MATHS

BOOKS - NTA MOCK TESTS

VECTOR ALGEBRA TEST

Multiple Choice Questions

1. If the vectors $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{c}$ are the sides BC,CA and AB respectively of a triangle ABC then

A. $\overrightarrow{a}.\overrightarrow{b}+\overrightarrow{b}.\overrightarrow{c}+\overrightarrow{c}.\overrightarrow{a}=0$

B. $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

C. $\vec{a} . \vec{b} = \vec{b} . \vec{c} = \vec{c} . \vec{a}$

D. $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = 0$

Answer: B

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2. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + 2\vec{b} + 2\vec{c} = \vec{0}$ then $\left|\vec{a} \times \vec{c}\right|$ is equal to

A. $\frac{1}{4}$

B. $\frac{15}{16}$

C. $\frac{\sqrt{15}}{4}$

D. $\frac{\sqrt{15}}{16}$

Answer: C

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3. A line with positive direction cosines passes through the point P(2,-1,2) makes equal angles with the coordinate axes. The line meets the plane $2x + y + z = 9$ at point Q. The length of the line segment PQ equals

A. 1

B. $\sqrt{2}$

C. $\sqrt{3}$

D. 2

Answer: C

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4. Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Which of the following is representing a vector $\vec{p}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and also whose scalar product with vector $\vec{c}$ would be $\vec{p} . \vec{c} = 18$.

A. $\overrightarrow{p} = 32\hat{i} - 2\hat{j} - 28\hat{k}$

B. $\overrightarrow{p} = 64\hat{i} - 2\hat{j} - 28\hat{k}$

C. $\overrightarrow{p} = 64\hat{i} + 2\hat{j} - 28\hat{k}$

D. $\overrightarrow{p} = 64\hat{i} - 2\hat{j} + 28\hat{k}$

Answer: B

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5. $\overrightarrow{a}.\left(\overrightarrow{a} \times \overrightarrow{b}\right) =$

A. $\overrightarrow{b}.\overrightarrow{b}$

B. a^2b

C. 0

D. $a^2 + ab$

Answer: C

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6. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three noncoplanar unit vectors then the values of $[\vec{a}\ \vec{p}\ \vec{q}]\vec{a} + \left[\vec{b}\ \vec{p}\ \vec{q}\right]\vec{b} + [\vec{c}\ \vec{p}\ \vec{q}]\vec{c}$ is always equal to

A. $\left(\vec{a} + \vec{b} + \vec{c}\right) \times \left(\vec{p} \times \vec{q}\right)$

B. $\vec{a} + \vec{b} + \vec{c} + \vec{p} + \vec{q}$

C. $\overrightarrow{p} + \overrightarrow{q}$

D. $\overrightarrow{p} \times \overrightarrow{q}$

Answer: D

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7. If the scalar projection of the vectors $x\hat{i} - \hat{j} + \hat{k}$ on the vectors $2\hat{i} - \hat{j} + 5\hat{k}$ is $\frac{1}{\sqrt{3}}$ then value of x is equal to

A. $\frac{-5}{2}$

B. 6

C. -6

D. 3

Answer: A

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8. Let OACB be parallelogram with O at origin & OC a diagonal.Let D be the mid point of OA. Then the ratio in which OC intersect BD is

A. $2:1$

B. $2:3$

C. $3:4$

D. $4:5$

Answer: A

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9. Let $\overrightarrow{r}$ be a unit vector satisfying $\overrightarrow{r} \times \overrightarrow{a} = \overrightarrow{b}$ where $\left|\overrightarrow{a}\right| = \sqrt{3}$ and $\left|\overrightarrow{b}\right| = \sqrt{2}$ then

A. $\overrightarrow{r} = \frac{2}{3}\left(\overrightarrow{a} + \overrightarrow{a} \times \overrightarrow{b}\right)$

B. $\overrightarrow{r} = \frac{1}{3}\left(\pm \overrightarrow{a} + \overrightarrow{a} \times \overrightarrow{b}\right)$

C. $\overrightarrow{r} = \frac{1}{4}\left(\pm \overrightarrow{a} + \overrightarrow{a} \times \overrightarrow{b}\right)$

D. $\overrightarrow{r} = \frac{2}{3}\left(\pm \overrightarrow{a} + \overrightarrow{a} \times \overrightarrow{b}\right)$

Answer: B

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10. Let $\vec{a} = \hat{i} + \hat{j} + \sqrt{2}\hat{k}$,

$\vec{b} = b_1\hat{i} + b_2\hat{j} + \sqrt{2}\hat{k}$ and

$\vec{c} = 6\hat{i} + \hat{j} + \sqrt{2}\hat{k}$ be three vectors such that the projection vector of $\vec{b}$ on $\vec{a}$ is $\left|\vec{a}\right|$

If $\vec{a} + \vec{b}$ is perpendicular to $\vec{c}$ then $\left|\vec{b}\right|$ is equal to

A. $\sqrt{22}$

B. $\sqrt{32}$

C. 6

D. 4

Answer: C

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11. Unit vectors $\widehat{a}$ and $\hat{b}$ are perpendicular to each other and the unit vector $\hat{c}$ is inclined at angle θ to both $\widehat{a}$ and $\hat{b}$. If $\hat{c} = m\left(\widehat{a} + \hat{b}\right) + n\left(\widehat{a} \times \hat{b}\right)$ and m,n are real, then

A. $\frac{\pi}{4} \leq \theta \leq \frac{3\pi}{4}$

B. $\frac{\pi}{4} \leq \theta \leq \frac{3\pi}{2}$

C. $\frac{\pi}{4} \leq \theta \leq \frac{\pi}{2}$

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

Answer: A

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12. If the three vectors $\lambda\hat{i} + \hat{j} + 2\hat{k}$, $\hat{i} + \lambda\hat{j} - \hat{k}$ and $2\hat{i} - \hat{j} + \lambda\hat{k}$ are coplanar, then λ may be equal to

A. -2

B. -3

C. 2

D. $1 - 2\sqrt{3}$

Answer: A

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13. If vector $\vec{a}$, $\vec{b}$ and $\vec{c}$ satisfy the condition $\left(\vec{b}-\vec{a}\right).\left(\vec{c}-\frac{\vec{a}+\vec{b}}{2}\right)$ is

A. 2

B. 1

C. -1

D. 0

Answer: D

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14. The vector c directed along the internal bisector of the angle between the vectors $\overrightarrow{a} = 7\hat{i} - 4\hat{j} - 4\hat{k}$ and $\overrightarrow{b} = -2\hat{i} - \hat{j} + 2\hat{k}$ with $\left|\overrightarrow{c}\right| = 5\sqrt{6}$ is

A. $\frac{5}{3}\left(\hat{i} - 7\hat{j} + 2\hat{k}\right)$

B. $\frac{5}{3}\left(5\hat{i} + 5\hat{j} + 2\hat{k}\right)$

C. $\frac{5}{3}\left(\hat{i} + 7\hat{i} + 2\hat{k}\right)$

D. $\frac{5}{3}\left(-5\hat{i} + 5\hat{j} + 2\hat{k}\right)$

Answer: A

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15. Let $\vec{x}, \vec{y}, \vec{z}$ be vectors such that $|\vec{x}| = |\vec{y}| = |\vec{z}| = \sqrt{2}$ and $\vec{x}, \vec{y}, \vec{z}$ make angles of 60° with each other and $\left(\vec{x} \times \vec{y}\right) = \vec{c}$ then $\vec{x} =$

A. $\left\{\left(\vec{a} + \vec{b}\right) \times \vec{c} - \left(\vec{a} + \vec{b}\right)\right\}$

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

C. $\frac{1}{2}\left(\vec{a} + \vec{b}\right) \times \vec{c} - \left(\vec{a} + \vec{b}\right)\}$

D. None of these

Answer: C

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16. If A,B and C are the vertices of a triangle whose position vectors are $\vec{a}$, $\vec{b}$ and $\vec{c}$ respectively G is the centroid of the ΔABC,then $\overrightarrow{GA}+\overrightarrow{GB}+\overrightarrow{GC}$ is

A. $\vec{0}$

B. $\vec{a}+\vec{b}+\vec{c}$

C. $\dfrac{\vec{a}+\vec{b}+\vec{c}}{3}$

D. $\dfrac{\vec{a}-\vec{b}-\vec{c}}{3}$

Answer: A

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17. A unit vector in the xy-plane that makes an angle of 45° with the vector $\hat{i} + \hat{j}$ and an angle of 60° with the vector $3\hat{i} - 4\hat{j}$ is

A. $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$

B. $\frac{\hat{i} - \hat{j}}{\sqrt{2}}$

C. $\frac{2\hat{i} - \hat{j}}{\sqrt{2}}$

D. None of these

Answer: D

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18. If $\overrightarrow{x}+\overrightarrow{y}+\overrightarrow{z}=\overrightarrow{0}$,

$\left|\overrightarrow{x}\right|=\left|\overrightarrow{y}\right|=\left|\overrightarrow{z}\right|=2$ and θ is the angle between $\overrightarrow{y}$ and $\overrightarrow{z}$ then the value of $\cos ec^2\theta+\cot^2\theta$ is equal to

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

B. $\dfrac{5}{3}$

C. $\dfrac{1}{3}$

D. 1

Answer: B

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19. If $\overrightarrow{a} = -\hat{i} + \hat{j} + 2\hat{k}$, $\overrightarrow{b} = 2\hat{i} - \hat{j} - \hat{k}$ and $\overrightarrow{c} = -2\hat{i} + 2\hat{j} + 3\hat{k}$ then the angle between $2\overrightarrow{a} - \overrightarrow{c}$ and $\overrightarrow{a} + \overrightarrow{b}$ is

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

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

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

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

Answer: B

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20. The point of intersection of the lines

$\overrightarrow{r} = 7\hat{i} + 10\hat{j} + 13\hat{k} + s\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$

and $\overrightarrow{r} = 3\hat{i} + 5\hat{j} + 7\hat{k} + t\left(\hat{i} + 2\hat{j} + 3\hat{k}\right)$ is

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

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

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

D. $\hat{i} + \hat{j} + \hat{k}$

Answer: D

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21. If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors then $\left|\vec{a}-\vec{b}\right|^2+\left|\vec{b}-\vec{c}\right|^2+\left|\vec{c}-\vec{a}\right|^2$ does not exceed.

A. 6

B. 9

C. 5

D. 2

Answer: B

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22. If A,B and C are three points with position vectors $\vec{a}, \vec{b}, \vec{c}$ respectively then perpendicular distance of A from the line joining B and C is

A. $\dfrac{\left|\vec{a} \times \vec{b} \times \vec{c}\right|}{2\left(\vec{b} \times \vec{c}\right)}$

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

C. $\dfrac{\left|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}\right|}{\left|\vec{b} - \vec{c}\right|}$

D. Non

Answer: C

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23. If three points whose position vectors are $A = a\hat{i} + b\hat{j} + c\hat{k}, B = \hat{i} + \hat{j}$ and $C = -\hat{i} - \hat{j}$ are collinear then

A. $\overrightarrow{a} - 2\overrightarrow{b} = 1$

B. $\overrightarrow{a} - 2\overrightarrow{b} = 2$

C. $\overrightarrow{a} - 2\overrightarrow{b} = 3$

D. $\overrightarrow{a} - 2\overrightarrow{b} = 0$

Answer: A

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24. Consider $\widehat{a}$ and $\hat{b}$ be two unit vectors such that $\widehat{a} + \hat{b}$ is also a unit vector. Then the angle between $\widehat{a}$ and $\hat{b}$ is

A. Acute angle

B. Riht angle

C. Obtuse angle

D. Striaght angle

Answer: C

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25. If $\vec{a} = \vec{b} + \vec{c}, \vec{b} \times \vec{d} = \vec{0}, \vec{c}, \vec{d} = 0$ then the vector $\dfrac{\vec{d} \times \left(\vec{a} \times \vec{d}\right)}{\left|\vec{d}\right|^2}$ is always equal to

A. $\vec{a}$

B. $\vec{d}$

C. $\vec{b}$

D. $\vec{c}$

Answer: D

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26. $\vec{a}, \vec{b}, \vec{c}$ are three noncoplanar vectors such that

$$\left[\vec{a}+\vec{b}+\vec{c}\,\vec{a}-\vec{b}+\vec{c}\,2\vec{a}+\vec{b}-\vec{c}\right]$$

$= k\left[\vec{a} \quad \vec{b} \quad \vec{c}\right]$ then k is

A. 3

B. -3

C. 2

D. 6

Answer: D

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27. If the vectors $\vec{b} = \left(\tan\alpha, -1, 2\sqrt{\sin\alpha/2}\right)$ and $\vec{c} = \left(\tan\alpha, \tan\alpha - \frac{3}{\sqrt{\sin\alpha/2}}\right)$ are orthogonal and a vector $\vec{a} = (1, 3, \sin\alpha)$ makes an obtuse angle wit z-axis, then the value of α is

A. $\alpha = (4n+1)\pi - \tan^{-1} 2, n \in Z$

B. $\alpha = (4n+2)\pi - \tan^{-1} 2, n \in Z$

C. $\alpha = (4n-1)\pi + \tan^{-1} 2, n \in Z$

D. $\alpha = (4n+2)\pi + \tan^{-1} 2, n \in Z$

Answer: A

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28. If $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 4\left|\vec{c}\right| = 5$ and $\vec{a} \perp \left(\vec{b} + \vec{c}\right)$ $\vec{b} \perp \left(\vec{c} + \vec{a}\right), \vec{c} \perp \left(\vec{a} + \vec{b}\right),$ then $\left|\vec{a} + \vec{b} + \vec{c}\right|$ is equal to

A. 50

B. 25

C. $5\sqrt{2}$

D. 12

Answer: C

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29. If $\vec{a}, \vec{b}, \vec{c}$ are non coplanar non zero vectors such that

$\vec{b} \times \vec{c} = \vec{a}, \vec{a} \times \vec{b} = \vec{c}$ and $\vec{c} \times \vec{a} = \vec{b}$,

then which of the following is not true

A. $\left|\vec{a}\right| = 1$

B. $\left[\vec{a} \quad \vec{b} \quad \vec{c}\right] = 1$

C. $\left|\vec{a}\right| + \left|\vec{b}\right| + \left|\vec{c}\right| = 3$

D. $\left|\vec{a}\right| \neq \left|\vec{b}\right| \neq \left|\vec{c}\right|$

Answer: D

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30. If x, y and z are non zero real numbers and $\vec{a} = x\hat{i} + 2\hat{j}$, $\vec{b} = y\hat{j} + \hat{k}$ and $\vec{c} = x\hat{i} + y\hat{j} + z\hat{k}$ are such that $\vec{a} \times \vec{b} = z\hat{i} - 3\hat{j} + \hat{k}$ then $\left[\vec{a} \ \vec{b} \ \vec{c}\right]$ equals to

A. 3

B. 10

C. 9

D. 6

Answer: C

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