***Problem* 1.** A car travels 6 *km* towards north at an angle of 45° to the east and then travels distance of 4 *km* towards north at an angle of 135° to the east. How far is the point from the starting point. What angle does the straight line joining its initial and final position makes with the east

(a) $\sqrt{50}\ km$ and $\tan^{-1}(5)$ (b) $10\ km$ and $\tan^{-1}(\sqrt{5})$

(c) $\sqrt{52}\ km$ and $\tan^{-1}(5)$ (d) $\sqrt{52}\ km$ and $\tan^{-1}(\sqrt{5})$

***Problem* 2.** There are two force vectors, one of 5 *N* and other of 12 *N* at what angle the two vectors be added to get resultant vector of 17 *N*, 7 *N* and 13 *N* respectively

(a) 0°, 180° and 90° (b) 0°, 90° and 180° (c) 0°, 90° and 90° (d) 180°, 0° and 90°

***Problem* 3.** Given that $\vec{A}+\vec{B}+\vec{C}=0$ out of three vectors two are equal in magnitude and the magnitude of third vector is $\sqrt{2}$ times that of either of the two having equal magnitude. Then the angles between vectors are given by

(a) 30°, 60°, 90° (b) 45°, 45°, 90° (c) 45°, 60°, 90° (d) 90°, 135°, 135°

***Problem* 4.** If $\vec{A}=4\hat{i}-3\hat{j}$ and $\vec{B}=6\hat{i}+8\hat{j}$ then magnitude and direction of $\vec{A}+\vec{B}$ will be

(a) $5, \tan^{-1}(3/4)$ (b) $5\sqrt{5}, \tan^{-1}(1/2)$ (c) $10, \tan^{-1}(5)$ (d) $25, \tan^{-1}(3/4)$

***Problem* 5.** A truck travelling due north at 20 *m/s* turns west and travels at the same speed. The change in its velocity be

(a) 40 *m/s N–W* (b) $20\sqrt{2}$ *m/s N–W* (c) 40 *m/s S–W* (d) $20\sqrt{2}$ *m/s S–W*

***Problem* 6.** If the sum of two unit vectors is a unit vector, then magnitude of difference is

(a) $\sqrt{2}$ (b) $\sqrt{3}$ (c) $1/\sqrt{2}$ (d) $\sqrt{5}$

***Problem* 7.** The sum of the magnitudes of two forces acting at point is 18 and the magnitude of their resultant is 12. If the resultant is at 90° with the force of smaller magnitude, what are the, magnitudes of forces

(a) 12, 5 (b) 14, 4 (c) 5, 13 (d) 10, 8

***Problem* 8.** Two forces $F_1 = 1\,N$ and $F_2 = 2\,N$ act along the lines $x = 0$ and $y = 0$ respectively. Then the resultant of forces would be

(a) $\hat{i} + 2\hat{j}$ (b) $\hat{i} + \hat{j}$ (c) $3\hat{i} + 2\hat{j}$ (d) $2\hat{i} + \hat{j}$

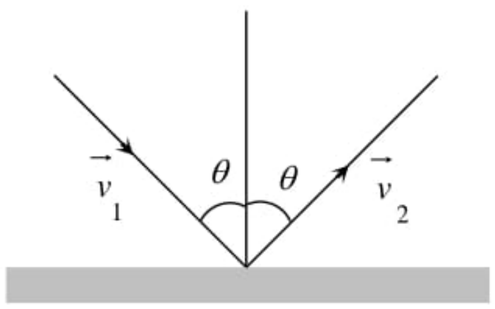
***Problem* 9.** Let $\vec{A} = 2\hat{i} + \hat{j}, B = 3\hat{j} - \hat{k}$ and $\vec{C} = 6\hat{i} - 2\hat{k}$ value of $\vec{A} - 2\vec{B} + 3\vec{C}$ would be

(a) $20\hat{i} + 5\hat{j} + 4\hat{k}$ (b) $20\hat{i} - 5\hat{j} - 4\hat{k}$ (c) $4\hat{i} + 5\hat{j} + 20\hat{k}$ (d) $5\hat{i} + 4\hat{j} + 10\hat{k}$

***Problem* 10.** A vector $\vec{a}$ is turned without a change in its length through a small angle $d\theta$. The value of $|\Delta\vec{a}|$ and Δa are respectively

(a) $0, a\,d\theta$ (b) $a\,d\theta, 0$ (c) 0, 0 (d) None of these

***Problem* 11.** An object of *m kg* with speed of *v m/s* strikes a wall at an angle θ and rebounds at the same speed and same angle. The magnitude of the change in momentum of the object will be



(a) $2m\,v\cos\theta$ (b) $2m\,v\sin\theta$ (c) 0 (d) $2m\,v$

***Problem* 12.** If a particle moves 5 m in $+x$- direction. The displacement of the particle will be

(a) $5\,j$ (b) $5\,i$ (c) $-5\,j$ (d) $5\,k$

***Problem* 13.** Position of a particle in a rectangular-co-ordinate system is (3, 2, 5). Then its position vector will be

(a) $3\hat{i}+5\hat{j}+2\hat{k}$ (b) $3\hat{i}+2\hat{j}+5\hat{k}$ (c) $5\hat{i}+3\hat{j}+2\hat{k}$ (d) None of these

***Problem* 14.** If a particle moves from point P (2,3,5) to point Q (3,4,5). Its displacement vector be

(a) $\hat{i}+\hat{j}+10\hat{k}$ (b) $\hat{i}+\hat{j}+5\hat{k}$ (c) $\hat{i}+\hat{j}$ (d) $2\hat{i}+4\hat{j}+6\hat{k}$

***Problem* 15.** A force of 5 N acts on a particle along a direction making an angle of 60° with vertical. Its vertical component be (a) 10 N (b) 3 N (c) 4 N (d) 2.5 N

***Problem* 16.** If $A=3\hat{i}+4\hat{j}$ and $B=7\hat{i}+24\hat{j}$, the vector having the same magnitude as B and parallel to A is

(a) $5\hat{i}+20\hat{j}$ (b) $15\hat{i}+10\hat{j}$ (c) $20\hat{i}+15\hat{j}$ (d) $15\hat{i}+20\hat{j}$

***Problem* 17.** Vector $\vec{A}$ makes equal angles with x, y and z axis. Value of its components (in terms of magnitude of $\vec{A}$) will be

(a) $\frac{A}{\sqrt{3}}$ (b) $\frac{A}{\sqrt{2}}$ (c) $\sqrt{3}\,A$ (d) $\frac{\sqrt{3}}{A}$

***Problem* 18.** If $\vec{A} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ the direction of cosines of the vector $\vec{A}$ are

(a) $\frac{2}{\sqrt{45}}, \frac{4}{\sqrt{45}}$ and $\frac{-5}{\sqrt{45}}$ (b) $\frac{1}{\sqrt{45}}, \frac{2}{\sqrt{45}}$ and $\frac{3}{\sqrt{45}}$ (c) $\frac{4}{\sqrt{45}}, 0$ and $\frac{4}{\sqrt{45}}$ (d) $\frac{3}{\sqrt{45}}, \frac{2}{\sqrt{45}}$ and $\frac{5}{\sqrt{45}}$

***Problem* 19.** The vector that must be added to the vector $\hat{i} - 3\hat{j} + 2\hat{k}$ and $3\hat{i} + 6\hat{j} - 7\hat{k}$ so that the resultant vector is a unit vector along the *y*-axis is

(a) $4\hat{i} + 2\hat{j} + 5\hat{k}$ (b) $-4\hat{i} - 2\hat{j} + 5\hat{k}$ (c) $3\hat{i} + 4\hat{j} + 5\hat{k}$ (d) Null vector

***Problem* 20.** $\vec{A} = 2\hat{i} + 4\hat{j} + 4\hat{k}$ and $\vec{B} = 4\hat{i} + 2\hat{j} - 4\hat{k}$ are two vectors. The angle between them will be

(a) $0°$ (b) $45°$ (c) $60°$ (d) $90°$

***Problem* 21.** If two vectors 2 i + 3 j - k and $-4\hat{i} - 6\hat{j} + \pi\hat{k}$ are parallel to each other then value of pie be

(a) 0 (b) 2 (c) 3 (d) 4

***Problem* 22.** In above example if vectors are perpendicular to each other then value of λ be

(a) 25 (b) 26 (c) – 26 (d) – 25

***Problem* 23.** If $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} + 4\hat{k}$ then projection of $\vec{A}$ on $\vec{B}$ will be

(a) $\frac{3}{\sqrt{13}}$ (b) $\frac{3}{\sqrt{26}}$ (c) $\sqrt{\frac{3}{26}}$ (d) $\sqrt{\frac{3}{13}}$

***Problem* 24.** A body, acted upon by a force of 50 *N* is displaced through a distance 10 *meter* in a direction making an angle of $60°$ with the force. The work done by the force be

(a) 200 *J* (b) 100 *J* (c) 300 (d) 250 *J*

***Problem* 25.** A particle moves from position $3\hat{i}+2\hat{j}-6\hat{k}$ to $14\hat{i}+13\hat{j}+9\hat{k}$ due to a uniform force of $4\hat{i}+\hat{j}+3\hat{k}\,N$. If the displacement in meters then work done will be

(a) $100\,J$ (b) $200\,J$ (c) $300\,J$ (d) $250\,J$

***Problem* 26.** If for two vector $\vec{A}$ and $\vec{B}$, sum $(\vec{A}+\vec{B})$ is perpendicular to the difference $(\vec{A}-\vec{B})$. The ratio of their magnitude is

(a) 1 (b) 2 (c) 3 (d) None of these

***Problem* 27.** A force $\vec{F}=-K(y\hat{i}+x\hat{j})$ (where K is a positive constant) acts on a particle moving in the x-y plane. Starting from the origin, the particle is taken along the positive x- axis to the point $(a, 0)$ and then parallel to the y-axis to the point (a, a). The total work done by the forces $\vec{F}$ on the particle is

(a) $-2Ka^2$ (b) $2Ka^2$ (c) $-Ka^2$ (d) Ka^2

***Problem* 28.** If $\vec{A}=3\hat{i}+\hat{j}+2\hat{k}$ and $\vec{B}=2\hat{i}-2\hat{j}+4\hat{k}$ then value of $|\vec{A}\times\vec{B}|$ will be

(a) $8\sqrt{2}$ (b) $8\sqrt{3}$ (c) $8\sqrt{5}$ (d) $5\sqrt{8}$

***Problem* 29.** In above example a unit vector perpendicular to both $\vec{A}$ and $\vec{B}$ will be

(a) $+\frac{1}{\sqrt{3}}(\hat{i}-\hat{j}-\hat{k})$ (b) $-\frac{1}{\sqrt{3}}(\hat{i}-\hat{j}-\hat{k})$ (c) Both (a) and (b) (d) None of these

***Problem* 30.** The vectors from origin to the points A and B are $\vec{A}=3\hat{i}-6\hat{j}+2\hat{k}$ and $\vec{B}=2\hat{i}+\hat{j}-2\hat{k}$ respectively. The area of the triangle OAB be

(a) $\frac{5}{2}\sqrt{17}$ *sq.unit* (b) $\frac{2}{5}\sqrt{17}$ *sq.unit* (c) $\frac{3}{5}\sqrt{17}$ *sq.unit* (d) $\frac{5}{3}\sqrt{17}$

***Problem* 31.** The angle between the vectors $\vec{A}$ and $\vec{B}$ is θ. The value of the triple product $\vec{A}.(\vec{B}\times\vec{A})$ is

(a) A^2B (b) Zero (c) $A^2B\sin\theta$ (d) $A^2B\cos\theta$

***Problem* 32.** The torque of the force $\vec{F}=(2\hat{i}-3\hat{j}+4\hat{k})N$ acting at the point $\vec{r}=(3\hat{i}+2\hat{j}+3\hat{k})m$ about the origin be

(a) $6\hat{i}-6\hat{j}+12\hat{k}$ (b) $17\hat{i}-6\hat{j}-13\hat{k}$ (c) $-6\hat{i}+6\hat{j}-12\hat{k}$ (d) $-17\hat{i}+6\hat{j}+13\hat{k}$

***Problem* 33.** If $\vec{A}\times\vec{B}=\vec{C}$, then which of the following statements is wrong

(a) $\vec{C}\perp\vec{A}$ (b) $\vec{C}\perp\vec{B}$ (c) $\vec{C}\perp(\vec{A}+\vec{B})$ (d) $\vec{C}\perp(\vec{A}\times\vec{B})$

***Problem* 34.** Two trains along the same straight rails moving with constant speed 60 *km/hr* and 30 km/hr respectively toward each other. If at time t =0 , the distance between them is 90 *km,* the time when they collide is

(a) 1 *hr* (b) 2 *hr* (c) 3 *hr* (d) 4 *hr*

***Problem* 35.** Two cars are moving in the same direction with the same speed 30 *km/hr.* They are separated by a distance of 5 *km,* the speed of a car moving in the opposite direction if it meets these two cars at an interval of 4 minutes, will be

(a) 40 *km/hr* (b) 45 *km/hr* (c) 30 *km/hr* (d) 15 *km/hr*

***Problem* 36.** A steam boat goes across a lake and comes back (a) On a quite day when the water is still and (b) On a rough day when there is uniform current so as to help the journey onward and to impede the journey back. If the speed of the launch on both days was same, in which case it will complete the journey in lesser time

(a) Case (a) (b) Case (b)

(c) Same in both (d) Nothing can be predicted

***Problem* 37.** A man standing on a road hold his umbrella at 30° with the vertical to keep the rain away. He throws the umbrella and starts running at 10 *km/hr*. He finds that raindrops are hitting his head vertically, the speed of raindrops with respect to the road will be

(a) 10 *km/hr* (b) 20 *km/hr* (c) 30 *km/hr* (d) 40 *km/hr*

***Problem* 38.** In the above problem, the speed of raindrops *w.r.t.* the moving man, will be

(a) $10/\sqrt{2}\ km/h$ (b) 5 *km/h* (c) $10\sqrt{3}\ km/h$ (d) $5/\sqrt{3}\ km/h$

***Problem* 39.** To a person, going eastward in a car with a velocity of 25 *km/hr*, a train appears to move towards north with a velocity of $25\sqrt{3}$ *km/hr*. The actual velocity of the train will be

(a) 25 *km/hr* (b) 50 *km/hr* (c) 5 *km/hr* (d) $5\sqrt{3}$ *km/hr*

***Problem* 40.** A boat is moving with a velocity $3i + 4j$ with respect to ground. The water in the river is moving with a velocity $-3i - 4j$ with respect to ground. The relative velocity of the boat with respect to water is

(a) $8j$ (b) $-6i - 8j$ (c) $6i + 8j$ (d) $5\sqrt{2}$