Chapter 01

Basic Mathematics

NEET-RANKER'S STUFF

Q.1 The resultant of $\vec{A}$ & $\vec{B}$ is $\vec{R}_1$. On reversing the vector $\vec{B}$, the resultant becomes $\vec{R}_2$. What is the value of $R_1^2 + R_2^2$?

(1) $A^2 + B^2$ (2) $A^2 - B^2$

(3) $2(A^2 + B^2)$ (4) $2(A^2 - B^2)$

Q.2 **Statement-1:** If the rectangular components of a force are 8 N and 6N, then the magnitude of the force is 10N.

Statement-2: If $|\vec{A}|=|\vec{B}|=1$ then $|\vec{A}\times\vec{B}|^2 + |\vec{A}.\vec{B}|^2 = 1$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

Q.3 Given that P = Q = R. If $\vec{P}+\vec{Q}=\vec{R}$ then the angle between $\vec{P}\&\vec{R}$ is θ_1. If $\vec{P}+\vec{Q}+\vec{R}$ = 0 then the angle between $\vec{P}\&\vec{R}$ is θ_2. What is the relation between θ_1 and θ_2:

(1) $\theta_1 = \theta_2$ (2) $\theta_1 = \frac{\theta_2}{2}$

(3) $\theta_1 = 2\theta_2$ (4) None of the above

Q.4 Given that $\vec{A}+\vec{B}+\vec{C}=0$. Out of these three vectors two are equal in magnitude and the magnitude of the third vector is $\sqrt{2}$ times as that of either of the two having equal magnitude. Then the angles between vectors are given by :

(1) 30°, 60°, 90° (2) 45°, 45°, 90°

(3) 45°, 60°, 90° (4) 90°, 135°, 135°

Q.5 cos 2θ + 2 cos θ is always-

(1) greater than $-\frac{3}{2}$

(2) less than or equal to $\frac{3}{2}$

(3) greater than or equal to $-\frac{3}{2}$

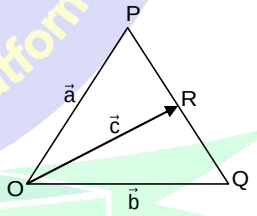
(4) None of these

Q.6 A vector of length ℓ is turned through the angle θ about its tail. What is the change in the position vector of its head ?

(1) ℓ cos (θ/2) (2) 2ℓ sin (θ/2)

(3) 2ℓ cos (θ/2) (4) ℓ sin(θ/2)

Q.7 Figure shown the vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ where R is the mid point of PQ. Then which of the following is correct ?



(1) $\vec{a}+\vec{b}=2\vec{c}$ (2) $\vec{a}+\vec{b}=\vec{c}$

(3) $\vec{a}-\vec{b}=2\vec{c}$ (4) $\vec{a}-\vec{b}=\vec{c}$

Q.8 Acceleration of a particle in a magnetic field is given by $\vec{a} = \frac{q}{m}(\vec{V}\times\vec{B})$ if a charged particle is projected in a magnetic field $(2\hat{i}+2\hat{j}+2\hat{k})$ tesla, then acceleration of the particle at an instant is $(x\hat{i}+2\hat{j}-6\hat{k})$ m/s². value of x is

(1) 4 (2) 2 (3) 3 (4) 1

Q.9 The sign of the product sin 2 sin 3 sin 5 is -

(1) Negative (2) Positive

(3) 0 (4) None of these

Q.10 If $\vec{a}=2\hat{i}+\sqrt{5}\hat{j}$ and $\vec{b}=5\hat{i}+\sqrt{5}\hat{j}+4\hat{k}$, then find a vector of same magnitude of vector $\vec{a}$ and parallel to $\vec{a}-\vec{b}$

(1) $\frac{7\hat{i}+2\sqrt{5}\hat{j}+4\hat{k}}{3}$ (2) $-3\hat{i}-4\hat{k}$

(3) $\frac{-9\hat{i}-12\hat{k}}{5}$ (4) $-9\hat{i}+12\hat{k}$

Q.11 The distance of a point (2, 1) from the line 2x + y + 3 = 0 is -

(1) $\frac{8}{5}$ (2) $\frac{8}{\sqrt{3}}$

(3) $\frac{8}{\sqrt{5}}$ (4) None of these

Q.12 Which of the following is correct-

(1) sin 1° > sin 1 (2) sin1° < sin 1

(3) sin 1° = sin 1 (4) sin 1° = $\frac{\pi}{180}$ sin 1

Q.13 **Statement-1:** The minimum number of non-zero vectors of unequal magnitude required to produce zero resultant is three.

Statement-2: Three vectors of unequal magnitude which can be represented by the three sides of a triangle taken in order, produce zero resultant.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

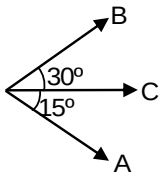
Q.14 $|\vec{A}\times\vec{B}|^2+(\vec{A}.\vec{B})^2$ =

(1) Zero (2) A^2B^2 (3) AB (4) $\sqrt{AB}$

Q.15 The displacement vector of a particle is given as $\vec{S}=(t^2-2t+12)\hat{i}+t^2\hat{j}$. The time after which velocity vector and acceleration vector becomes perpendicular to each other is equal to

(1) 1 (2) 1/2 (3) 1/3 (4) 1/4

Q.16 If $\vec{A}$ and $\vec{B}$ are the components of $\vec{C}$, then :



(1) B = C $\frac{\sqrt{3}}{2}$ (2) A = $\frac{C}{\sqrt{2}}$

(3) B = $\frac{C}{\sqrt{2}}$ (4) A = $\frac{\sqrt{3}C}{2}$

Q.17 A sail boat sails 2 km due East 5 km 37° South of East and finally an unknown displacement. If the final displacement of the boat from the starting point is 6 km due East, determine the third displacement.

(1) 3 km, North (2) 4 km, South

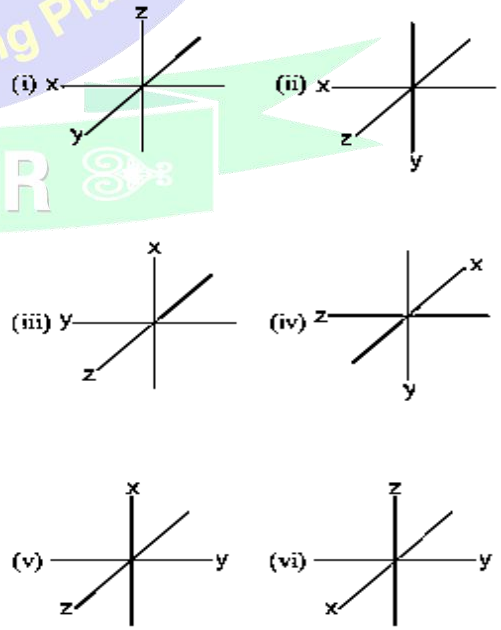
(3) 5 km, East (4) 3 km, West

Q.18 A vector $\overrightarrow{OA}=3\hat{i}$ is rotated by an angle θ about its starting point O in x-z plane in clockwise sense, as seen by an observer located at a point on +y -axis. The new vector will be :

(1) $3\cos\theta\,\hat{i}+3\sin\theta\,\hat{j}$ (2) $3[\cos\theta\,\hat{i}+\sin\theta\,\hat{k}]$

(3) $3[\cos\theta\,\hat{i}-\sin\theta\,\hat{k}]$ (4) $3[\sin\theta\,\hat{i}+3\cos\theta\,\hat{k}]$

Q.19 Which of the arrangement of axes in fig. can be labelled "right handed coordinate system" ? As usual, each axis lable indicates the positive side of the axis.



(1) (i), (ii),(iii), (v)only (2) (i), (iii), (iv) only
(3) (i), (ii) (iii) (iv) & (vi) (4) none of these

Q.20 There are three vectors $\vec{P}$, $\vec{Q}$, and $\vec{R}$. The angle between $\vec{P}$ and $\vec{Q}$ is 60° and $\vec{R}$ is perpendicular to the plane containing the vectors $\vec{P}$ and $\vec{Q}$. Consider the following relations.

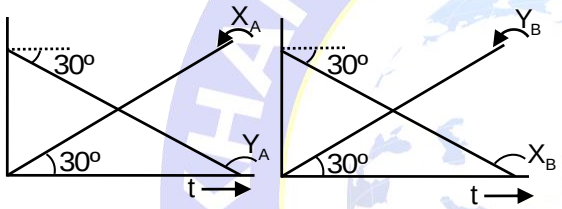
(a) $\vec{P}+\vec{Q}+\vec{R}=0$ (b) $\vec{P}\times\vec{Q}=\vec{R}$

(c) $\vec{P}\times\vec{R}=\vec{Q}$

The possible relations are

(1) (a) & (b) (2) (a) & (c)
(3) (b) & (c) (4) Only (b)

Q.21 Displacement versus time plot for two particles A and B is shown below. X_A X_B and Y_A Y_B refer to x and y coordinates of particles A and B.



Velocity of particle A with respect to particle B is

(1) $0\hat{i}+0\hat{j}$ (2) Dependent of time t

(3) $\frac{2}{\sqrt{3}}\hat{i}-\frac{2}{\sqrt{3}}\hat{j}$ (4) $-\frac{2}{\sqrt{3}}\hat{i}+\frac{2}{\sqrt{3}}\hat{j}$

Q.22 A body moving with a constant speed describes a circular path whose radius vector is given by $\vec{r}=15(\cos pt\,\hat{i}+\sin pt\,\hat{j})$ m, where p is in rad/s, and t is in second. What is its centripetal acceleration at t = 3 s? [$a_{centripetal} = v^2/r$]

(1) $45p^2$ m/s^2 (2) $5p^2$ m/s^2
(3) 15p m/s^2 (4) $15p^2$ m/s^2

Q.23 If $\vec{a}$ denotes a unit vector along an incident light $\vec{b}$ a unit vector along refracted ray into a medium having refractive index 'μ' (relative to first medium and $\vec{c}$ is a unit vector normal to boundary of two media and directed towards first medium, then law of refraction is [$\sin\theta_1 = \mu\sin\theta_2$]

(1) $\vec{a}.\vec{c}=\mu(\vec{b}.\vec{c})$ (2) $\vec{a}\times\vec{c}=\mu(\vec{c}\times\vec{b})$

(3) $\vec{a}\times\vec{c}=\mu(\vec{b}\times\vec{c})$ (4) $\mu(\vec{a}\times\vec{c})=(\vec{b}\times\vec{c})$

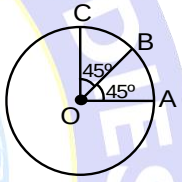
Q.24 A ladder 10 m long rests against a vertical wall with the lower end on the horizontal ground. The lower end of the ladder is pulled along the ground away from the wall at the rate of 3 cm/sec. The height of the upper end while it is descending at the rate of 4 cm/sec. is [velocity along the rod is constant]

(1) $4\sqrt{3}$ m (2) 6 m
(3) $5\sqrt{2}$ m (4) 8 m

Q.25 100 coplanar forces each equal to 10 N act on a body. Each force makes angle $\frac{\pi}{50}$ with the preceding force. What is the resultant of the forces

(1) 1000 N (2) 500 N
(3) 250 N (4) Zero

Q.26 Find the resultant of three vectors $\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OC}$ shown in the following figure. Radius of the circle is R.



(1) 2R (2) R(1 + $\sqrt{2}$)
(3) R$\sqrt{2}$ (4) R($\sqrt{2}-1$)

Q.27 The sum of two forces acting at a point is 16 N. If the resultant force is 8N and its direction is perpendicular to smaller force then the forces are

(1) 6 N and 10 N (2) 8 N and 8N
(3) 4 N and 12 N (4) 2N and 14 N

Q.28 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 ?

(1) 12, 5 (2) 14, 4
(3) 5, 13 (4) 10, 8

Q.29 Three forces P, Q and R are acting on a particle in the plane, the angle between P and Q & Q and R are 150° and 120° respectively. Then for equilibrium, forces P, Q and R are in the ratio :

(1) 1 : 2 : 3 (2) 1 : 2 : $\sqrt{3}$
(3) 3 : 2 : 1 (4) $\sqrt{3}$: 2 : 1

Q.30 Following forces start acting on a particle at rest at the origin of the co-ordinate system simultaneously

$\vec{F}_1 = -4\hat{i} - 5\hat{j} + 5\hat{k}$, $\vec{F}_2 = -5\hat{i} + 8\hat{j} + 6\hat{k}$, and $\vec{F}_3 = -3\hat{i} + 4\hat{j} - 7\hat{k}$ then the particle will move

(1) In x-y plane (2) In y-z plane
(3) In x-z plane (4) Along x-axis

Q.31 A body is at rest under the action of three forces two of which are $\vec{F}_1 = 4\hat{i}$, $\vec{F}_2 = 6\hat{j}$, the third force is

(1) $4\hat{i} + 6\hat{j}$ (2) $4\hat{i} - 6\hat{j}$
(3) $-4\hat{i} + 6\hat{j}$ (4) $-4\hat{i} - 6\hat{j}$

Q.32 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

(1) $4\hat{i} + 2\hat{j} + 5\hat{k}$ (2) $-4\hat{i} - 2\hat{j} + 5\hat{k}$
(3) $3\hat{i} + 4\hat{j} + 5\hat{k}$ (4) Null vector

Q.33 The unit vector parallel to the resultant of the vectors $\vec{A} = 4\hat{i} + 3\hat{j} + 6\hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} - 8\hat{k}$ is

(1) $\frac{1}{7}(3\hat{i} + 6\hat{j} - 2\hat{k})$ (2) $\frac{1}{7}(3\hat{i} + 6\hat{j} + 2\hat{k})$
(3) $\frac{1}{49}(3\hat{i} + 6\hat{j} - 2\hat{k})$ (4) $\frac{1}{49}(3\hat{i} - 6\hat{j} + 2\hat{k})$

Q.34 Let $\vec{A} = \hat{i}A\cos\theta + \hat{j}A\sin\theta$ be any vector. Another vector $\vec{B}$ which is normal to A is

(1) $\hat{i}B\cos\theta + \hat{j}B\sin\theta$ (2) $\hat{i}B\sin\theta + \hat{j}B\cos\theta$
(3) $\hat{i}B\sin\theta - \hat{j}B\cos\theta$ (4) $\hat{i}B\cos\theta - \hat{j}B\sin\theta$

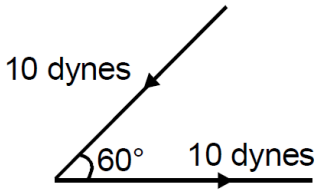
Q.35 The angle subtended at the centre of the circle of diameter 50 cm by an arc of 11 cm, is (in degree)

(1) 22° 10 ' (2) 23° 10 '
(3) 20° 12 ' (4) 25° 12 '

Q.36 A bird moves from point (1, – 2, 3) to (4, 2, 3). If the speed of the bird is 10m/sec, then the velocity vector of the bird is

(1) $5(\hat{i} - 2\hat{j} + 3\hat{k})$ (2) $5(4\hat{i} + 2\hat{j} + 3\hat{k})$
(3) $5(0.6\hat{i} + 0.8\hat{j})$ (4) $6\hat{i} + 8\hat{j}$

Q.37 Two forces each numerically equal to 10 dynes are acting as shown in the following figure, then their resultant is –



(1) 10 dynes (2) 20 dynes
(3) $10\sqrt{3}$ dynes (4) 5 dynes

Q.38 $[(\hat{i} \times \hat{j}) \times (\hat{i} \times \hat{k})].\hat{j}$ equals to .....?

(1)0 (2) 1 (3) –1 (4) 2

Each of the following contains two statements. Read the statements and choose any one of the following four responses:

(A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.

(B) Assertion is True, Reason is True; Reason is NOT a correct explanation for Assertion

(C) Assertion is True, Reason is False

(D) Assertion is False, Reason is True

Q.39 **Assertion :** $\cos 10^\circ$ & $\cos(-10)^\circ$ both are positive & have same value

Reason : $\cos\theta = \cos(-\theta)$ & 10° & $(-10)^\circ$ both lie in III[rd] quadrant.

(1) A (2) B (3) C (4) D

Q.40 **Assertion :** The minimum number of non-zero vectors of unequal magnitude required to produce zero resultant is three.

Reason : Three vectors of unequal magnitude which can be represented by the three sides of a triangle taken in order, produce zero resultant.

(1) A (2) B (3) C (4) D

Q.41 **Assertion :** If three vectors $\vec{A}$, $\vec{B}$ **and** $\vec{C}$ satisfy the relation $\vec{A} \cdot \vec{B} = 0$ & $\vec{A} \cdot \vec{C} = 0$ then the vector $\vec{A}$ is parallel to $\vec{B} \times \vec{C}$.

Reason : $\vec{A} \perp \vec{B}$ and $\vec{A} \perp \vec{C}$ and $\vec{B} \times \vec{C} \neq 0$ hence $\vec{A}$ is perpendicular to plane formed by $\vec{B}$ and $\vec{C}$.

(1) A (2) B (3) C (4) D

Q.42 **Assertion :** If the rectangular components of a force are 8 N and 6N, then the magnitude of the force is 10N.

Reason : If $|\vec{A}| = |\vec{B}| = 1$ then $|\vec{A} \times \vec{B}|^2 + |\vec{A}.\vec{B}|^2 = 1$

(1) A (2) B (3) C (4) D

Q.43

Column-I		Column-II	
(1)	The maximum value of $12\sin\theta - 9\sin^2\theta$ is	(P)	$-\sqrt{2}$
(2)	Maximum value of $5\sin^2\theta + 4\cos^2\theta$	(Q)	$4-\sqrt{10}$
(3)	The minimum value of $\cos\theta - \sin\theta$ is	(R)	4
(4)	The least value of $\cos^2\theta - 6\sin\theta\cos\theta + 3\sin^2\theta + 2$ is attained at θ =	(S)	5

(1) 1 $\rightarrow$ R, 2 $\rightarrow$ S, 3 $\rightarrow$ P, 4 $\rightarrow$ Q
(2) 2 $\rightarrow$ R, 2 $\rightarrow$ S, 1 $\rightarrow$ P, 4 $\rightarrow$ Q
(3) 1 $\rightarrow$ R, 4 $\rightarrow$ S, 3 $\rightarrow$ P, 2 $\rightarrow$ Q
(4) 4 $\rightarrow$ R, 2 $\rightarrow$ S, 3 $\rightarrow$ P, 1 $\rightarrow$ Q

ANSWER KEY

NEET-RANKER'S STUFF

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	2	2	4	3	2	1	1	1	3	3	2	1	2	2
Que.	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Ans.	1	1	3	3	4	3	4	3	2	4	2	1	3	4	2
Que.	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**		
Ans.	4	2	1	3	4	4	1	1	3	1	4	2	1		