MATHS

BOOKS - CENGAGE

DOT PRODUCT

Dpp 2 1

1. Let $a, b > 0$ and $\vec{\alpha} = \left(\frac{\vec{i}}{a} + \frac{4\hat{j}}{b} + b\hat{k}\right)$ and $\vec{\beta} = b\hat{i} + a\hat{j} + \frac{1}{b}\hat{k}$, then the maximum value of $\frac{30}{5 + \vec{\alpha} . \vec{\beta}}$ is

A. 1

B. 2

C. 3

D. 8

Answer: A

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2. If a vector $\vec{r}$ is equall inclined with the vectors $\vec{a} = \cos\theta\hat{i} + \sin\theta\hat{j}, \vec{b} = -\sin\theta\hat{i} + \cos\theta\hat{j}$ and $\vec{c} = \hat{k}$, then the angle between $\vec{r}$ and $\vec{a}$ is

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

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

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

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

Answer: B

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3. Let G be the centroid of the ΔABC, whose sides are of lengths a,b,c. If P be a point in the plane of $\triangle ABC$, such that $PA = 1, PB = 3, PC = 4$ and $PG = 2$, then the value of $a^2 + b^2 + c^2$ is

A. 42

B. 40

C. 36

D. 28

Answer: A

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4. If $\overrightarrow{a} = 3\hat{i} - \hat{j} + 5\hat{k}$ and $\overrightarrow{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ are given vectors. A vector $\overrightarrow{c}$ which is perpendicular to z-axis satisfying $\overrightarrow{c}.\overrightarrow{a} = 9$ and $\overrightarrow{c}.\overrightarrow{b} = -4$. If inclination of $\overrightarrow{c}$ with x-axis and y-axis and y-axis is α and β respectively, then which of the following is not true?

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

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

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

D. $\beta < \frac{\pi}{2}$

Answer: C

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5. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}$ is perpendicular to the plane of $\vec{b}, \vec{c}$ and the angle between $\vec{b}, \vec{c}$ is $\frac{\pi}{3}$, then $\left|\vec{a} + \vec{b} + \vec{c}\right| =$

A. 1

B. 2

C. 3

D. 4

Answer: B

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6. A unit vector $\overrightarrow{a}$ in the plane of $\overrightarrow{b} = 2\hat{i} + \hat{j}$ and $\overrightarrow{c} = \hat{i} - \hat{j} + \hat{k}$ is such that angle between $\overrightarrow{a}$ and $\overrightarrow{d}$ where $\overrightarrow{d} = \overrightarrow{j} + 2\overrightarrow{k}$ is

A. $\dfrac{\overrightarrow{i} + \overrightarrow{j} + \overrightarrow{k}}{\sqrt{3}}$

B. $\dfrac{\overrightarrow{i} - \overrightarrow{j} + \overrightarrow{k}}{\sqrt{3}}$

C. $\frac{2\overrightarrow{i} + \overrightarrow{j}}{\sqrt{5}}$

D. $\frac{2\overrightarrow{i} - \overrightarrow{j}}{\sqrt{5}}$

Answer: B

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7. In a tetrahedron OABC, the edges are of lengths, $|OA| = |BC| = a, |OB| = |AC| = b, |OC| = |AB| = c.$ Let G_1 and G_2 be the centroids of the triangle ABC and AOC such that $OG_1 \perp BG_2,$ then the value of $\frac{a^2 + c^2}{b^2}$ is

A. 2

B. 3

C. 6

D. 9

Answer: B

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8. The vectors $\vec{x}$ and $\vec{y}$ satisfy the equation $p\vec{x}+q\vec{y}=\vec{a}$ (where p,q are scalar constants and $\vec{a}$ is a known vector). It is given that $\vec{x}.\vec{y}\geq\frac{\left|\vec{a}\right|^2}{4pq}$, then $\frac{\left|\vec{x}\right|}{\left|\vec{y}\right|}$ is equal to $(pq>0)$

A. 1

B. $\frac{p^2}{q^2}$

C. $\frac{p}{q}$

D. $\frac{q}{p}$

Answer: D

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9. If $\vec{a}, \vec{b}, \vec{c}$ non-zero vectors such that $\vec{a}$ is perpendicular to $\vec{b}$ and $\vec{c}$ and $\left|\vec{a}\right| = 1, \left|\vec{b}\right| = 2, \left|\vec{c}\right| = 1, \vec{b} . \vec{c} = 1$. There is a non-zero vector coplanar with $\vec{a} + \vec{b}$ and $2\vec{b} - \vec{c}$ and $\vec{d} . \vec{a} = 1$, then the minimum value of $\left|\vec{d}\right|$ is

A. $\dfrac{2}{\sqrt{13}}$

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

C. $\dfrac{4}{\sqrt{5}}$

D. $\dfrac{4}{\sqrt{13}}$

Answer: D

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10. Let two non-collinear vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ inclined at an angle $\dfrac{2\pi}{3}$ be such that $\left|\overrightarrow{a}\right| = 3$ and $|\overrightarrow{b}| = 2$. If a point P moves so that at any time t its position vector $\overrightarrow{OP}$ (where O is the origin) is given as

$\overrightarrow{OP} = \left(t + \frac{1}{t}\right)\overrightarrow{a} + \left(t - \frac{1}{t}\right)\overrightarrow{b}$ then least distance of P from the origin is

A. $\sqrt{2\sqrt{133} - 10}$

B. $\sqrt{2\sqrt{133} + 10}$

C. $\sqrt{5 + \sqrt{133}}$

D. none of these

Answer: B

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11. Four vectors $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ and $\overrightarrow{x}$ satisfy the relation $\left(\overrightarrow{a}.\overrightarrow{x}\right)\overrightarrow{b} = \overrightarrow{c} + \overrightarrow{x}$ where $\overrightarrow{b}.\overrightarrow{a} \neq 1$. The value of

$\vec{x}$ in terms of $\vec{a}$, $\vec{b}$ and $\vec{c}$ is equal to

A. $\dfrac{\left(\vec{a}\,.\,\vec{c}\right)\vec{b} - \vec{c}\left(\vec{a}\,.\,\vec{b} - 1\right)}{\left(\vec{a}\,.\,\vec{b} - 1\right)}$

B. $\dfrac{\vec{c}}{\vec{a}\,.\,\vec{b} - 1}$

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

D. $\dfrac{2\left(\vec{a}\,.\,\vec{c}\right)\vec{c} + \vec{c}}{\left(\vec{a}\,.\,\vec{b}\right) - 1}$

Answer: A

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12. If area of a triangular face BCD of a regular tetrahdedron ABCD is $4\sqrt{3}$ sq. units, then the area of a triangle whose two sides are represented by vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ is

A. 6 sq. units

B. 8 sq.units

C. 12 sq. units

D. 16 sq.units

Answer: B

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13. If OABC is a tetrahedron such that $OA^2 + BC^2 = OB^2 + CA^2 = OC^2 + AB^2$ then

A. $OA \perp BC$

B. $OB \perp AC$

C. $OC \perp AB$

D. $AB \perp AC$

Answer: C

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14. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three units vectors equally inclined to each other at an angle α. Then the angle between $\vec{a}$ and plane of $\vec{b}$ and $\vec{c}$ is

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

B. $\theta = \sin^{-1}\left(\frac{\cos\alpha}{\cos\left(\frac{\alpha}{2}\right)}\right)$

C. $\theta = \cos^{-1}\left(\frac{\sin\left(\frac{\alpha}{2}\right)}{\sin\alpha}\right)$

D. $\theta = \sin^{-1}\left(\frac{\sin\left(\frac{\alpha}{2}\right)}{\sin\alpha}\right)$

Answer: A

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15. If a,b,c and A,B,C $\in$ R-{0} such that $aA + bB + cC - \sqrt{(a^2 + b^2 + c^2)(A^2 + B^2 + C^2)} = 0$, then value of $\frac{aB}{bA} + \frac{bC}{cB} + \frac{cA}{aC}$ is

A. 3

B. 4

C. 5

D. 6

Answer: A

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