ASSIGNMENT-I

Sub-CALCULUS B

Choose the correct choice with proper Explanation

Q.1 The area of a triangle formed by the tips of vectors $\bar{a}, \bar{b}$ and $\bar{c}$ is

(a) $\frac{1}{2}(\bar{a}-\bar{b})\cdot(\bar{a}-\bar{c})$ (b) $\frac{1}{2}|(\bar{a}-\bar{b}) \times (\bar{a}-\bar{c})|$

(c) $\frac{1}{2}|\bar{a} \times \bar{b} \times \bar{c}|$ (d) $\frac{1}{2}(\bar{a} \times \bar{b})\cdot \bar{c}$

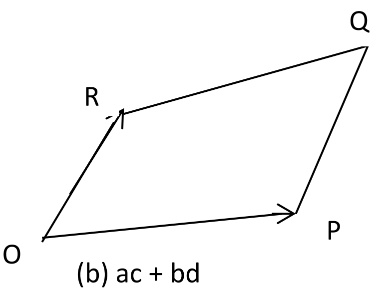
Q.2 If $\vec{a}$ and $\vec{b}$ are two arbitrary vectors with magnitudes a and b, respectively, $\left|\vec{a}\times\vec{b}\right|^2$

Will be equal to

(a) $a^2b^2 - (\vec{a}.\vec{b})^2$ (b) ab $-\vec{a}.\vec{b}$

(c) $a^2b^2 + \left(\vec{a}.\vec{b}\right)^2$ (d) ab + $\vec{a}.\vec{b}$

Q.3 For the parallelogram OPQR shown in the sketch, $\overline{OP}$ = a$\hat{\imath}$+ b$\hat{\jmath}$ and $\overline{OR}$ = c$\hat{\imath}$+ d$\hat{\jmath}$. The area of the -------



(a) ad – bc (b) ac + bd

(c) ad +bc (d) ab – bd

Q.4 The area of a triangle formed by the tips of vectors $\bar{a}, \bar{b}$ and $\bar{c}$ is

(a) $\frac{1}{2}(\bar{a}-\bar{b})\cdot(\bar{a}-\bar{c})$ (b) $\frac{1}{2}|(\bar{a}-\bar{b}) \times (\bar{a}-\bar{c})|$

(c) $\frac{1}{2}|\bar{a} \times \bar{b} \times \bar{c}|$ (d) $\frac{1}{2}(\bar{a} \times \bar{b})\cdot \bar{c}$

Q.5 The angle (in degree) between two planes vectors $\vec{a} = \frac{\sqrt{3}}{2}\hat{\imath} + \frac{1}{2}\hat{\jmath}$ and $\vec{b} = \frac{-\sqrt{3}}{2}\hat{\imath} + \frac{1}{2}\hat{\jmath}$ is

(a) 30 (b) 60

(c) 90 (d) 120

Q.6 The inner (dot) product of two nonzero vectors $\vec{P}$ and $\vec{Q}$ is zero. The angle (degrees) between The two vectors is

(a) 0 (b) 30 (c) 90 (d) 120

Q.7 Velocity vector of a flow field is given as $\vec{V}$ = 2xy$\hat{\imath}$ - $x^2z\hat{\jmath}$. The velocity vector at (1, 1, 1) is

(a) 4$\hat{\imath}$- $\hat{\jmath}$ (b) 4$\hat{\imath}$ - $\hat{k}$ (c) $\hat{\imath}$-4$\hat{\jmath}$ (d) $\hat{\imath}$ - 4$\hat{k}$

Q.8 If A (0, 4, 3), B (0,0,0) and C (3, 0, 4) are three points defined in x , y, z co-ordinate system, then Which of the following vector is perpendicular to both vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$.

(a) 16$\hat{\imath}$+ 9$\hat{\jmath}$ - 12$\hat{k}$ (b) 16$\hat{\imath}$- 9$\hat{\jmath}$ + 12$\hat{k}$ (c) 16$\hat{\imath}$- 9$\hat{\jmath}$ - 12$\hat{k}$ (d) 16$\hat{\imath}$+ 9$\hat{\jmath}$+12$\hat{k}$

Q.9 The vector that is NOT perpendicular to the vector (I + j + k) and (I + 2j + 3k) is _______.

(a) (i – 2j + k) (b) (-I + 2j – K) (c) (oi+ 0j + 0k) (d) (4i + 3j + 5k)

Q.10 $\vec{a}, \vec{b}, \vec{c}$ are three orthogonal vectors, Given that $\vec{a} = \hat{\imath} + 2\hat{\jmath} + 5\hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} - \hat{k}$, the vector $\vec{c}$ is parallel to

(a) $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ (b) $2\hat{\imath} + \hat{J}$ (c) $2\hat{\imath} - \hat{\jmath}$ (d) $4\hat{k}$

Answer the following questions

Q.11 Determine whether the points A (1,3, 2), B (3, -1, 6), C (5, 2, 0) and D (3, 6, -4) lie in the same plane.

Q.12 Find a vector equation and parametric equation for the line segment that joins P to Q.

$$P(0,-1,1),\ Q\left(\frac{1}{2},\frac{1}{3},\frac{1}{4}\right).$$

Q13. Determine whether the lines L_1 and L_2 are parallel, skew, or intersecting. If they intersect, find the point of intersection.

L_1: x=3+2t, y= 4-t, z=1+3t

L_2: x=1+4s, y=3-2s, z=4+5s

Q14 Find the velocity, acceleration, and speed of a particle with the given position function.

$$r(t) = t^2 i + 2tj + In\ t\ k.$$

Q15 Find the position vector of the particle that has given acceleration and the specified initial velocity and position. $a(t) = t\,i + e^t j + e^{-t} k$ $v(0)=k$, $r(0)=j+k$

Q16 Find the curvature of $r(t) = \langle t, t^2, t^3 \rangle$ at the point (1, 1, 1).

Q.17 Find the length of the curve $r(t) = 12ti + 8t^{3/2} j + 3t^2 k, 0 \le t \le 1$

Q18 Find equations of the normal plane and osculating plane of the curve at the given point.

$$x = 2\sin 3t, y = t, z = 2\cos 3t; (0, \pi, -2).$$

Q19 A projectile is fired with an initial speed of 200 m/s and angle of elevation 60^0. Find (a) the range of the projectile, (b) the maximum height reached, and (c) the speed at impact.

Q20 Find the tangential and normal components of the acceleration vector.

$$r(t) = e^t i + \sqrt{2}tj + e^{-1}k.$$

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