MATHS

BOOKS - CENGAGE MATHS (HINGLISH)

VECTORS TRIPLE PRODUCTS, RECIPROCAL SYSTEM OF VECTORS

Dpp 2 4

1. $\vec{a} = 2\vec{i} + \vec{j} + \vec{k}, \vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k},$
$\vec{a} \times \vec{b} = 5\hat{i} + 2\hat{j} - 12\hat{k}, \vec{a} . \vec{b} = 11$, then $b_1 + b_2 + b_3 =$

A. 3

B. 5

C. 7

D. 9

Answer: B

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2. If $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are unit vectors such that $\vec{a}.\vec{b} = \frac{1}{2}, \vec{c}.\vec{d} = \frac{1}{2}$ and angle between $\vec{a} \times \vec{b}$ and $\vec{c} \times \vec{d}$ is $\frac{\pi}{6}$ then the value of $\left|\left[\vec{a}\,\vec{b}\,\vec{d}\right]\vec{c} - \left[\vec{a}\,\vec{b}\,\vec{c}\right]\vec{d}\right| =$

A. $3/2$

B. $3/4$

C. $3/8$

D. 2

Answer: C

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3. If $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{d}, \overrightarrow{d}$ be vectors such that

$$\left[\overrightarrow{a}\overrightarrow{b}\overrightarrow{c}\right] = 2$$

and

$$\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \left(\overrightarrow{c} \times \overrightarrow{d}\right) + \left(\overrightarrow{b} \times \overrightarrow{c}\right) \times \left(\overrightarrow{c} \times \overrightarrow{d}\right) + \left(\overrightarrow{c} \times \overrightarrow{a}\right) \times \left(\overrightarrow{b}\right.$$

Then the value of μ is

A. 0

B. 1

C. 3

D. 4

Answer: D

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4. Let $\left(\hat{p} \times \overrightarrow{q}\right) \times \left(\hat{p}.\,\overrightarrow{q}\right)\overrightarrow{q}$

$$= \left(x^2 + y^2\right)\overrightarrow{q} + (14 - 4x - 6y)\overrightarrow{p}$$

Where $\hat{p}$ and $\hat{q}$ are two non-collinear vectors $\overrightarrow{p}$ is unit vector and x,y are scalars. Then the value of $(x + y)$ is

A. 4

B. 5

C. 6

D. 7

Answer: B

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5. If $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are three on-coplanar vectors such that $\overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{c}, \overrightarrow{b} \times \overrightarrow{c} = \overrightarrow{a}, \overrightarrow{c} \times \overrightarrow{a} = \overrightarrow{b}$, then the value of $\left|\overrightarrow{a}\right| + \left|\overrightarrow{b}\right| + \left|\overrightarrow{c}\right|$ is

A. $1/3$

B. 1

C. 3

D. 6

Answer: C

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6. Let $\widehat{a}$ and $\hat{b}$ be two unit vectors such that $\widehat{a}.\ \hat{b} = \frac{1}{3}$ and $\overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{c}$,

Also $\overrightarrow{F} = \alpha\widehat{a} + \beta\hat{b} + \lambda\hat{c}$,

where, α, β, λ are scalars. If $\alpha = k_1\left(\widehat{F}.\ \widehat{a}\right) - k_2\left(\widehat{F}.\ \hat{b}\right)$ then the value of $2(k_1 + k_2)$ is

A. $2\sqrt{3}$

B. $\sqrt{3}$

C. 3

D. 1

Answer: C

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7. Let $\vec{a}$ and $\vec{c}$ be unit vectors inclined at $\pi/3$ with each other. If $\left(\vec{a} \times \left(\vec{b} \times \vec{c}\right)\right). \left(\vec{a} \times \vec{c}\right) = 5$, then $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ is equal to

A. -10

B. -5

C. -20

D. none of these

Answer: A

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8. if $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + 2\hat{k}$ and $\left|\vec{c}\right| = 1$

Such that $\left[\vec{a} \times \vec{b}\ \vec{b} \times \vec{c}\ \vec{c} \times \vec{a}\right]$ has maximum value, then the value of $\left|\left(\vec{a} \times \vec{b}\right) \times \vec{c}\right|^2$ is

A. 0

B. 1

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

D. none of these

Answer: A

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9. If the angles between the vectors $\vec{a}$ and $\vec{b}$, $\vec{b}$ and $\vec{c}$, $\vec{c}$ an $\vec{a}$ are respectively $\frac{\pi}{6}, \frac{\pi}{4}$ and $\frac{\pi}{3}$, then the angle the vector $\vec{a}$ makes with the plane containing $\vec{b}$ and $\vec{c}$, is

A. $\cos^{-1}\sqrt{1-\sqrt{2/3}}$

B. $\cos^{-1}\sqrt{2-\sqrt{3/2}}$

C. $\cos^{-1}\sqrt{\sqrt{3/2}-1}$

D. $\cos^{-1}\sqrt{\sqrt{2/3}}$

Answer: B

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10. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors having magnitudes 1,1 and 2 resectively. If $\vec{a} \times (\vec{a} \times \vec{c}) + \vec{b} = \vec{0}$ then the acute angel between $\vec{a}$ and $\vec{c}$ is

A. $\pi/4$

B. $\pi/6$

C. $\pi/3$

D. $\pi/2$

Answer: B

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11. If $\vec{a}, \vec{b}, \vec{c}$ are non coplanar vectors and $\vec{p}, \vec{q}, \vec{r}$ are reciprocal vectors, then

$\left(l\vec{a} + m\vec{b} + n\vec{c}\right).\left(l\vec{p} + m\vec{q} + n\vec{r}\right)$ is equal to

A. $l^2 + m^2 + n^2$

B. lm+mn+nl

C. 0

D. None of these

Answer: A

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12. Let $\vec{a} = \hat{i} - 3\hat{j} + 4\hat{k}$, $\vec{B} = 6\hat{i} + 4\hat{j} - 8\hat{k}$, $\vec{C} = 5\hat{i} + 2\hat{j} + 5\hat{k}$ and a vector $\vec{R}$ satisfies $\vec{R} \times \vec{B} = \vec{C} \times \vec{B}$, $\vec{R} . \vec{A} = 0$, then the value of $\frac{\left|\vec{B}\right|}{\left|\vec{R} - \vec{C}\right|}$ is

A. 1

B. 2

C. 3

D. 4

Answer: B

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13. The volume of the parallelepiped whose coterminous edges are represented by the vectors $2\vec{b}\times\vec{c}, 3\vec{c}\times\vec{a}$ and $4\vec{a}\times\vec{b}$ where $\vec{a}=(1+\sin\theta)\hat{i}+\cos\theta\hat{j}+\sin 2\theta\hat{k}$,
$\vec{b}=\sin\left(\theta+\frac{2\pi}{3}\right)\hat{i}+\cos\left(\theta+\frac{2\pi}{3}\right)\hat{j}+\sin\left(2\theta+\frac{4\pi}{3}\right)\hat{k}$,
$\vec{c}=\sin\left(\theta-\frac{2\pi}{3}\right)\hat{i}+\cos\left(\theta-\frac{2\pi}{3}\right)\hat{j}+\sin\left(2\theta-\frac{4\pi}{3}\right)\hat{k}$ is 18 cubic units, then the values of θ, in the interval $\left(0,\frac{\pi}{2}\right)$, is/are

A. $\frac{\pi}{9}$

B. $\frac{2\pi}{9}$

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

D. $\frac{4\pi}{9}$

Answer: A::B::D

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14. Let $\vec{a}$ and $\vec{b}$ be two non- zero perpendicular vectors. A vector $\vec{r}$ satisfying the equation $\vec{r} \times \vec{b} = \vec{a}$ can be

A. $\vec{b} - \dfrac{\vec{a} \times \vec{b}}{\left|\vec{b}\right|^2}$

B. $2\vec{b} - \dfrac{\vec{a} \times \vec{b}}{\left|\vec{b}\right|^2}$

C. $\left|\vec{a}\right|\left|\vec{b}\right| - \dfrac{\vec{a} \times \vec{b}}{\left|\vec{b}\right|^2}$

D. $\left|\vec{b}\right|\left|\vec{b}\right| - \dfrac{\vec{a} \times \vec{b}}{\left|\vec{b}\right|^2}$

Answer: A::B::C::D

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15. If $\vec{a}, \vec{b}, \vec{c}$ are three non-zero vectors, then which of the following statement(s) is/are true?

A. $\vec{a} \times (\vec{b} \times \vec{c}), \vec{b} \times (\vec{c} \times \vec{a}), (\vec{c} \times \vec{a}), \vec{c} \times (\vec{a} \times \vec{b})$

form a right handed system

B. $\vec{c}, (\vec{a} \times \vec{b}) \times \vec{c}, \vec{a} \times \vec{b}$ from a right handed system

C. $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a} < 0$ if $\vec{a} + \vec{b} + \vec{c} = \vec{0}$

D. $\dfrac{(\vec{a} \times \vec{b}).(\vec{b} \times \vec{c})}{(\vec{b} \times \vec{c}).(\vec{a} \times \vec{c})} = -1$ if $\vec{a} + \vec{b} + \vec{c} = 0$

Answer: B::C::D

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16. Vectors $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors and $\vec{c}$ is equally inclined to both $\vec{a}$ and $\vec{b}$. Let

$$\vec{a} \times (\vec{b} \times \vec{c}) + \vec{b} \times (\vec{c} \times \vec{a})$$
$$= (4 + x^2)\vec{b} - (4x\cos^2\theta)\vec{a},$$

then $\vec{a}$ and $\vec{b}$ are non-collinear vectors, $x > 0$

A. $x = 2$

B. $\theta = 0^\circ$

C. $\theta = x$

D. $x = 4$

Answer: A::B::C

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17. If $\vec{a}$ and $\vec{b}$ are unequal unit vectors such that $\left(\vec{a} - \vec{b}\right) \times \left[\left(\vec{b} + \vec{a}\right) \times \left(2\vec{a} + \vec{b}\right)\right] = \vec{a} + \vec{b}$, then angle θ between $\vec{a}$ and $\vec{b}$ can be

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

B. 0

C. π

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

Answer: A::C

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18. $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ and non zero vector $\vec{c}$ are such that $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \vec{a} \times \left(\vec{b} \times \vec{c}\right)$.

Then vector $\vec{c}$ may be given as

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

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

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

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

Answer: A

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19. Volume of parallelogram whose adjacent sides are given by $\vec{a}, \vec{b}, \vec{b} \times \vec{c}$ is,

A. 18

B. 54

C. 12

D. 36

Answer: D

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20. A vector along the bisector of angle between the vectors $\overrightarrow{b}$ and $\overrightarrow{c}$ is,

A. $(2+\sqrt{3})\hat{i}+(1-\sqrt{3})\hat{j}+(2+\sqrt{3})\hat{k}$

B. $(2+\sqrt{3})\hat{i}+(1-\sqrt{3})\hat{j}-(2+\sqrt{3})\hat{k}$

C. $(2+\sqrt{3})\hat{i}-(1-\sqrt{3})\hat{j}-(2+\sqrt{3})\hat{k}$

D. $(2+\sqrt{3})\hat{i}-(1-\sqrt{3})\hat{j}+(2+\sqrt{3})\hat{k}$

Answer: A

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