



MATHS

BOOKS - CENGAGE MATHS (ENGLISH)

VECTORS TRIPLE PRODUCTS, RECIPROCAL SYSTEM OF VECTORS

Dpp 2 4

$$1. \vec{a} = 2\vec{i} + \vec{j} + \vec{k}, \vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k},$$

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

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 $\vec{a} \cdot \vec{b} = \frac{1}{2}, \vec{c} \cdot \vec{d} = \frac{1}{2}$ and angle between $\vec{a} \times \vec{b}$ and $\vec{c} \times \vec{d}$ is $\frac{\pi}{6}$ then the value of

$$\left| \left[\begin{matrix} \vec{a} & \vec{b} & \vec{d} \end{matrix} \right] \vec{c} - \left[\begin{matrix} \vec{a} & \vec{b} & \vec{c} \end{matrix} \right] \vec{d} \right| =$$

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 $[\vec{a} \vec{b} \vec{c}] = 2$ and $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) + (\vec{b} \times \vec{c}) \times (\vec{c} \times \vec{d}) + (\vec{c} \times \vec{a}) \times (\vec{c} \times \vec{d})$

Then the value of μ is

A. 0

B. 1

C. 3

D. 4

Answer: D

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

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 $|\vec{a}| + |\vec{b}| + |\vec{c}|$ is

A. 1/3

B. 1

C. 3

D. 6

Answer: C



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

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

where, α, β, λ are scalars. If $\alpha = k_1 \left(\vec{F} \cdot \hat{a} \right) - k_2 \left(\vec{F} \cdot \hat{b} \right)$ 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 \vec{a} and \vec{c} be unit vectors inclined at $\frac{\pi}{3}$ with each other. If

$$(\vec{a} \times (\vec{b} \times \vec{c})) \cdot (\vec{a} \times \vec{c}) = 5, \text{ then } -[\vec{a} \ \vec{b} \ \vec{c}] =$$

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 $|\vec{c}| = 1$

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} and \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 $\vec{a} \times (\vec{a} \times \vec{c}) + \vec{b} = \vec{0}$, 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

$(l\vec{a} + m\vec{b} + n\vec{c}) \cdot (l\vec{p} + m\vec{q} + n\vec{r})$ 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 $\vec{R} \times \vec{B} = \vec{C} \times \vec{B}$, $\vec{R} \cdot \vec{A} = 0$, then the value of

$$\frac{|\vec{B}|}{|\vec{R} - \vec{C}|}$$
 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

$$\vec{a} = (1 + \sin \theta)\hat{i} + \cos \theta \hat{j} + \sin 2\theta \hat{k},$$

$$\vec{b} = \sin\left(\theta + \frac{2\pi}{3}\right)\hat{i} + \cos\left(\theta + \frac{2\pi}{3}\right)\hat{j} + \sin\left(2\theta + \frac{4\pi}{3}\right)\hat{k},$$

$$\vec{c} = \sin\left(\theta - \frac{2\pi}{3}\right)\hat{i} + \cos\left(\theta - \frac{2\pi}{3}\right)\hat{j} + \sin\left(2\theta - \frac{4\pi}{3}\right)\hat{k} \text{ is 18 cubic}$$

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

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

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

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

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 true?

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

form a right handed system

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

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

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

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

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

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 $(\vec{a} - \vec{b}) \times \left[(\vec{b} + \vec{a}) \times (2\vec{a} + \vec{b}) \right] = \vec{a} + \vec{b}$ 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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