Chapter 01

# Basic Mathematics

## TOPIC WISE QUESTIONS

### TRIGONOMETRY

**Q.1** **Change radian into degree –**

(i) $\pi/4$ (ii) $5\pi/6$ (iii) $7\pi/2$ (iv) $3\pi/5$

(v) $2\pi/3$ (vi) $3\pi/4$

**Q.2** **Change degree into radian –**

(i) 160° (ii) 135° (iii) 75° (iv) 65°

(v) 225° (vi) 250° (vii) 310°

**Q.3** **Find the value of following**

(i) sin 15° (ii) cos 15°

(iii) tan 15° (iv) sin 53°

(v) cos 53° (vi) tan 37°

(vii) tan 53° (viii) sin 53° – cos 37°

**Q.4** **Calculate the value of following :–**

(i) $\frac{\sin 135^\circ}{\cos 120^\circ}$ (ii) $\frac{\sin 120^\circ}{\cos 150^\circ}$

(iii) sin 105° (iv) sin 300°

(v) cos 240° (vi) $\sin^2(20^\circ) + \sin^2(70^\circ)$

(vii) sin 225° (viii) sin 315°

(ix) cos 270°

**Q.5** **Calculate the value of following :–**

(i) 2 sin 15° cos 15° (ii) sin 22.5° cos 22.5°

(iii) tan 75° (iv) $\sin^2 22.5^\circ$

**Q.6** **Calculate the value of following :–**

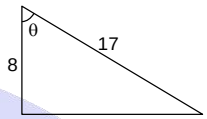
(i) $\sin\left(\frac{3\pi}{4}\right)$ (ii) $\tan\left(\frac{7\pi}{6}\right)$

(iii) $\cos\left(\frac{5\pi}{4}\right)$ (iv) $\sin\left(\frac{2\pi}{3}\right)$

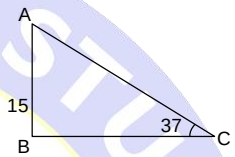
**Q.7** **Calculate the value of following :–**

(i) If $\tan\theta = \frac{5}{12}$; find $\sin\theta$

(ii) If $4\sin^2\theta = 1$ find $\theta$. {where $\theta$ (0, $\pi$)}

(iii) 

find $\sin\theta$.

(iv) 

find AC

### APPROXINATIONS

**Q.8** Use the approximation $(1 + x)^n \approx 1 + nx$, $|x| << 1$, to find approximate value for $\sqrt{99}$

(1) 9.05 (2) 9.95

(3) 8.85 (4) 7.91

**Q.9** Find approximate value for $\frac{1}{1.01}$

(1) 0.99 (2) 1.02 (3) 0.90 (4) 1.99

**Q.10** Use the small angle approximations to find approximate values for tan 4°.

(1) 0.05 (2) 0.26 (3) 0.07 (4) 0.69

### DIFFERENTIATION

**Q.11** Find the derivative of given functions w.r.t. corresponding independent variable.

(i) $y = x^3$ (ii) $y = \frac{1}{x^2}$

(iii) $y = x^2 + x + 8$ (iv) $y = 2\tan x$

(v) $y = 5\sin x$ (vi) $y = x^2 + \sin x$

(vii) $y = \tan x + \cot x$ (viii) Example $\sin x$

(ix) $x \sin x$ (x) $y = e^x \ln x$

(xi) $y = e^x \tan x$

(xii) $y = (x^2 + 3x + 2) \cdot (2x^4 - 5)$

(xiii) $y = \sin x \cos x$ (xiv) $s = (t^2 + 1)(t^2 - 1)$

**Q.12** Find derivative of given functions w.r.t. x

(i) $y = \frac{\sin x}{\cos x}$ (ii) $y = \frac{x^2+1}{x}$

(iii) $y = \frac{\sin x}{x^2}$ (iv) $y = \frac{x^2}{2x+1}$

(v) $y = \frac{\cos x}{x}$ (vi) $y = \sin 2x$

(vii) $y = \sin^2 x$ (viii) $y = \sin 5x$

(ix) $y = 2 \sin (ax + b)$ where a and b constants

(x) $y = (2x + 1)^5$ (xi) $y = (4 - 3x)^9$

(xii) $y = \sin^2(3 - 4x)$ (xiii) $y = \sqrt{4x^2+2}$

(xiv) $y = \sqrt{(2x+5)}$ (xv) $y = \frac{1}{\sqrt{6x^2+2x+3}}$

(xvi) $y = \frac{1}{\sqrt{7x-2}}$ (xvii) $x = 2y^2 + 2$

(xviii) $x = 4 \sin y + 6$ (xix) $x = 4 \ln y + 6$

**Q.13** Find the first derivative & second derivative of given functions w.r.t. corresponding independent variable.

(i) $y = \sin x$ (ii) $r = 2\theta^2$

(iii) $y = \ln x$ (iv) $y = 6x^2 - 10x - 5x^{-2}$

(v) $r = \frac{12}{\theta} - \frac{4}{\theta^3} + \frac{1}{\theta^4}$ (vi) $y = \sin x + \cos x$

(vii) $y = \ln x + e^x$

**Q.14** What is $\frac{dy}{dx}$ when x = 0

(i) $y = 6x^2 - 4x + 3$ (ii) $y = 3x^2 + 2x - 5$

(iii) $y^2 + x^2 = 16$ (iv) $x = 4y^2 - 16$

**Q.15** Find out f'(x) when f''(x) = 0

(i) $f(x) = 3x^3 - 18x^2 + 2x + 4$

(ii) $f(x) = x^3 - 3x^2 + 2x + 1$

(iii) $f(x) = \sqrt{x} + \frac{1}{\sqrt{x}}$

(iv) $f(x) = x^2 + \frac{1}{x}$

## MAXIMA & MINIMA

**Q.16** Find out minimum/maximum value of $y = 1 - x^2$ also find out those points where value is minimum/maximum.

**Q.17** Find out minimum/maximum value of $y = 2x^3 - 15x^2 + 36x + 11$ also find out those points where value is minimum/maximum.

**Q.18** Determine the position where potantial energy wil be minimum if $U(x) = 100 - 50x + 1000x^2$ J.

**Q.19** Find out minimum/maximum value of $y = 4x - x^2 + 6$ also find out those points where value is minimum/maximum.

## INTEGRATION OF ELEMENTRY FUNCTIONS

**Q.20** Find integrals of given functions

(i) (a) 2x (b) $x^2$ (c) $x^2 - 2x + 1$

(ii) (a) $\frac{1}{x^2}$ (b) $\frac{5}{x^2}$ (c) $2 - \frac{5}{x^2}$

(iii) (a) $\frac{3}{2}\sqrt{x}$ (b) $\frac{3}{2\sqrt{x}}$ (c) $\sqrt{x} + \frac{1}{\sqrt{x}}$

(iv) (a) $\frac{4}{3}\sqrt[3]{x}$ (b) $\frac{1}{3\sqrt[3]{x}}$ (c) $\sqrt[3]{x} + \frac{1}{\sqrt[3]{x}}$

(v) $(1 - x^2 - 3x^5)$ (vi) $\frac{4}{9}x^3 + \frac{7}{x^2} + x$

(vii) $x^8 + 9$ (viii) $x^{-7}$, (ix) $\frac{1}{3x}$

(x) $\int\left(\frac{1}{5} - \frac{2}{x^3} + 2x\right)dx$ (xi) $\int x^{-3}(x+1)\,dx$

(xii) $\int\left(y^2 + \frac{1}{2y} - y^3 + 3\right)dx$

**Q.21** Find integrals of given functions

(i) 3 sin x

(ii) $\int(\sin t - \cot + t^3 + 3t^2 + 4)\,dt$

(iii) $\int\left(\sin x + \frac{2}{x^3} - 5x^4 + e^{-2x} + 3\right)dx$

(iv) $\int \sin 3x\,dx$ (v) $\int 7\sin\frac{\theta}{3}d\theta$

(vi) $\int 3\cos 5\theta d\theta$

**Q.22 Definite integration**

(i) $\int_{-2}^{1} 5dx$ (ii) $\int_{-4}^{1} \frac{\pi}{2}d\theta$

(iii) $\int_{-2}^{4}\left(\frac{x}{2} + 3\right)dx$ (iv) $\int_{0}^{2\pi} \sin\theta d\theta$

(v) $\int_{0}^{1} e^x\,dx$ (vi) $\int_{\pi}^{2\pi} \theta d\theta$

(vii) $\int_{0}^{\sqrt[3]{7}} x^2\,dx$ (viii) $\int_{0}^{\pi} \cos x\,dx$

(ix) Evaluate: $\int_{0}^{1} \frac{1}{2x-3}dx$

## CALCULATION OF AREA

**Q.23** A particle is moving along x axis as $v = 2t + 3t^2 + 2$ here v is velocity and t is time in second then

find average velocity when particle moves t = 0 to t = 5 second.
(1) 25 (2) 40 (3) 32 (4) 30

**Q.24** Current is flowing in conductor as $i = 6t + 9t^2$ here t is time in second and i is current then find average current in conductor t = 0 to t = 10 sec.
(1) 50 A (2) 330 A (3) 200 A (4) 420 A

## CO-ORDINATE GEOMETRY

**Q.25** Write an equation for (a) the vertical line and (b) the horizontal line passing through the given point.
(i) (2, 3) (ii) (0,0) (iii) (– 4, 0) (iv) (0, b)

**Q.26** Write an equation for the line determined by the given point and slope.
(i) (1, 1), m = 1 (ii) (1, –1), m = –1
(iii) (–1, 1) m = 1 (iv) (–1, 1), m = –1
(v) (0, b), m = 2 (vi) (a, 0), m = – 2

**Q.27** Write the equation of line :
(i) having slope 2 and passing through (1, 3)
(ii) having slope –1 and passing through (2, 1)

**Q.28** Find an equation for the line determined by the given points
(i) (1, 1), (2, 1) (ii) (1, 1), (1, 2)
(iii) (T, 0),(0, $F_0$) ($T \neq 0, F_0 \neq 0$)
(iv) (1, 2), (4, 3) (v) (–1, 4), (2, 6)

**Q.29** Write an equation for the line with the given slope and y-intercept.
(i) m = – 1, c = 2 (ii) m = 1, c = $\sqrt{2}$
(iii) $m = -\frac{1}{2}$ c = – 3

**Q.30** Find the slope and y-intercept of the line.
(i) y = 3x + 5 (ii) x + y = 2
(iii) x – 2y = 4 (iv) 4x – 3y = 12
(v) $\frac{x}{3}+\frac{y}{4}=1$ (vi) $\frac{x}{2}-\frac{y}{3}=-1$

**Q.31** Write the equation of line :
(i) having x intercept 3 and y intercept 2.
(ii) having x intercept –2 and y intercept 2.

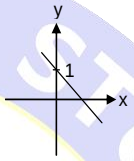
**Q.32** Find the angle of inclination of the given line.
(i) y = x + 2 (ii) $x + \sqrt{3}y = 3$
(iii) 4x + 3y = 12

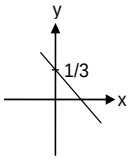
**Q.33** Find the line through the given point with the given angle of inclination .
(i) (1, 4) $\phi = 60°$ (ii) (–1, –1), $\phi = 135°$
(iii) (–2, 3) $\phi = 90°$ (iv) (3, –2) $\phi = 0°$

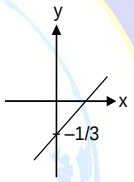
**Q.34** Find the center and radius of the circle and plot it.
(i) $x^2 + y^2 + 4x - 6y = 12$
(ii) $y^2 + x^2 = 4$
(iii) $(x - 3)^2 + (y - 2)^2 = 1$

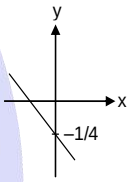
## GRAPHS

**Q.35** Correct graph of 3x + 4y + 1 = 0 is :

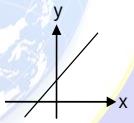
(1) 

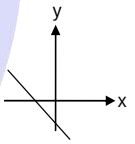

(2) 

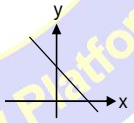

(3) 

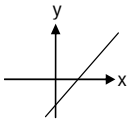

(4) 


**Q.36** Graph of y = 2x – 3 is :

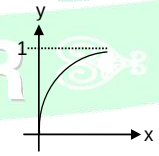
(1) 

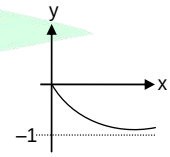

(2) 

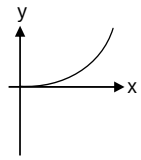

(3) 

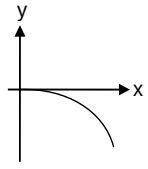

(4) 


**Q.37** Graph of $y = 1 - e^{-x}$ is best represent by (for x > 0):

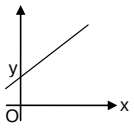
(1) 

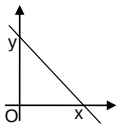

(2) 

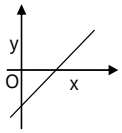

(3) 

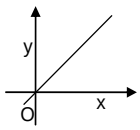

(4) 


**Q.38** Which of the following graphs has positive slope (m) and negative intercept (c) on y-axis?

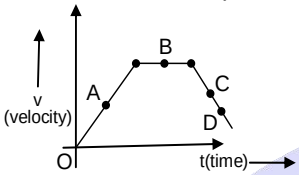
(1) 


(2) 


(3) 


(4) 


**Q.39** The slope of v – t is zero at point :




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

## QUADRATIC EQUATION RATIO & PERCENTAGE

**Q.40** Find root of given quadratic equations.
$x^2 - 12x + 35 = 0$
(1) 7, 5 (2) 2,3 (3) 4, 6 (4) 0, 1

**Q.41** Find sum of roots and multiplication of root of given equations. $x^2 - 5x + 12 = 0$
(1) 2, 12 (2) 5, 12 (3) 7, 12 (4) 4, 11

**Q.42** A particle has momentum is p if its momentum increased by 20% then find % increase in kinetic energy.
(1) 55% (2) 44 % (3) 46% (4) 52%

**Q.43** A charge particle moving perpendicular to magnetic field and force on particle is F = qvB (here q is charge in coulomb and v is velocity in m/s and B is magnetic field in web.) if velocity of particle decrease 10% then find % change in force on change particle.
(1) 10% increase (2) 10 % decrease
(3) 25 % increase (4) 15 % increase

**Q.44** If $\frac{p}{q} = \frac{39}{17}$ then find
(i) $\frac{p+q}{p-q}$ (ii) $\frac{p+q}{q}$ (iii) $\frac{p-q}{q}$
(1) (i)$\frac{28}{11}$(ii)$\frac{56}{17}$(iii)$\frac{22}{11}$
(2) (i)$\frac{7}{11}$(ii)$\frac{5}{9}$(iii)$\frac{3}{7}$
(3) (i)$\frac{7}{12}$(ii)$\frac{3}{9}$(iii)$\frac{12}{7}$
(4) (i)$\frac{5}{12}$(ii)$\frac{4}{9}$(iii)$\frac{7}{12}$

## DEFINITION, TYPES OF VECTOR & ANGLE BETWEEN THE VECTORS

**Q.45** Which one of the following statement is false
(1) Mass, speed and energy are scalars
(2) Momentum, force and torque are vectors
(3) Distance is a scalar while displacement is a vector
(4) A vector has only magnitude where as a scalar has both magnitude and direction

**Q.46** If is a unit vector in the direction of the vector $\vec{A}$, then :-
(1) $\hat{n} = \frac{\vec{A}}{|\vec{A}|}$ (2) $\hat{n} = \vec{A}|\vec{A}|$
(3) $\hat{n} = \frac{|\vec{A}|}{\vec{A}}$ (4) $\hat{n} = \hat{n} \times \vec{A}$

**Q.47** Electro motive force (EMF) is :
(1) scalar
(2) vector
(3) neither scalar nor vector
(4) none of these

**Q.48** Which of the following physical quantities is an axial vector ?
(1) displacement (2) force
(3) velocity (4) torque

**Q.49** The forces, which meet at one point but their lines of action do not lie in one plane, are called:
(1) non-coplanar and non-concurrent forces
(2) coplanar and non-concurrent forces
(3) non-coplanar and concurrent forces
(4) coplanar and concurrent forces

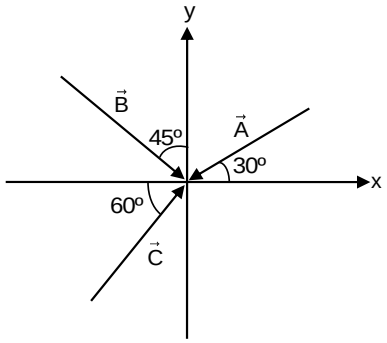
**Q.50** A vector is not changed if
(1) it is displaced parallel to itself
(2) it is rotated through an arbitrary angle
(3) it is cross-multiplied by a unit vector
(4) it is multiplied by an arbitrary scalar.

**Q.51** The unit vector along $\hat{i} + \hat{j}$ is :
(1) $\hat{k}$ (2) $\hat{i} + \hat{j}$ (3) $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$ (4) $\frac{\hat{i} + \hat{j}}{2}$

**Q.52** If a unit vector is represented by
$0.5\hat{i} - 0.8\hat{j} + c\hat{k}$,
then the value of 'c' is :
(1) 1 (2) $\sqrt{0.11}$ (3) $\sqrt{0.01}$ (4) $\sqrt{0.39}$

**Comprehension 53 to 55**

Vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are shown in figure. Find angle between

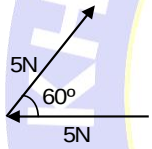



**Q.53** $\vec{A}$ and $\vec{B}$
(1) 105° (2) 110° (3) 115° (4) 120°

**Q.54** $\vec{A}$ and $\vec{C}$
(1) 120° (2) 150° (3) 175° (4) 190°

**Q.55** $\vec{B}$ and $\vec{C}$
(1) 90° (2) 120° (3) 105° (4) 150°

**Q.56** The forces, each numerically equal to 5 N, are acting as shown in the Figure. Find the angle between forces?




(1) 105° (2) 110° (3) 115° (4) 120°

**Q.57** The vector joining the points A (1, 1, –1) and B (2, –3, 4) & pointing from A to B is -
(1) $-\hat{i}+4\hat{j}-5\hat{k}$ (2) $\hat{i}+4\hat{j}+5\hat{k}$
(3) $\hat{i}-4\hat{j}+5\hat{k}$ (4) $-\hat{i}-4\hat{j}-5\hat{k}$

**Q.58** If $\vec{A}=3\hat{i}+4\hat{j}$ then find $\hat{A}$
(1) $\frac{3\hat{i}+4\hat{j}}{5}$ (2) $\frac{3\hat{i}-4\hat{j}}{5}$
(3) $\frac{4\hat{i}+3\hat{j}}{5}$ (4) $\frac{4\hat{i}-3\hat{j}}{5}$

## ADDITION & SUBTRACTION OF VECTORS

**Q.59** Given : $\vec{A}=2\hat{i}+3\hat{j}$ and $\vec{B}=5\hat{i}-6\hat{j}$. The magnitude of $\vec{A}+\vec{B}$ is
(1) 4 units (2) 10 units
(3) $\sqrt{58}$ units (4) $\sqrt{32}$ units

**Q.60** Given: $\vec{A}=2\hat{i}-\hat{j}+2\hat{k}$ and $\vec{B}=-\hat{i}-\hat{j}+\hat{k}$. The unit vector of $\vec{A}-\vec{B}$ is
(1) $\frac{3\hat{i}+k\hat{j}}{\sqrt{10}}$ (2) $\frac{3\hat{i}}{\sqrt{10}}$
(3) $\frac{\hat{k}}{\sqrt{10}}$ (4) $\frac{-3\hat{i}-\hat{k}}{\sqrt{10}}$

**Q.61** Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane, another vector $\vec{C}$ lies outside this plane, then the resultant of these three vectors i.e. $\vec{A}+\vec{B}+\vec{C}$ :
(1) Can be zero
(2) Cannot be zero
(3) Lies in the plane containing $\vec{A}$ & $\vec{B}$
(4) Lies in the plane containing $\vec{B}$ & $\vec{C}$

**Q.62** Given that $\vec{P}+\vec{Q}=\vec{P}-\vec{Q}$. This can be true when:
(1) $\vec{P}=\vec{Q}$
(2) $\vec{Q}=\vec{0}$
(3) Neither $\vec{P}$ nor $\vec{Q}$ is a null vector
(4) $\vec{P}$ is perpendicular to $\vec{Q}$

**Q.63** The resultant of $\vec{A}$ and $\vec{B}$ makes an angle $\alpha$ with $\vec{A}$ and $\beta$ with $\vec{B}$, then :
(1) $\alpha < \beta$ (2) $\alpha < \beta$ if A < B
(3) $\alpha < \beta$ if A > B (4) $\alpha < \beta$ if A = B

**Q.64** The minimum number of vectors of equal magnitude required to produce a zero resultant is :
(1) 2 (2) 3
(3) 4 (4) more than 4

**Q.65** How many minimum number of coplanar vectors having different magnitudes can be added to give zero resultant:-
(1) 2 (2) 3 (3) 4 (4) 5

**Q.66** How many minimum number of vectors in different planes can be added to give zero resultant:-
(1) 2 (2) 3 (3) 4 (4) 5

**Q.67** The vector sum of the forces of 10 newton and 6 newton can be :
(1) 2 N (2) 8 N (3) 18 N (4) 20 N

**Q.68** Vector sum of two forces of 10N and 6N cannot be :
(1) 4 N (2) 8 N (3) 12 N (4) 2 N

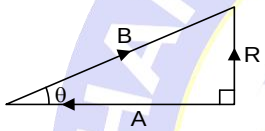
**Q.69** Which of the following pair of forces will never give resultant force of 2 N :
(1) 2 N and 2 N (2) 1 N and 1 N
(3) 1 N and 3 N (4) 1 N and 4 N

**Q.70** If $\vec{A}+\vec{B}$ is a unit vector along x-axis and $\vec{A}=\hat{i}-\hat{j}+\hat{k}$, then what is $\vec{B}$ ?
(1) $\hat{j}+\hat{k}$ (2) $\hat{j}-\hat{k}$
(3) $\hat{i}+\hat{j}+\hat{k}$ (4) $\hat{i}+\hat{j}-\hat{k}$

**Q.71** Force 3 N, 4 N and 12 N act at a point in mutually perpendicular directions. The magnitude of the resultant force is :
(1) 19 N (2) 13 N (3) 11 N (4) 5 N

**Q.72** If vectors $\vec{P}$, $\vec{Q}$ and $\vec{R}$ have magnitudes 5, 12 and 13 units and $\vec{P} + \vec{Q} = \vec{R}$, the angle between $\vec{Q}$ and $\vec{R}$ is :
(1) $\cos^{-1}\left(\frac{5}{12}\right)$ (2) $\cos^{-1}\left(\frac{5}{13}\right)$
(3) $\cos^{-1}\left(\frac{12}{13}\right)$ (4) $\cos^{-1}\left(\frac{2}{13}\right)$

**Q.73** In vector diagram shown in figure where ($\vec{R}$) is the resultant of vectors ($\vec{A}$) and ($\vec{B}$). If R = $\frac{B}{\sqrt{2}}$, the value of angle $\theta$ is :




(1) 30° (2) 45° (3) 60° (4) 75°

**Q.74** Two vectors $\vec{A}$ and $\vec{B}$ are such that $\vec{A}+\vec{B}=\vec{C}$ and $A^2 + B^2 = C^2$. Which of the following statements, is correct: -
(1) $\vec{A}$ is parallel to $\vec{B}$
(2) $\vec{A}$ is anti-parallel to $\vec{B}$
(3) $\vec{A}$ is perpendicular to $\vec{B}$
(4) $\vec{A}$ and $\vec{B}$ are equal in magnitude

**Q.75** The resultant of $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$. What is the angle between $\vec{A}$ and $\vec{B}$ ?
(1) $\cos^{-1}\left(\frac{A}{B}\right)$ (2) $\cos^{-1}\left(-\frac{A}{B}\right)$
(3) $\sin^{-1}\left(\frac{A}{B}\right)$ (4) $\sin^{-1}\left(-\frac{A}{B}\right)$

**Q.76** When two vector $\vec{a}$ and $\vec{b}$ are added, the magnitude of the resultant vector is always
(1) greater than (a + b)
(2) less than or equal to (a + b)
(3) less than (a + b)
(4) equal to (a + b)

**Q.77** Six forces, 9.81 N each, acting at a point are coplanar. If the angles between neighboring forces are equal, then the resultant is
(1) 0 N (2) 9.81 N
(3) 2 (9.81) N (4) 3 (9.81) N.

**Q.78** Rain is falling vertically downwards with a speed 5 m/s. If unit vector along upward is defined as $\hat{j}$, represent velocity of rain in vector form.
(1) $5\hat{j}$ (2) $-5\hat{j}$ (3) $8\hat{j}$ (4) $-8\hat{j}$

**Q.79** Two force and are acting at right angles to each other, find their resultant ?
(1) $\sqrt{F_1^2 - F_2^2}$ (2) $\sqrt{F_1^2 + F_2^2}$
(3) $\sqrt{F_1^3 - F_2^3}$ (4) $\sqrt{F_1^3 + F_2^3}$

**Q.80** Two force of $\vec{F}_1$ = 500 N due east and $\vec{F}_2$ = 250 N due north, Find $\vec{F}_2 - \vec{F}_1$ ?
(1) 250 $\sqrt{5}$ N, $\tan^{-1}$(2) W of N
(2) 250 $\sqrt{5}$ N, $\tan^{-1}$ (2) N of W
(3) 250 N, $\tan^{-1}$ (2) W of S
(4) 250 N, $\tan^{-1}$ (2) S of W

**Q.81** Two vectors $\vec{a}$ and $\vec{b}$ inclined at an angle $\theta$ w.r.t. each other have a resultant $\vec{c}$ which makes an angle $\beta$ with $\vec{a}$. If the directions of $\vec{a}$ and $\vec{b}$ are interchanged, then the resultant will have the same
(1) magnitude
(2) direction
(3) magnitude as well as direction
(4) neither magnitude nor direction.

**Q.82** A set of vectors taken in a given order gives a closed polygon. Then the resultant of these vectors is a
(1) scalar quantity (2) pseudo vector
(3) unit vector (4) null vector

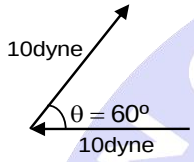
**Q.83** The vector sum of two force P and Q is minimum when the angle $\theta$ between their positive directions, is
(1) $\frac{\pi}{4}$ (2) $\frac{\pi}{3}$ (3) $\frac{\pi}{2}$ (4) $\pi$.

**Q.84** The vector sum of two vectors $\vec{A}$ and $\vec{B}$ is maximum, then the angle $\theta$ between two vectors is -
(1) 0° (2) 30° (3) 45° (4) 60°

**Q.85** Given : $\vec{C}$ = $\vec{A}$ + $\vec{B}$. Also, the magnitude of $\vec{A}$, $\vec{B}$ and $\vec{C}$ are 12, 5 and 13 units respectively. The angle between $\vec{A}$ and $\vec{B}$ is
(1) 0° (2) $\frac{\pi}{4}$ (3) $\frac{\pi}{2}$ (4) $\pi$.

**Q.86** The sum and difference of two perpendicular vectors of equal lengths are
(1) of equal lengths and have an acute angle between them
(2) of equal length and have an obtuse angle between them
(3) also perpendicular to each other and are of different lengths
(4) also perpendicular to each other and are of equal lengths.

**Q.87** Two forces, each numerically equal to 10 dyne are acting as shown in the following figure. Their resultant is :




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

**Q.88** What is the angle between $\vec{A}$ and the resultant of $(\vec{A}+\vec{B})$ and $(\vec{A}-\vec{B})$ ?

(1) 0° (2) $\tan^{-1}\left(\frac{A}{B}\right)$
(3) $\tan^{-1}\left(\frac{B}{A}\right)$ (4) $\tan^{-1}\left(\frac{A-B}{A+B}\right)$

## DOT PRODUCT & CROSSPRODUCT

**Q.89** The angle that the vector $\vec{A}=2\hat{i}+3\hat{j}$ makes with y-axis is :
(1) $\tan^{-1}(3/2)$ (2) $\tan^{-1}(2/3)$
(3) $\sin^{-1}(2/3)$ (4) $\cos^{-1}(3/2)$

**Q.90** A vector perpendicular to $(4\hat{i}-3\hat{j})$ may be :
(1) $4\hat{i}+3\hat{j}$ (2) $7\hat{k}$
(3) $6\hat{i}$ (4) $3\hat{i}-4\hat{j}$

**Q.91** The vector $\vec{B}=5\hat{i}+2\hat{j}-S\hat{k}$ is perpendicular to the vector $\vec{A}=3\hat{i}+\hat{j}+2\hat{k}$ if S =
(1) 1 (2) 4.7
(3) 6.3 (4) 8.5

**Q.92** The angle between two vectors given by $(6\hat{i}+6\hat{j}-3\hat{k})$ and $(7\hat{i}+4\hat{j}+4\hat{k})$ is :
(1) $\cos^{-1}\left(\frac{1}{2}\right)$ (2) $\cos^{-1}\left(\frac{1}{3}\right)$
(3) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (4) $\cos^{-1}\left(\frac{2}{3}\right)$

**Q.93** If $\vec{A}+\vec{B}=\vec{C}$ and A + B = C, then the angle between $\vec{A}$ and $\vec{B}$ is :
(1) 0 (2) $\pi/4$
(3) $\pi/2$ (4) $\pi$

**Q.94** The angle between the two vectors $\vec{A}=3\hat{i}+4\hat{j}+5\hat{k}$ and $\vec{B}=3\hat{i}+4\hat{j}-5\hat{k}$ will be :
(1) zero (2) 180°
(3) 90° (4) 45°

**Q.95** If $\vec{P}.\vec{Q}$ = PQ, then angle between $\vec{P}$ and $\vec{Q}$ is :
(1) 0° (2) 30°
(3) 45° (4) 60°

**Q.96** The magnitudes of vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are respectively 12, 5 and 13 units and $\vec{A}+\vec{B}=\vec{C}$, then the angle between $\vec{A}$ and $\vec{B}$ is :
(1) 0 (2) 45°
(3) $\pi/2$ (4) $\pi$

**Q.97** Area of a parallelogram, whose diagonals are $3\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+4\hat{k}$ will be :
(1) $\sqrt{95}$ (2) $\sqrt{99}$
(3) $\sqrt{105}$ (4) $\sqrt{100}$

**Q.98** A vector $\vec{A}$ points vertically downward & $\vec{B}$ points towards east, then the vector product $\vec{A}\times\vec{B}$ is
(1) along west (2) along east
(3) zero (4) along south

**Q.99** If $\hat{i}$, $\hat{j}$ and $\hat{k}$ are unit vectors along X, Y & Z axis respectively, then tick the wrong statement:
(1) $\hat{i}.\hat{i}=1$ (2) $\hat{i}\times\hat{j}=\hat{k}$
(3) $\hat{i}.\hat{j}=0$ (4) $\hat{i}\times\hat{k}=-\hat{i}$

**Q.100** Two vectors $\vec{P}$ and $\vec{Q}$ are inclined to each other at angle $\theta$. Which of the following is the unit vector perpendicular to $\vec{P}$ and $\vec{Q}$ ?
(1) $\frac{\vec{P}\times\vec{Q}}{\vec{P}.\vec{Q}}$ (2) $\frac{\hat{P}\times\hat{Q}}{\sin\theta}$
(3) $\frac{\hat{P}\times\hat{Q}}{PQ\sin\theta}$ (4) $\frac{\hat{P}\times\vec{Q}}{PQ\sin\theta}$

**Q.101** The magnitude of the vector product of two vectors $\vec{A}$ and $\vec{B}$ may not be :
(1) Greater than AB (2) Less than AB
(3) Equal to AB (4) Equal to zero

**Q.102** If $\vec{P}\times\vec{Q}=\vec{R}$, then which of the following statements is not true :

(1) $\vec{R}\perp\vec{P}$ (2) $\vec{R}\perp\vec{Q}$

(3) $\vec{R}\perp(\vec{P}+\vec{Q})$ (4) $\vec{R}\perp(\vec{P}\times\vec{Q})$

**Q.103** Which of the following vector identities is false?

(1) $\vec{P}+\vec{Q}=\vec{Q}+\vec{P}$ (2) $\vec{P}+\vec{Q}=\vec{Q}\times\vec{P}$

(3) $\vec{P}.\vec{Q}=\vec{Q}.\vec{P}$ (4) $\vec{P}\times\vec{Q}\neq\vec{Q}\times\vec{P}$

**Q.104** If the vectors $\left(\hat{i}+\hat{j}+\hat{k}\right)$ and $3\hat{i}$ form two sides of a triangle, then area of the triangle is :

(1) $\sqrt{3}$ unit (2) $2\sqrt{3}$ unit

(3) $\frac{3}{\sqrt{2}}$ unit (4) $3\sqrt{2}$ unit

**Q.105** What is the value of $\left(\vec{A}+\vec{B}\right)\cdot\left(\vec{A}\times\vec{B}\right)$?

(1) 0 (2) $A^2 - B^2$

(3) $A^2 + B^2 + 2AB$ (4) none of these

**Q.106** If $\vec{A}\times\vec{B}=\vec{0}$ and $\vec{B}\times\vec{C}=\vec{0}$, then the angle between $\vec{A}$ and $\vec{C}$ may be :

(1) zero (2) $\frac{\pi}{4}$

(3) $\frac{\pi}{2}$ (4) none of these

**Q.107** Find the magnitude of $3\hat{i}+2\hat{j}+\hat{k}$ ?

(1) $\sqrt{14}$ (2) $\sqrt{13}$ (3) $\sqrt{12}$ (4) $\sqrt{10}$

**Q.108** Three non zero vectors $\vec{A}$, $\vec{B}$ & $\vec{C}$ satisfy the relation $\vec{A}\,.\,\vec{B}=0$ & $\vec{A}\,.\,\vec{C}=0$. Then $\vec{A}$ can be parallel to :

(1) $\vec{B}$ (2) $\vec{C}$ (3) $\vec{B}.\vec{C}$ (4) $\vec{B}\times\vec{C}$

**Q.109** If $\hat{n}=a\hat{i}+b\hat{j}$ is perpendicular to the vector, $\left(\hat{i}-\hat{j}\right)$, then the value of a and b may be :

(1) 1, 0 (2) –2, 0

(3) 3, 0 (4) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

**Q.110** For a body, angular velocity ($\vec{\omega}$) = $\hat{i}-2\,\hat{j}+3\,\hat{k}$ and radius vector ($\vec{r}$) = $\hat{i}+\hat{j}+\hat{k}$, then its velocity is:

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

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

## RESOLTUION OF VECTOR, PROJECTION OF VECTOR, MISC

**Q.111** What is the projection of $\vec{A}$ on $\vec{B}$ ?

(1) $\vec{A}\,.\,\vec{B}$ (2) $\vec{A}.\hat{B}$

(3) $\vec{B}.\vec{A}$ (4) $\hat{A}.\hat{B}$

**Q.112** What is the maximum number of components into which a vector can be split ?

(1) 2 (2) 3

(3) 4 (4) $\infty$

**Q.113** What is the maximum number of rectangular components into which a vector can be split in its own plane ?

(1) 2 (2) 3 (3) 4 (4) $\infty$

**Q.114** What is the maximum number of rectangular components into which a vector can be split in space ?

(1) 2 (2) 3 (3) 4 (4) $\infty$

**Q.115** Vector makes angle $\alpha$, $\beta$ and $\gamma$ with the X, Y and Z axes respectively.

Then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ =

(1) 0 (2) 1 (3) 2 (4) 3

**Q.116** The direction cosines of a vector $\hat{i}+\hat{j}+\sqrt{2}\hat{k}$ are:

(1) $\frac{1}{2}, \frac{1}{2}, 1$ (2) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

(3) $\frac{1}{2}, \frac{1}{2}, \frac{1}{\sqrt{2}}$ (4) None of these

**Q.117** What is the x component of a 25 m displacement at an angle of 210° with the x-axis (anti clockwise) ?

(1) 25 cos 30° (2) 25 sin 30°

(3) – 25 cos 30° (4) – 25 sin 30°

**Q.118** One of the rectangular components of a velocity of 60 km $h^{-1}$ is 30 km $h^{-1}$. Find other rectangular component ?

(1) $20\sqrt{3}$ km $h^{-1}$ (2) $30\sqrt{2}$ km $h^{-1}$

(3) $20\sqrt{2}$ km $h^{-1}$ (4) $30\sqrt{3}$ km $h^{-1}$

# ANSWER KEY

## TOPIC WISE QUESTIONS

**Q.1** **Change radian to degree**
(i) 45° (ii) 150° (iii) 630° (iv) 108°
(v) 120° (vi) 135°

**Q.2** **Change degree to radian**
(i) $8\pi/9$ (ii) $3\pi/4$ (iii) $5\pi/12$ (iv) $13\pi/36$
(v) $5\pi/4$ (vi) $25\pi/18$ (vii) $31\pi/18$

**Q.3** (i) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ (ii) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ (iii) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$
(iv) $\frac{3}{4}$
(v) $\frac{3}{5}$ (vi) $\frac{3}{4}$ (vii) $\frac{4}{3}$ (viii) Zero

**Q.4** (i) $-\sqrt{2}$ (ii) $-1$
(iii) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ (iv) $-\frac{\sqrt{3}}{2}$
(v) $-\frac{1}{2}$ (vi) 1 (vii) $-\frac{1}{\sqrt{2}}$ (viii) $-\frac{1}{\sqrt{2}}$
(ix) 0

**Q.5** (i) $\frac{1}{2}$ (ii) $\frac{1}{2\sqrt{2}}$ (iii) $\frac{\sqrt{3}+1}{\sqrt{3}-1}$
(iv) $\frac{\sqrt{2}-1}{2\sqrt{2}}$

**Q.6** (i) $\frac{1}{\sqrt{2}}$ (ii) $\frac{1}{\sqrt{3}}$ (iii) $-\frac{1}{\sqrt{2}}$ (iv) $\frac{\sqrt{3}}{2}$

**Q.7** (i) $\pm\frac{5}{13}$ (ii) $\frac{\pi}{6}, \frac{5\pi}{6}$ (ii) $\frac{15}{17}$ (iv) 25

### APPROXIMATION

**Q.8** (2)
**Q.9** (1)
**Q.10** (3)

### DIFFERENTIATION

**Q.11** (i) $3x^2$ (ii) $\frac{-2}{x^3}$
(iii) $\frac{dy}{dx} = 2x + 1$ (iv) $2\sec^2 x$
(v) $\frac{dy}{dx} = 5\cos x$ (vi) $\frac{dy}{dx} = 2x + \cos x$
(vii) $\sec^2 x - \text{cosec}^2 x$
(viii) $\frac{dy}{dx} = e^x.\sin x + e^x \cos x$
(ix) $\sin x + x\cos x$ (x) $e^x \ln x + \frac{e^x}{x}$
(xi) $e^x(\tan x + \sec^2 x)$
(xii) $\frac{dy}{dx} = (2x+3)(2x^4-5) + (x^2+3x-2)(8x^3)$
(xiii) $\cos^2 x - \sin^2 x$
(xiv) $\frac{ds}{dt} = (t^2+1)(2t) + (t^2-1)2t = 4t^3$

**Q.12** (i) $\sec^2 x$ (ii) $1 - \frac{1}{x^2}$
(iii) $\frac{x^2(\cos x) - \sin x(2x)}{x^4}$
(iv) $\frac{dy}{dx} = \frac{(2x+1)2x - x^2\times 2}{(2x+1)^2} \Rightarrow \frac{2x^2+2x}{(2x+1)^2}$
(v) $\frac{dy}{dx} = \frac{x(-\sin x) - \cos x}{x^2}$
(vi) $2\cos 2x$ (vii) $\sin 2x$
(viii) $5\cos 5x$ (ix) $2a\cos(ax+b)$
(x) $10(2x+1)^4$ (xi) $-27(4-3x)^8$
(xii) $y = -4\sin(6-8x)$ (xiii) $\frac{4x}{\sqrt{4x^2+2}}$
(xiv) $\frac{1}{\sqrt{2x+5}}$ (xv) $y = \frac{-(6x+1)}{(6x^2+2x+3)^{3/2}}$
(xvi) $-\frac{7}{2(7x-2)^{3/2}}$ (xvii) $\frac{1}{2\sqrt{2x-4}}$
(xviii) $\frac{dy}{dx} = \frac{1}{\sqrt{16-(x-6)^2}}$

(xix) $\frac{e^{\frac{x-6}{4}}}{4}$

**Q.13** Find out first derivative & second derivative

(i) cos x, – sin x

(ii) 4θ, 4

(iii) $\frac{1}{x}, -\frac{1}{x^2}$

(iv) $12x - 10 + 10x^{-3}$, $12 - 30x^{-4}$

(v) $-\frac{12}{\theta^2}+\frac{12}{\theta^4}-\frac{4}{\theta^5}$; $\frac{24}{\theta^3}-\frac{48}{\theta^5}+\frac{20}{\theta^6}$

(vi) cosx – sin x; – sin x – cos x

(vii) $\frac{1}{x}+e^x, -\frac{1}{x^2}+e^x$

**Q.14** (i) –4 (ii) 2 (iii) 0 (iv) $\frac{1}{16}$

**Q.15** (i) –34 (ii) –1 (iii) $\frac{1}{3\sqrt{3}}$ (ii) –3

## MAXIMA & MINIMA

**Q.16** Max. value = 1 at x = 0

**Q.17** Max. value = 39 at x = 2, Min. value = 38 at x = 3

**Q.18** The minimum occurs at $x = 0.25 \times 10^{-1}$

**Q.19** Max. value = 10 at x = 2

## INTEGRATION

**Q.20** (i) (a) $x^2 + c$ (b) $\frac{x^3}{3}+c$

(c) $\frac{x^3}{3}-x^2+x+c$

(ii) (a) $-\frac{1}{x}+C$ (b) $-\frac{5}{2x^2}+c$

(c) $2x+\frac{5}{x}+c$

(iii) (a) $\sqrt{x^3}+c$ (b) $3\sqrt{x}+c$

(c) $\frac{2\sqrt{x^3}}{3}+2\sqrt{x}+c$

(iv) (a) $x^{4/3}+c$ (b) $\frac{x^{2/3}}{2}+c$

(c) $\frac{3x^{4/3}}{4}+\frac{3x^{2/3}}{2}+c$

(v) $x-\frac{x^3}{3}-\frac{x^6}{2}+C$ (vi) $\frac{x^4}{9}-\frac{7}{x}+\frac{x^2}{2}+C$

(vii) $\frac{x^9}{9}+9x+C$ (viii) $\frac{x^{-6}}{-6}+C$

(ix) $\frac{1}{3}\ell nx+c$ (x) $\frac{x}{5}+\frac{1}{x^2}+x^2+C$

(xi) $-\frac{1}{x}-\frac{1}{2x^2}+C$

(xii) $\frac{y^2}{3}+\frac{1}{2}\log_e y-\frac{y^4}{4}+3y+C$

**Q.21** (i) – 3 cos x + c

(ii) –cost – sint + $\frac{t^4}{4}+t^3+4t+C$

(iii) $-\cos x-\frac{1}{x^2}-x^5-\frac{e^{-2x}}{2}+3x+C$

(iv) $-\frac{\cos 3x}{3}+C$

(v) $-21\cos\frac{\theta}{3}+C$ (vi) $\frac{3}{5}\sin 5\theta+c$

**Q.22** (i) 15 (ii) $\frac{3\pi}{2}$ (iii) 21 (iv) 0

(v) e – 1 (vi) $\frac{3\pi^2}{2}$ (vii) $\frac{7}{3}$ (viii) 0

(ix) $-\frac{1}{2}\log 3$

## CALCULATION OF AREA

**Q.23** (3) 32

**Q.24** (2) 330 A

## COORDINATE GEOMATRY

**Q.25** (i) (a) x = 2, (b) y = 3 (ii) (a) x = 0, (b) y = 0

(iii) (a) x = – 4, (b) y = 0 (iv) (a) x = 0, (b) y = b

**Q.26** (i) y = x (ii) y + x = 0

(iii) y = x + 2 (iv) y + x = 0

(v) y = 2x + b (vi) y + 2x = 2a

**Q.27** (i) y = 2x + 1 (ii) x + y = 3

**Q.28** (i) y = 1 (ii) x = 1

(iii) $y = (-F_0/T)x + F_0$ (iv) 3y = x + 5

(v) 3y = 2x + 14

**Q.29** (i) y + x = 2 (ii) $y = x+\sqrt{2}$

(iii) y + = –3

**Q.30** (i) m = 3, c = 5 (ii) m = – 1, c = 2

(iii) m = $\frac{1}{2}$, c = –2 (iv) m = $\frac{4}{3}$, c = –4

(v) m = $-\frac{4}{3}$, c = 4 (vi) m = $\frac{3}{2}$, c = 3

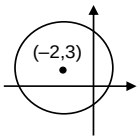
## PHYSICS

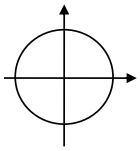
**Q.31** (i) $2x + 3y = 6$ (ii) $y = x + 2$

**Q.32** (i) 45° (ii) 150° (iii) 127°

**Q.33** (i) $y = \sqrt{3}x + (4 - \sqrt{3})$ (ii) $y + x + 2 = 0$

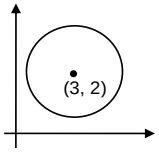
(iii) $x = -2$ (iv) $y = -2$

**Q.34** (i) 


(ii) 

Center C(–2, 3), Radius r = 5

Center C(0, 0), Radius r = 2

(iii) 


Center C(3, 2), Radius r = 1

| **Que.** | **35** | **36** | **37** | **38** | **39** | **40** | **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 4 | 4 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 1 | 4 | 1 | 1 | 4 | 3 |
| **Que.** | **50** | **51** | **52** | **53** | **54** | **55** | **56** | **57** | **58** | **59** | **60** | **61** | **62** | **63** | **64** |
| Ans. | 1 | 3 | 2 | 1 | 2 | 3 | 4 | 3 | 1 | 3 | 1 | 2 | 2 | 3 | 1 |
| **Que.** | **65** | **66** | **67** | **68** | **69** | **70** | **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** |
| Ans. | 2 | 3 | 2 | 4 | 4 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 2 |
| **Que.** | **80** | **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** | **91** | **92** | **93** | **94** |
| Ans. | 1 | 1 | 4 | 4 | 1 | 3 | 4 | 1 | 1 | 2 | 4 | 4 | 4 | 1 | 3 |
| **Que.** | **95** | **96** | **97** | **98** | **99** | **100** | **101** | **102** | **103** | **104** | **105** | **106** | **107** | **108** | **109** |
| Ans. | 1 | 3 | 2 | 4 | 4 | 2 | 1 | 4 | 2 | 3 | 1 | 1 | 1 | 4 | 4 |
| **Que.** | **110** | **111** | **112** | **113** | **114** | **115** | **116** | **117** | **118** | | | | | | |
| Ans. | 1 | 2 | 4 | 1 | 2 | 3 | 3 | 3 | 4 | | | | | | |