forces start acting simultaneously on a particle moving with velocity $\vec{v}$. These forces are reprsented in magnitude and direction by the three sides of a triangle ABC as shown in the figure. The particle will now move with velocity :

A. $\left|\vec{v}\right|$ in the direction of the largest force along $\vec{v}$

B. $\vec{v}$, remaining unchanged

C. greater than $\vec{v}$

D. less than $\vec{v}$

Answer: B

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12. Two forces of equal magnitude act at a point making an angle θ with each other. If the direction of one of the forces is reversed, the direction of the resultant will turn through

A. 30°

B. 45°

C. 60°

D. 90°

Answer: D

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13. Three forces of 4 N, 1N and 2 N acting on a body are as shown in the figure. We want to have the resultant force only along the y-direction. What should be the magnitude of the minimum additional force required for it ?

A. 0.5 N

B. 1.5 N

C. $\sqrt{3}N$

D. $\frac{\sqrt{3}}{4}N$

Answer: A

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14. A body of mass $5\sqrt{3}$ kg is acted upon by two forces each of magnitude 2 N and inclinded at 60° with each other. What is the acceleration of the body in m/s^2 ?

A. 1.5

B. 0.5

C. 0.4

D. 0.8

Answer: C

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15. The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to the vector $\vec{A}$ and its magnitude is equal to half the magnitude of vector $\vec{B}$. What is the angle between $\vec{A}$ and $\vec{B}$?

A. 30°

B. 45°

C. 150°

D. 120°

Answer: C

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16. $\hat{i}$ and $\hat{j}$ are unit vectors along x and y axis. What is the magnitude and direction of the vector $\hat{i} + \hat{j}$?

A. $1.414, 45^\circ$

B. $1.732, 45^\circ$

C. $1.850, 30^\circ$

D. $1.325, 60^\circ$

Answer: A

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17. Which one of the following is not a zero vector or a null vector ?

A. The displacement of a stone thrown upwards and received back by the thrower

B. The displacement of a particle along the circumference of a circle of radius r when it goes from one point on the circle to its diametrically opposite point

C. The acceleration vector of a body moving with uniform velocity along a straight line

D. The displacement of a stationary object from time $t_1 = 1$ minute to time $t_2 = 4$ minute

Answer: B

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18. A force of 20 N is acting on a body of mass 4 kg in the x-y plane. The direction of the force makes an angle of $\cos^{-1}\left(\frac{3}{5}\right)$ with the x axis. What is the component of acceleration along the axis ?

A. $3m/s^2$

B. $4m/s^2$

C. $5m/s^2$

D. $2m/s^2$

Answer: B

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19. You are given a vector, $\vec{P} = \frac{1}{\sqrt{2}}\cos\theta\hat{i} + \frac{1}{\sqrt{2}}\sin\theta\hat{j}$ What is the unit vector in the direction of $\vec{P}$?

A. $\frac{1}{\sqrt{2}}\left[\cos\theta\hat{i} + \sin\theta\hat{j}\right]$

B. $\cos\theta\hat{i} + \sin\theta\hat{j}$

C. $\cos\theta\hat{i} - \sin\theta\hat{j}$

D. $\frac{1}{2}\left[\cos\theta\hat{i} - \sin\theta\hat{j}\right]$

Answer: B

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20. If $\hat{i}, \hat{j}, \hat{k}$ represent unit vectors along the X,Y, Z axes respectively, then the angle between the vectors $\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} + \hat{j}$ is equal to

A. 90°

B. $\sin^{-1}\left(\sqrt{\frac{2}{3}}\right)$

C. $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

D. $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

Answer: D

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21. What are the values of a and b if vectors $a\hat{i}+b\hat{j}=\hat{n}$ and $\left(\hat{i}+\hat{j}\right)$ are perpendicular to each other ?

A. 1,0

B. 0,-1

C. 2,1

D. $\left(\frac{1}{\sqrt{2}}\right),\left(-\frac{1}{\sqrt{2}}\right)$

Answer: D

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22. A vector $\vec{P}$ when added to the sum of the vectors $2\hat{i} - 3\hat{j} + \hat{k}$ and $-3\hat{i} - \hat{j} + \hat{k}$ gives a unit vector along the x-axis. What is the magnitude of the vector $\vec{P}$?

A. $\sqrt{12}$

B. $\sqrt{20}$

C. $\sqrt{24}$

D. $\sqrt{32}$

Answer: C

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23. The momentum of a body is $\vec{P} = 2\cos t\hat{i} + 2\sin t\hat{j}$. What is the angle between the force $\vec{F}$ acting on the body and the momentum $\vec{P}$?

A. 90°

B. 45°

C. 135°

D. 120°

Answer: A

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24. The angle between the vectors $\vec{A} = \hat{i} + \hat{j}$ and $\vec{B} = \hat{i} + \hat{j} + c\vec{k}$ is 30° What is the value of c ?

A. 0

B. ± 1

C. $\pm\sqrt{\frac{2}{3}}$

D. $\pm\frac{1}{2}$

Answer: C

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25. What is the value of a, if two vectors $\vec{P} = \hat{i} + 12\hat{j} + \hat{k}$ and $\vec{Q} = 2\hat{i} - a\hat{j} + 4\hat{k}$ are perpendicular to each other ?

A. 1

B. $\frac{1}{2}$

C. $-\frac{1}{2}$

D. 2

Answer: B

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26. The vector sum of two forces is perpendicular to their vector differences. In that case, the force

A. parallel to each other

B. perpendicular to each other

C. equal in magnitude

D. unequal in magnitude

Answer: C

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27. $\vec{A}$ and $\vec{B}$ are two vectors and θ is the angle between them. If $\vec{A} . \vec{B} = 0,$ then which one of the following options is worng ?

A. $\vec{A} = 0$

B. $\vec{B} = 0$

C. $\theta = 0^\circ$

D. $\theta = 90^\circ$

Answer: C

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28. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces

A. are equal to each other

B. are not equal to each other in magnitude

C. cannot be predicted

D. are equal to each other in magnitude

Answer: D

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29. If a vector $\left(2\hat{i}+3\hat{j}+8\hat{k}\right)$ is perpendicular to the vector $\left(4\hat{j}-4\hat{i}+\alpha\hat{k}\right)$, then the value of α is :

A. -1

B. 1

C. $-\frac{1}{2}$

D. $\frac{1}{2}$

Answer: C

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30. Two vectors $\vec{A}$ and $\vec{B}$ are such that $\left|\vec{A}+\vec{B}\right|=\left|\vec{A}-\vec{B}\right|$ then what is the angle between $\vec{A}$ and $\vec{B}$:-

A. 0°

B. 90°

C. 60°

D. 120°

Answer: B

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31. Find the angle between the vertors $\overrightarrow{A} = \hat{i} + 2\hat{j} - \hat{k}$ and $\overrightarrow{B} = -\hat{i} + \hat{j} - 2\hat{k}$.

A. π

B. $\frac{\pi}{3}$

C. $\frac{\pi}{2}$

D. 0

Answer: B

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32. If $\vec{P}$ and $\vec{Q}$ are two vectors, then the value of $\left(\vec{P}+\vec{Q}\right)\times\left(\vec{P}-\vec{Q}\right)$ is

A. $\vec{P}\times\vec{Q}$

B. $-\left(\vec{P}\times\vec{Q}\right)$

C. $2\left(\vec{Q}\times\vec{P}\right)$

D. $+2\left(\vec{P}\times\vec{Q}\right)$

Answer: C

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33. If $\left|\vec{A}\times\vec{B}\right|=\sqrt{3}\vec{A}.\vec{B}$, then the value of $\left|\vec{A}+\vec{B}\right|$ is

A. $\left(A^2+B^2+AB\right)^{1/2}$

B. $\left(A^2+B^2+\sqrt{3}AB\right)^{1/2}$

C. $A+B$

D. $\left(A^2+B^2+\frac{AB}{\sqrt{3}}\right)^{1/2}$

Answer: A

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34. The diagonals of a parallelogram are $2\hat{i}$ and $2\hat{j}$. What is the area of the parallelogram

A. 0.5 unit

B. 1 unit

C. 1.5 unit

D. 2 units

Answer: D

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35. The vector product of two vectors $\vec{A}$ and $\vec{B}$ is zero. The scalar product of $\vec{A}$ and $\left(\vec{A}+\vec{B}\right)$ will be

A. zero

B. A^2

C. AB

D. A^2+AB

Answer: D

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36. If the angle between the vectors $\vec{A}$ and $\vec{B}$ is θ, the value of the product $\left(\vec{B}\times\vec{A}\right)\cdot\vec{A}$ is equal to

A. $BA^2\sin\theta$

B. $BA^2\cos\theta$

C. $BA^2 \sin\theta \cos\theta$

D. zero

Answer: D

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37. Which one of the following is not a a vector product of two vectors ?

A. Moment of a force (torque)

B. Force acting on a moving charge in a magnetic field

C. Work done in lifting a stone

D. Area of a triangle formed by two vectors $\vec{P}$ and $\vec{Q}$ as adjacent sides

Answer: C

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Test Your Grasp

1. You are given two vectors $\vec{A}$ and $\vec{B}$. Which one of the following operation cannot be performed ?

A. Addition

B. Subtraction

C. Multiplication

D. Division $\frac{\vec{A}}{\vec{B}}$

Answer: D

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2. 3 forces acting on a particle are given by

(1) $\left(2\hat{i}+3\hat{j}-2\hat{k}\right)N$

(2) $\left(3\hat{i}+\hat{j}-3\hat{k}\right)N$

(3) $\left(-5\hat{i}-2\hat{j}+\hat{k}\right)N$ The particle will move in

A. X - Y plane

B. Y - Z plane

C. X - Z plane

D. Along X-axis

Answer: B

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3. What is the angle between a vector $\vec{A}=4\hat{i}+3\hat{j}+5\hat{k}$ and the x-axis ?

A. $\cos^{-1}\left(\frac{3}{5}\right)$

B. $\cos^{-1}\left(\frac{2\sqrt{2}}{\sqrt{5}}\right)$

C. $\cos^{-1}\left(\frac{3}{\sqrt{5}}\right)$

D. $\cos^{-1}\left(\frac{2}{5}\right)$

Answer: B

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4. The maximum value of the magnitude of the resultant of two vectors $\overrightarrow{P}$ and $\overrightarrow{Q}$ is 24 units and the minimum value of the magnitude of their resultant is 4 units. What is the ratio of the magnitudes of the vectors $\overrightarrow{P}$ and $\overrightarrow{Q}$?

A. $\frac{3}{4}$

B. $\frac{4}{5}$

C. $\frac{6}{5}$

D. $\frac{7}{5}$

Answer: D

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5. What is the angle between $\hat{i}+\hat{j}$ and $\hat{i}$?

A. 15°

B. 30°

C. 45°

D. 60°

Answer: C

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6. A vector $\overrightarrow{P}$ when added to the sum of the vectors $2\hat{i}-3\hat{j}+\hat{k}$ and $-3\hat{i}-\hat{j}+\hat{k}$ gives a unit vector along the x-axis. What is the magnitude of the vector $\overrightarrow{P}$?

A. $\sqrt{12}$

B. $\sqrt{20}$

C. $\sqrt{24}$

D. $\sqrt{32}$

Answer: C

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7. A particle moves with a velocity $v = \left(5\hat{i} - 3\hat{j} + 6\hat{k}\right) ms^{-1}$ under the influence of a constant force $F = \left(10\hat{i} + 10\hat{j} + 20\hat{h}\right) N$, the instantaneous power applied to the particle is.

A. 200 W

B. 140 W

C. 100 W

D. 75 W

Answer: B

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8. If $\vec{A} \cdot \vec{B} = 0$ and $\vec{A} \times \vec{C} = 0$, then the angle between B and C is

A. 0

B. 45°

C. 90°

D. 60°

Answer: C

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9. If $\vec{P}$ and $\vec{Q}$ are two vectors, then the value of $\left(\vec{P} + \vec{Q}\right) \times \left(\vec{P} - \vec{Q}\right)$ is

A. $\vec{P} \times \vec{Q}$

B. $-\left(\overrightarrow{P} \times \overrightarrow{Q}\right)$

C. $2\left(\overrightarrow{Q} \times \overrightarrow{P}\right)$

D. $+2\left(\overrightarrow{P} \times \overrightarrow{Q}\right)$

Answer: C

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10. The resultant of two forces 3P and 2P is R. If the first force is doubled then resultant is also doubled.The angle between the two forces is

A. 120°

B. 60°

C. 180°

D. 90°

Answer: A

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