Exercise

Vector

(Physicsaholics)

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Exercise-1

(Objective Type: Single Correct)

Q 1. If a vector $2\hat{i}+3\hat{j}+8\hat{k}$ is perpendicular to the vector $4\hat{j}-4\hat{i}+\alpha\hat{k}$ then the value of α is

(a) 1/2 (b) – 1/2 (c) 1 (d) – 1

Q 2. The position vectors of points A, B, C and D are

A = $3\hat{i}+4\hat{j}+5\hat{k}$, **B** = $4\hat{i}+5\hat{j}+6\hat{k}$,

C = $7\hat{i}+9\hat{j}+3\hat{k}$ and **D** = $4\hat{i}+6\hat{j}$

Then the displacement vectors **AB** and **CD** are -

(A) perpendicular (B) parallel

(C) anti-parallel (D) inclined at an angle of 60º

Q 3. If $\vec{A}=3\hat{\imath}+4\hat{\jmath}+5\hat{k}$, then the component of $\vec{A}$ along z-axis is :

(A) 3 (B) 4 (C) 5 (D) $5\sqrt{2}$

Q 4. If $\vec{a}$ is a vector and x is a non-zero scalar, then
(A) x $\vec{a}$ is a vector in the direction of $\vec{a}$ (B) x $\vec{a}$ is a vector collinear to $\vec{a}$
(C) x $\vec{a}$ and $\vec{a}$ have independent directions (D) none of these.

Q 5. Two vector $\vec{A}$ and $\vec{B}$ have magnitude 3 each. $\vec{A}\times\vec{B}=-5\hat{k}+2\hat{i}$. Find angle between A and B

(a) $\cos^{-1}\frac{\sqrt{29}}{9}$ (b) $\tan^{-1}\left(\frac{-5}{2}\right)$ (c) $\sin^{-1}\left(\frac{2}{5}\right)$ (d) $\sin^{-1}\left(\frac{\sqrt{29}}{9}\right)$

Q 6. $\vec{A}=3\hat{i}+4\hat{j}+2\hat{k}, \vec{B}=6\hat{i}-\hat{j}+3\hat{k}$. Find a vector parallel to $\vec{A}$ whose magnitude is equal to that of $\vec{B}$.

(a) $\sqrt{\frac{46}{29}}\left(3\hat{i}+4\hat{j}+2\hat{k}\right)$ (b) $\sqrt{\frac{46}{29}}\left(6\hat{i}-\hat{j}+3\hat{k}\right)$ (c) $\sqrt{\frac{29}{46}}\left(3\hat{i}+4\hat{j}+2\hat{k}\right)$ (d) none

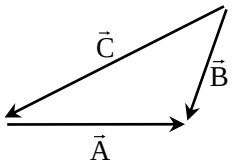
Q 7. Vectors $\vec{A}=\hat{\imath}+\hat{\jmath}-2\hat{k}$ and $\vec{B}=3\hat{\imath}+3\hat{\jmath}-6\hat{k}$ are :

(A) Parallel (B) Antiparallel

(C) Perpendicular (D) at acute angle with each other

Q 8. A vector is not changed if
(A) it is slid parallel to itself (B) it is cross multiplied by a unit vector
(C) it is rotated through an arbitrary angle (D) it is multiplied by a scalar.

Q 9. For the figure –



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

Q 10. If a, b, c are three non-zero vectors such that $\vec{a}+\vec{b}+\vec{c}=0$ the value of $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$ is

(A) Less than zero (B)equal to zero (C) greater than zero (D) 3.

Q 11. Two forces of 4 dyne and 3 dyne act upon a body. The resultant force on the body can only be –
(A) more than 3 dynes (B) more than 4 dynes
(C) between 3 and 4 dynes (D) between 1 and 7 dynes

Q 12. Let there be two vectors $\vec{a}$ and $\vec{b}$ such that $\vec{a}+\vec{b}$ is in same direction as $\vec{a}-\vec{b}$. Select the correct alternative.

(A) $\vec{a}\times\vec{b}$ =0 (B)$|\vec{a}|>|\vec{b}|$

(C) Both (1) and (2) must be simultaneously true (D) $\vec{a}\cdot\vec{b}=0$

Q 13. Which of the sets given below may represent the magnitudes of three vectors adding to zero ?

(A) 2, 4, 8 (B) 4, 8, 16 (C) 1, 2, 1 (D) 0.5, 1, 2

Q 14. What displacement must be added to the displacement $25\hat{i}-6\hat{j}$ m to give a displacement of 7.0 m pointing in the x-direction ?

(A) $18\hat{i}-6\hat{j}$ (B) $32\hat{i}-13\hat{j}$ (C) $-18\hat{i}+6\hat{j}$ (D) $-25\hat{i}+13\hat{j}$

Q 15. Two vectors have magnitudes 3 unit and 4 unit respectively. What should be the angle between them if the magnitude of the resultant is -

(i) 1 unit (ii) 5 unit (iii) 7 unit

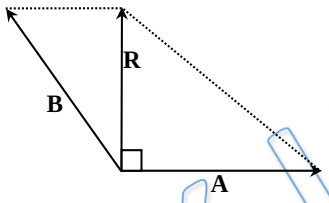
(A) 180º, 90º, 0º (B) 80º, 70º, 0º (C) 90º, 170º, 50º (D) None of these

Q 16. If $\vec{A}.\vec{B} = \vec{B}.\vec{C}$ then

(a) $\vec{A} = \vec{C}$ always (b) $\vec{A} \neq \vec{C}$ always

(c) $\vec{A}$ may not be equal to $\vec{C}$ (d) none of these

Q 17. The resultant of two vectors **A** and **B** is perpendicular to the vector **A** and its magnitude is equal to half the magnitude of vector **B**. The angle between **A** and **B** is -



(A) 120º (B) 150º (C) 135º (D) None of these

Q 18. If $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ then angle between the vectors A and B is

(a) 0 (b) $\pi/3$ (c) $\pi/2$ (d) $\pi/4$

Q 19. In a given co-ordinate system, a vector quantity is given as $\vec{A} = 3\hat{j} + 4\hat{k}$. In another co-ordinate system choosen arbitrarily, $\vec{A}$ can not be

(A) $5\hat{i}$ (B) $5\hat{j}$ (C) $\frac{5}{2}(\hat{i} + \sqrt{3}\hat{j})$ (D) $5(\hat{i} + \hat{j})$

Q 20. If the angle between vector **a** and **b** is an acute angle, then the difference **a** – **b** is -

(A) the main diagonal of the parallelogram (B) the minor diagonal of the parallelogram

(C) any of the above (D) none of the above

Q 21. If $|\vec{a}| = 11$, $|\vec{b}| = 23$, $|\vec{a} - \vec{b}| = 30$, then $|\vec{a} + \vec{b}|$ is :

(A) 10 (B) 20 (C) 30 (D) 40

Q 22. $\overrightarrow{F_1}$ acts due east and $\overrightarrow{F_2}$ acts 60° north of east. Both have equal magnitude 40N each. What is the magnitude and direction of $\vec{F}_1 + \vec{F}_2$?

(A) $20\sqrt{3}$ N, 30^0 east of north. (B) $40\sqrt{3}$ N, 30^0 east of north.

(C) $20\sqrt{3}$ N, 30^0 north of east. (D) $40\sqrt{3}$ N, 30^0 north of east.

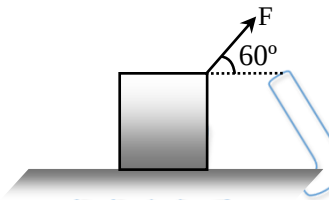
Q 23. There are three vectors $\vec{P}$. $\vec{Q}$ and $\vec{R}$. The angle between $\vec{P}$ and $\vec{Q}$ is 60º and $\vec{R}$ is perpendicular to the plane containing the vectors $\vec{P}$ and $\vec{Q}$ Consider the following relations.

(a) $\vec{P} + \vec{Q} + \vec{R} = 0$ (b)$\vec{P} \times \vec{Q} = \vec{R}$ (c)$\vec{P} \times \vec{R} = \vec{Q}$

The possible relations are

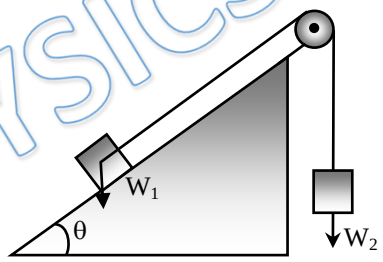
(A) (a) & (b) (B) (a) & (c) (C) (b) & (c) (D) Only (b)

Q 24. A child pulls a box with a force of 200 N at an angle of 60º above the horizontal. Then the horizontal and vertical components of the force are-



(A) 100 N, 175 N (B) 86.6 N, 100 N (C) 100 N, 86.6 N (D) 100 N, 0 N

Q 25. In the accompanying diagram W_1 is 5 kg weight and W_2 is 3 kg weight. If the component of W_1 parallel to the incline is equal to W_2, then the angle θ is nearly-



(A) 37º (B) 53º (C) 45º (D) Nothing can be said

Q 26. The value of a unit vector in the direction of vector $\vec{A} = 5\hat{i} - 12\hat{j}$, is -

(A) $\hat{i}$ (B) $\hat{j}$ (C) $(\hat{i}+\hat{j})/13$ (D) $(5\hat{i}-12\hat{j})/13$

Q 27. The force determined by the vector $\vec{F} = (\hat{\imath} - 8\hat{\jmath} - 7\hat{k})$ is resolved along three mutually perpendicular directions, one of which is the direction of the vector $\vec{a} =$

$2\hat{i}+2\hat{j}+\hat{k}$. Then the vector component of the force $\vec{F}$ in the direction of the vector $\vec{a}$ is :

(A) $-14\hat{i}-14\hat{j}-7\hat{k}$ (B) $-\frac{14}{3}\hat{i}-\frac{14}{3}\hat{j}-\frac{7}{3}\hat{k}$ (C) $-\frac{2}{3}\hat{i}-\frac{2}{3}\hat{j}-\frac{1}{3}\hat{k}$ (D) none of these

Q 28. The component of a vector is -

(A) always less than its magnitude (B) always greater than its magnitude

(C) always equal to its magnitude (D) none of these

Q 29. What is the resultant of three coplanar forces: 300 N at 0°, 400 N at 30º and 400 N at 150º ?

(A) 500 N (B) 700 N (C) 1100N (D) 300 N

Q 30. X-component of $\vec{a}$ is twice its Y-component. If the magnitude of the vector is $5\sqrt{2}$ and it makes an angle of 135º with z-axis then the vector is :

(A) $(2\sqrt{3}, \sqrt{3}, -3)$ (B) $(2\sqrt{6}, \sqrt{6}, -6)$ (C) $(2\sqrt{5}, \sqrt{5}, -5)$ (D) none of these

Q 31. Given the three vectors, $\vec{a}=-2\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=\hat{i}+5\hat{j}$ & $\vec{c}=4\hat{i}+4\hat{j}-2\hat{k}$. The projection of the vector $3\vec{a}-2\vec{b}$ on the vector $\vec{c}$ is :

(A) 11 (B) - 11 (C) 13 (D) none of these

Q 32. If $\vec{e}_1$ & $\vec{e}_2$ are two unit vectors and θ is the angle between them , then $\sin\left(\frac{\theta}{2}\right)$ is :

(A) $\frac{1}{2}|\vec{e}_1+\vec{e}_2|$ (B) $\frac{1}{2}|\vec{e}_1-\vec{e}_2|$ (C) $\frac{\vec{e}_1\cdot\vec{e}_2}{2}$ (D) $\frac{|\vec{e}_1 \times \vec{e}_2|}{2|\vec{e}_1||\vec{e}_2|}$

Q 33. The angle between $\vec{a}$ and $\vec{b}$ is 0° then angle between $\vec{a}$ and $-3\vec{b}$ is

(A) $\pi/3$ (B) π (C) $\pi/6$ (D) none of these.

Q 34. A vector that is perpendicular to both the vectors $\vec{a}=\hat{i}-2\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$ is

(A) $-\hat{i}+\hat{k}$ (B) $-\hat{i}-2\hat{j}+\hat{k}$ (C) $\hat{i}-2\hat{j}+\hat{k}$ (D) $\hat{i}+\hat{k}$.

Q 35. If θ be the angle between the vectors $\hat{i}+\hat{j}$ and $2\hat{i}+2\hat{k}$, then θ is

(a) 0 (B) $\pi/4$ (C) $\pi/2$ (D) $\pi/3$.

Q 36. The sum, difference and cross product of two vectors $\vec{A}$ and $\vec{B}$ are mutually perpendicular if :

(a) $\vec{A}$ and $\vec{B}$ are perpendicular to each other and $|\vec{A}| = |\vec{B}|$

(b) $\vec{A}$ and $\vec{B}$ are perpendicular to each other

(c) $\vec{A}$ and $\vec{B}$ are perpendicular but their magnitudes are arbitrary

(d) $|\vec{A}| = |\vec{B}|$ and their directions are arbitrary

Q 37. Two vectors **A** and **B** lie in X-Y plane. The vector B is perpendicular to vector **A**. If **A** = $\hat{i} + \hat{j}$, then **B** may be -

(A) $\hat{i} - \hat{j}$ (B) $-\hat{i} + \hat{j}$ (C) $-2\hat{i} + 2\hat{j}$ (D) Any of the above

Q 38. The two vectors **A** = $2\hat{i} + \hat{j} + 3\hat{k}$ and **B** = $7\hat{i} - 5\hat{j} - 3\hat{k}$ are -

(A) parallel (B) perpendicular (C) anti-parallel (D) none of these

Q 39. Two vectors P = $2\hat{i} + b\hat{j} + 2\hat{k}$ and $Q = \hat{i} + \hat{j} + \hat{k}$ will be perpendicular if -

(A) b = 0 (B) b = 1 (C) b = 2 (D) b = – 4

Q 40. A vector perpendicular to $(4\hat{i} - 3\hat{j})$ is –

(A) $4\hat{i} + 3\hat{j}$ (B) $7\hat{k}$ (C) $6\hat{i}$ (D) $3\hat{i} - 4\hat{j}$

Q 41. Angle that the vector **A** = $2\hat{i} + 3\hat{j}$ makes with y-axis is –

(A) $\tan^{-1} 3/2$ (B) $\tan^{-1} 2/3$ (C) $\sin^{-1} 2/3$ (D) $\cos^{-1} 3/2$

Q 42. Projection of the vector $2\hat{i} + 3\hat{j} + 2\hat{k}$ on the vector $\hat{i} - 2\hat{j} + 3\hat{k}$ is

(A) $\frac{2}{\sqrt{14}}$ (B) $\frac{1}{\sqrt{14}}$ (C) $\frac{3}{\sqrt{17}}$ (D) $\frac{3}{\sqrt{14}}$.

Q 43. ABCDEF is a regular hexagon. What is the value of $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF}$

O is the centre of hexagon ?

(A) Zero (B) $2\overrightarrow{AO}$ (C) $4\overrightarrow{AO}$ (D) $6\overrightarrow{AO}$

Q 44. Two forces, F_1 and F_2 are acting on a body. One force is double that of the other force and the resultant is equal to the greater force. Then the angle between the two forces is -

(A) $\cos^{-1}(1/2)$ (B) $\cos^{-1}(-1/2)$ (C) $\cos^{-1}(-1/4)$ (D) $\cos^{-1}(1/4)$

Q 45. A three-dimensional vector has equal magnitude in all three direction. The magnitude of this vector is 30. Find the magnitude of component in each direction

(A) $5\sqrt{2}$ (B) $10\sqrt{3}$

(C) 20 (D) none of these

Q 46. If the magnitudes of the vectors **A**, **B** and **C** are 6, 8, 10 units respectively and if **A** + **B** = **C**, then the angle between **A** and **C** is -

(A) $\pi/2$ (B) cos (0. 6) (C) tan (0.75) (D) $\pi/4$

Q 47. Angle between (**P** + **Q**) and (**P** – **Q**) will be-

(A) 0º only

(B) 90º only

(C) 180º only

(D) between 0º and 180º (both the values inclusive)

Q 48. What is the angle between $\vec{P}$ and the resultant of $(\vec{P} + \vec{Q})$ and $(\vec{P} - \vec{Q})$?

(a) $\frac{\tan^{-1}\left|(\vec{P}-\vec{Q})\right|}{|P+Q|}$ (b) $\tan^{-1}(Q/P)$ (c) tan – 1(P/Q) (d) zero

Q 49. If **A** = **B** + **C** and magnitudes of **A**, **B** and **C** are 5, 4, and 3 units respectively, the angle between **A** and **C** is -

(A) $\sin^{-1}(3/4)$ (B) $\cos^{-1}(4/5)$ (C) $\cos^{-1}(3/5)$ (D) □/2

Q 50. If $(\vec{A}+\vec{B})$ is perpendicular to $\vec{B}$ and $(\vec{A}+2\vec{B})$ is perpendicular to $\vec{A}$, then

(A) $A = \sqrt{2}B$ (B) A = 2B (C) 2A = B (D) A = B.

Q 51. Out of addition, subtraction, dot product and cross product, the following operations are commutative -

(A) dot and cross products (B) addition and subtraction

(C) subtraction and cross product (D) addition and dot product

Q 52. If $\vec{a}$ is perpendicular to $\vec{b}$ and $\vec{c}$, then

(A) $\vec{a}\times(\vec{b}\times\vec{c})=1$ (B) $\vec{a}\times(\vec{b}\times\vec{c})=0$ (C) $\vec{a}\times(\vec{b}\times\vec{c})=-1$ (D) None of these.

Q 53. If $\vec{a}\times\vec{b}=\vec{a}\times\vec{c}$, $\vec{a}\neq 0$, then

(A) $\vec{b}=\vec{c}+\lambda\vec{a}$ (B) $\vec{c}=\vec{a}+\lambda\vec{b}$ (C) $\vec{a}=\vec{b}+\lambda\vec{c}$ (D) None of these.

Q 54. If the angle between the vectors $\vec{A}$ and $\vec{B}$ is θ, the value of the product $(\vec{B}\times\vec{A}).\vec{A}$ is equal to:

(A) $BA^2\cos\theta$ (B) $BA^2\sin\theta$ (C) $BA^2\sin\theta\cos\theta$ (D) zero

Q 55. If $\vec{a}.\vec{b}=\vec{a}.\vec{c}$ and $\vec{a}\times\vec{b}=\vec{a}\times\vec{c}$, then

(A) either $\vec{a}=\vec{0}$ or $\vec{b}=\vec{c}$ (B) $\vec{a}$ is parallel to $(\vec{b}-\vec{c})$

(C) $\vec{a}$ is perpendicular to $(\vec{b}-\vec{c})$ (D) none of these.

Q 56. If θ is the angle between vectors $\vec{a}$ and $\vec{b}$, and $|\vec{a}\times\vec{b}|=\vec{a}.\vec{b}$, then θ is equal to

(A) 0° (B) 180° (C) 135° (D) 45°

Q 57. $(\vec{a}-\vec{b})\times(\vec{a}+\vec{b})$ is equal to

(A) 0 (B) $\vec{a}\times\vec{b}$ (C) $2(\vec{a}\times\vec{b})$ (D) $|a|^2+|b|^2$.

Q 58. A parallelogram is formed with $\vec{a}$ and $\vec{b}$ as the sides. Let $\vec{d}_1$ and $\vec{d}_2$ be the diagonals of the parallelogram then $a^2+b^2=$

(a) $(d_1^2+d_2^2)/2$ (b) $(d_1^2-d_2^2)/2$ (c) $d_1^2+d_2^2$ (d) $d_1^2-d_2^2$

Q 59. The linear velocity of a rotating body is given by $\mathbf{v}=\boldsymbol{\omega}\times\mathbf{r}$, where $\boldsymbol{\omega}$ is the angular velocity and $\mathbf{r}$ is the radius vector. The angular velocity of a body $\boldsymbol{\omega}=\hat{i}-2\hat{j}+2\hat{k}$ and their radius vector $\mathbf{r}=4\hat{j}-3\hat{k}$, $|\mathbf{v}|$ is -

(A) $\sqrt{29}$ units (B) 31 units (C) $\sqrt{37}$ (D) $\sqrt{41}$ units

Q 60. Which of the following sets of displacements might be capable of returning a car to its starting point ?

(A) 4, 6, 8 and 15 km

(B) 10, 30, 50 and 120 km

(C) 5,10, 30 and 50 km

(D) 50, 50, 75 and 200 km

Q 61. The vector $\vec{a}\times(\vec{b}\times\vec{a})$ is :

(A) perpendicular to $\vec{a}$ (B) perpendicular to $\vec{b}$

(C) null vector (D) perpendicular to both $\vec{a}$ and $\vec{b}$.

Q 62. The value of $\hat{i}\ x\left(\vec{r}\ x\ \hat{i}\right) + \hat{j}\ x\left(\vec{r}\ x\ \hat{j}\right) + \hat{k}\ x\left(\vec{r}\ x\ \hat{k}\right)$ is :

(A) $\vec{r}$ (B) $2\vec{r}$ (C) $3\vec{r}$ (D) $4\vec{r}$

Q 63. $\vec{A}.(\vec{A}\times\vec{B})$ is

(A) = 0 (B) > 0 (C) < 0 (D) None of these.

Q 64. The magnitude of the vector product of two vectors $\vec{A}$ and $\vec{B}$ may be -

(a) Greater than AB (b) Equal to AB

(c) Less than AB (d) Equal to Zero

(A) a, b, c (B) b, c, d

(C) a, c, d (D) a, b, d

Answer Key

Q.1) B	Q.2) C	Q.3) C	Q.4) B	Q.5) D
Q.6) A	Q.7) A	Q.8) A	Q.9) C	Q.10) B
Q.11) D	Q.12) C	Q.13) C	Q.14) C	Q.15) A
Q.16) C	Q.17) B	Q.18) C	Q.19) D	Q.20) B
Q.21) B	Q.22) D	Q.23) D	Q.24) A	Q.25) A
Q.26) D	Q.27) B	Q.28) D	Q.29) A	Q.30) C
Q.31) B	Q.32) B	Q.33) B	Q.34) A	Q.35) D
Q.36) D	Q.37) D	Q.38) B	Q.39) D	Q.40) C
Q.41) B	Q.42) A	Q.43) D	Q.44) C	Q.45) B
Q.46) B	Q.47) D	Q.48) D	Q.49) C	Q.50) A
Q.51) D	Q.52) B	Q.53) A	Q.54) D	Q.55) A
Q.56) D	Q.57) C	Q.58) A	Q.59) A	Q.60) A
Q.61) A	Q.62) B	Q.63) A	Q.64) B	