MATHS

BOOKS - CENGAGE MATHS (ENGLISH)

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 $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ be vectors such that $\left[\vec{a}\ \vec{b}\ \vec{c}\right] = 2$ and $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) + \left(\vec{b} \times \vec{c}\right) \times \left(\vec{c} \times \vec{d}\right) + \left(\vec{c} \times \vec{a}\right) \times \left(\vec{b}\right.$

Then the value of μ is

A. 0

B. 1

C. 3

D. 4

Answer: D

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4. Let $\left(\vec{p} \times \vec{q}\right) \times \vec{p} + \left(\vec{p} \cdot \vec{q}\right)\vec{q} = \left(x^2 + y^2\right)\vec{q} + (14 - 4x - 6y)\vec{p}$

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

A. (a) 4

B. (b) 5

C. (c) 6

D. (d) 7

Answer: B

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5. If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors such that $\vec{a} \times \vec{b} = \vec{c}, \vec{b} \times \vec{c} = \vec{a}, \vec{c} \times \vec{a} = \vec{b}$, then the value of $\left|\vec{a}\right| + \left|\vec{b}\right| + \left|\vec{c}\right|$ 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 $\widehat{a} \times \hat{b} = \hat{c}$, Also $\overrightarrow{F} = \alpha\widehat{a} + \beta\hat{b} + \lambda\hat{c}$,

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

A. (a) $2\sqrt{3}$

B. (b) $\sqrt{3}$

C. (c) 3

D. (d) 1

Answer: C

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7. Let a and c be unit vectors inclined at $\frac{\pi}{3}$ with each other. If $(a \times (b \times c)) \cdot (a \times c) = 5$, then -[a b c]-1 =

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

A. 0

B. 1

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

D. none of these

Answer: A

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9. $\vec{a}$, $\vec{b}$, $\vec{c}$ are unit vectors such that if the angles between the vectors $\vec{a}$ and $\vec{b}$, $\vec{b}$ and $\vec{c}$, $\vec{c}$ and $\vec{a}$ are respectively $\frac{\pi}{6}$, $\frac{\pi}{4}$ and $\frac{\pi}{3}$, then find out the angle the vector $\vec{a}$ makes with the plane containing $\vec{b}$ and $\vec{c}$ is

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

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

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

D. (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, respectively, if $\vec{a} \times \left(\vec{a} \times \vec{c}\right) + \vec{b} = \vec{0}$, then the acute angle 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. $\vec{b} - \frac{\vec{a} \times \vec{b}}{\left|\vec{b}\right|^2}$

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

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

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

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

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15. If a, b, c are three non-zero vectors, then which of the following statement(s) is/are ture?

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

form a right handed system

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

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

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

A. (a) $x = 2$

B. (b) $\theta = 0^\circ$

C. (c) $\theta = x$

D. (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 $\vec{b}$ is

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. (a) $4\hat{i} + 2\hat{j} + 4\hat{k}$

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

C. (c) $\hat{i} + \hat{j} + \hat{k}$

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

Answer: A

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19. Volume of the parallelopiped whose adjacent edges are vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ 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 $\vec{b}$ and $\vec{c}$ 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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