1. A function $f$ from the set of natural numbers to integers defined by

$$f(n) = \begin{cases} \frac{n-1}{2}, \text{ when } n \text{ is odd} \\ -\frac{n}{2}, \text{ when } n \text{ is even} \end{cases}$$

is :
(a) one-one but not onto
(b) onto but not one-one
(c) one-one and onto both
(d) neither one-one nor onto

2. Let $z_1$ and $z_2$ be two roots of the equation $z^2 + az + b = 0$, $z$ being complex. Further, assume that the origin, $z_1$ and $z_2$ form an equilateral triangle. Then :
(a) $a^2 = b$ (b) $a^2 = 2b$
(c) $a^2 = 3b$ (d) $a^2 = 4b$

3. If $z$ and $\omega$ are two non-zero complex numbers such that $|z\omega| = 1$, and $\arg(z) - \arg(\omega) = \frac{\pi}{2}$, then $\bar{z}\omega$ is equal to :
(a) 1 (b) $-1$
(c) $i$ (d) $-i$

4. If $\left(\frac{1+i}{1-i}\right)^x = 1$, then :
(a) $x = 4n$, where $n$ is any positive integer
(b) $x = 2n$, where $n$ is any positive integer
(c) $x = 4n + 1$, where $n$ is any positive integer
(d) $x = 2n + 1$, where $n$ is any positive integer

5. If $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix} = 0$

and vectors $(1, a, a^2)$, $(1, b, b^2)$ and $(1, c, c^2)$ are non-coplanar, then the product $abc$ equals :
(a) 2 (b) $-1$
(c) 1 (d) 0

6. If the system of linear equations

$$x + 2ay + az = 0$$
$$x + 3by + bz = 0$$
$$x + 4cy + cz = 0$$

has a non-zero solution, then $a, b, c$ :
(a) are in AP
(b) are in GP
(c) are in HP
(d) satisfy $a + 2b + 3c = 0$

7. If the sum of the roots of the quadratic equation $ax^2 + bx + c = 0$ is equal to the sum of the squares of their reciprocals, then $\frac{a}{c}$, $\frac{b}{a}$ and $\frac{c}{b}$ are in :
(a) arithmetic progression
(b) geometric progression
(c) harmonic progression
(d) arithmetico-geometric progression

8. The number of the real solutions of the equation $x^2 - 3|x| + 2 = 0$ is :
(a) 2 (b) 4
(c) 1 (d) 3

9. The value of '$a$' for which one root of the quadratic equation

$$(a^2 - 5a + 3)x^2 + (3a - 1)x + 2 = 0$$

is twice as large as the other, is :
(a) 2/3 (b) $-2/3$
(c) 1/3 (d) $-1/3$

10. If $A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} \alpha & \beta \\ \beta & \alpha \end{bmatrix}$, then :
(a) $\alpha = a^2 + b^2, \beta = ab$
(b) $\alpha = a^2 + b^2, \beta = 2ab$
(c) $\alpha = a^2 + b^2, \beta = a^2 - b^2$
(d) $\alpha = 2ab, \beta = a^2 + b^2$

11. A student is to answer 10 out of 13 questions in an examination such that he must choose at least 4 from the first five questions. The number of choices available to him is :
(a) 140 (b) 196
(c) 280 (d) 346

12. The number of ways in which 6 men and 5 women can dine at a round table, if no two women are to sit together, is given by :
(a) $6! \times 5!$ (b) 30
(c) $5! \times 4!$ (d) $7! \times 5!$

13. If 1, $\omega$, $\omega^2$ are the cube roots of unity, then :

$$\Delta = \begin{vmatrix} 1 & \omega^n & \omega^{2n} \\ \omega^n & \omega^{2n} & 1 \\ \omega^{2n} & 1 & \omega^n \end{vmatrix}$$

is equal to :
(a) 0 (b) 1
(c) $\omega$ (d) $\omega^2$

**14.** If ${}^nC_r$ denotes the number of combinations of $n$ things taken $r$ at a time, then the expression ${}^nC_{r+1} + {}^nC_{r-1} + 2 \times {}^nC_r$ equals :

(a) ${}^{n+2}C_r$ (b) ${}^{n+2}C_{r+1}$

(c) ${}^{n+1}C_r$ (d) ${}^{n+1}C_{r+1}$

**15.** The number of integral terms in the expansion of $(\sqrt{3} + \sqrt[8]{5})^{256}$ is :

(a) 32 (b) 33

(c) 34 (d) 35

**16.** If $x$ is positive, the first negative term in the expansion of $(1 + x)^{27/5}$ is :

(a) 7th term (b) 5th term

(c) 8th term (d) 6th term

**17.** The sum of the series $\frac{1}{1 \cdot 2} - \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} - \ldots$ upto $\infty$ is equal to :

(a) $2 \log_e 2$ (b) $\log_e 2 - 1$

(c) $\log_e 2$ (d) $\log_e \left(\frac{4}{e}\right)$

**18.** Let $f(x)$ be a polynomial function of second degree. If $f(1) = f(-1)$ and $a, b, c$ are in AP, then $f'(a)$, $f'(b)$ and $f'(c)$ are in :

(a) AP

(b) GP

(c) HP

(d) arithmetico-geometric progression

**19.** If $x_1, x_2, x_3$ and $y_1, y_2, y_3$ are both in GP with the same common ratio, then the points $(x_1, y_1)$, $(x_2, y_2)$ and $(x_3, y_3)$ :

(a) lie on a straight line

(b) lie on an ellipse

(c) lie on a circle

(d) are vertices of a triangle

**20.** The sum of the radii of inscribed and circumscribed circles for an $n$ sided regular polygon of side $a$, is :

(a) $a \cot\left(\frac{\pi}{n}\right)$ (b) $\frac{a}{2} \cot\left(\frac{\pi}{2n}\right)$

(c) $a \cot\left(\frac{\pi}{2n}\right)$ (d) $\frac{a}{4} \cot\left(\frac{\pi}{2n}\right)$

**21.** If in a triangle $ABC$

$$a \cos^2\left(\frac{C}{2}\right) + c \cos^2\left(\frac{A}{2}\right) = \frac{3b}{2},$$

then the sides $a$, $b$ and $c$ :

(a) are in AP (b) are in GP

(c) are in HP (d) satisfy $a + b = c$

**22.** In a triangle $ABC$, medians $AD$ and $BE$ are drawn. If $AD = 4$, $\angle DAB = \frac{\pi}{6}$ and $\angle ABE = \frac{\pi}{3}$, then the area of the $\Delta ABC$ is :

(a) 8/3 (b) 16/3

(c) 32/3 (d) 64/3

**23.** The trigonometric equation $\sin^{-1} x = 2 \sin^{-1} a$, has a solution for :

(a) $\frac{1}{2} < |a| < \frac{1}{\sqrt{2}}$ (b) all real values of $a$

(c) $|a| < \frac{1}{2}$ (d) $|a| \geq \frac{1}{\sqrt{2}}$

**24.** The upper 3/4th portion of a vertical pole subtends an angle $\tan^{-1} 3/5$ at a point in the horizontal plane through its foot and at a distance 40 m from the foot. A possible height of the vertical pole is :

(a) 20 m (b) 40 m

(c) 60 m (d) 80 m

**25.** The real number $x$ when added to its inverse gives the minimum value of the sum at $x$ equals to :

(a) 2 (b) 1

(c) $-1$ (d) $-2$

**26.** If $f : R \to R$ satisfies $f(x + y) = f(x) + f(y)$, for all $x, y \in R$ and $f(1) = 7$, then $\sum_{r=1}^{n} f(r)$ is :

(a) $\frac{7n}{2}$ (b) $\frac{7(n+1)}{2}$

(c) $7n(n+1)$ (d) $\frac{7n(n+1)}{2}$

**27.** If $f(x) = x^n$, then the value of

$$f(1) - \frac{f'(1)}{1!} + \frac{f''(1)}{2!} - \frac{f'''(1)}{3!} + \ldots + \frac{(-1)^n f^n(1)}{n!}$$ is :

(a) $2^n$ (b) $2^{n-1}$

(c) 0 (d) 1

**28.** Domain of definition of the function $f(x) = \frac{3}{4 - x^2} + \log_{10}(x^3 - x)$, is :

(a) $(1, 2)$

(b) $(-1, 0) \cup (1, 2)$

(c) $(1, 2) \cup (2, \infty)$

(d) $(-1, 0) \cup (1, 2) \cup (2, \infty)$

**29.** $$\lim_{x \to \frac{\pi}{2}} \frac{\left[1 - \tan\left(\frac{x}{2}\right)\right][1 - \sin x]}{\left[1 + \tan\left(\frac{x}{2}\right)\right][\pi - 2x]^3}$$ is :

(a) $\frac{1}{8}$ (b) 0

(c) $\frac{1}{32}$ (d) $\infty$

**30.** If $\lim_{x \to 0} \frac{\log(3 + x) - \log(3 - x)}{x} = k$, the value of $k$ is :

(a) 0 (b) $-1/3$

(c) 2/3 (d) $-2/3$

31. If $f^n(a)$, $g^n(a)$ exist and are not equal for some $n$. Further if $f(a) = g(a) = k$ and $\lim_{x \to a} \frac{f(a)\,g(x) - f(a) - g(a)\,f(x) + g(a)}{g(x) - f(x)} = 4$, then the value of $k$ is equal to :

(a) 4 (b) 2
(c) 1 (d) 0

32. The function $f(x) = \log(x + \sqrt{x^2 + 1})$, is :

(a) an even function
(b) an odd function
(c) a periodic function
(d) neither an even nor an odd function

33. If $f(x) = \begin{cases} xe^{-\left[\frac{1}{|x|} + \frac{1}{x}\right]} & , x \neq 0 \\ 0 & ; x = 0 \end{cases}$ then $f(x)$ is :

(a) continuous as well as differentiable for all $x$
(b) continuous for all $x$ but not differentiable at $x = 0$
(c) neither differentiable nor continuous at $x = 0$
(d) discontinuous everywhere

34. If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, where $a > 0$, attains its maximum and minimum at $p$ and $q$ respectively such that $p^2 = q$, then $a$ equals :

(a) 3 (b) 1
(c) 2 (d) 1/2

35. If $f(y) = e^y$, $g(y) = y; y > 0$ and $F(t) = \int_0^t f(t - y)\,g(y)\,dy$, then :

(a) $F(t) = 1 - e^{-t}(1 + t)$
(b) $F(t) = e^t - (1 + t)$
(c) $F(t) = te^t$
(d) $F(t) = te^{-t}$

36. If $f(a + b - x) = f(x)$, then $\int_a^b x\,f(x)\,dx$ is equal to :

(a) $\frac{a+b}{2} \int_a^b f(b - x)\,dx$
(b) $\frac{a+b}{2} \int_a^b f(x)\,dx$
(c) $\frac{b-a}{2} \int_a^b f(x)\,dx$
(d) $\frac{a+b}{2} \int_a^b f(a + b + x)\,dx$

37. The value of $\lim_{x \to 0} \frac{\int_0^{x^2} \sec^2 t\,dt}{x \sin x}$ is :

(a) 3 (b) 2
(c) 1 (d) –1

38. The value of the integral $I = \int_0^1 x(1 - x)^n\,dx$ is :

(a) $\frac{1}{n+1}$ (b) $\frac{1}{n+2}$
(c) $\frac{1}{n+1} - \frac{1}{n+2}$ (d) $\frac{1}{n+1} + \frac{1}{n+2}$

39. $\lim_{n \to \infty} \frac{1 + 2^4 + 3^4 + \ldots + n^4}{n^5} - \lim_{n \to \infty} \frac{1 + 2^3 + 3^3 + \ldots + n^3}{n^5}$ is :

(a) 1/30 (b) 0
(c) 1/4 (d) 1/5

40. Let $\frac{d}{dx} F(x) = \left(\frac{e^{\sin x}}{x}\right)$, $x > 0$.

If $\int_1^4 \frac{3}{x} e^{\sin x^3}\,dx = F(k) - F(1)$,

then one of the possible values of $k$, is :

(a) 15 (b) 16
(c) 63 (d) 64

41. The area of the region bounded by the curves $y = |x - 1|$ and $y = 3 - |x|$ is :

(a) 2 sq unit (b) 3 sq unit
(c) 4 sq unit (d) 6 sq unit

42. Let $f(x)$ be a function satisfying $f'(x) = f(x)$ with $f(0) = 1$ and $g(x)$ be a function that satisfies $f(x) + g(x) = x^2$. Then the value of the integral $\int_0^1 f(x)\,g(x)\,dx$, is :

(a) $e - \frac{e^2}{2} - \frac{5}{2}$ (b) $e + \frac{e^2}{2} - \frac{3}{2}$
(c) $e - \frac{e^2}{2} - \frac{3}{2}$ (d) $e + \frac{e^2}{2} + \frac{5}{2}$

43. The degree and order of the differential equation of the family of all parabolas whose axis is $x$-axis, are respectively :

(a) 2, 1 (b) 1, 2
(c) 3, 2 (d) 2, 3

44. The solution of the differential equation

$$(1 + y^2) + (x - e^{\tan^{-1} y})\frac{dy}{dx} = 0, \text{ is :}$$

(a) $(x - 2) = ke^{-\tan^{-1} y}$
(b) $2x\,e^{\tan^{-1} y} = e^{2\tan^{-1} y} + k$
(c) $xe^{\tan^{-1} y} = \tan^{-1} y + k$
(d) $xe^{2\tan^{-1} y} = e^{\tan^{-1} y} + k$

45. If the equation of the locus of a point equidistant from the points $(a_1, b_1)$ and $(a_2, b_2)$ is $(a_1 - a_2)x + (b_1 - b_2)y + c = 0$, then the value of '$C$' is :

(a) $\frac{1}{2}(a_2^2 + b_2^2 - a_1^2 - b_1^2)$
(b) $a_1^2 - a_2^2 + b_1^2 - b_2^2$

(c) $\frac{1}{2}(a_1^2 + a_2^2 - b_1^2 + b_2^2)$

(d) $\sqrt{a_1^2 + b_1^2 - a_2^2 - b_2^2}$

**46.** Locus of centroid of the triangle whose vertices are $(a \cos t, a \sin t)$, $(b \sin t, - b \cos t)$ and $(1, 0)$, where $t$ is a parameter, is :

(a) $(3x - 1)^2 + (3y)^2 = a^2 - b^2$

(b) $(3x - 1)^2 + (3y)^2 = a^2 + b^2$

(c) $(3x + 1)^2 + (3y)^2 = a^2 + b^2$

(d) $(3x + 1)^2 + (3y)^2 = a^2 - b^2$

**47.** If the pair of straight lines $x^2 - 2pxy - y^2 = 0$ and $x^2 - 2qxy - y^2 = 0$ be such that each pair bisects the angle between the other pair, then :

(a) $p = q$ (b) $p = -q$

(c) $pq = 1$ (d) $pq = -1$

**48.** A square of side $a$ lies above the $x$-axis and has one vertex at the origin. The side passing through the origin makes an angle $\alpha \left(0 < \alpha < \frac{\pi}{4}\right)$ with the positive direction of $x$-axis. The equation of its diagonal not passing through the origin is :

(a) $y (\cos \alpha - \sin \alpha) - x (\sin \alpha - \cos \alpha) = a$

(b) $y (\cos \alpha + \sin \alpha) + x (\sin \alpha - \cos \alpha) = a$

(c) $y (\cos \alpha + \sin \alpha) + x (\sin \alpha + \cos \alpha) = a$

(d) $y (\cos \alpha + \sin \alpha) + x (\cos \alpha - \sin \alpha) = a$

**49.** If the two circles $(x - 1)^2 + (y - 3)^2 = r^2$ and $x^2 + y^2 - 8x + 2y + 8 = 0$ intersect in two distinct points, then :

(a) $2 < r < 8$ (b) $r < 2$

(c) $r = 2$ (d) $r > 2$

**50.** The lines $2x - 3y = 5$ and $3x - 4y = 7$ are diameters of a circle having area as 154 sq unit. Then the equation of the circle is :

(a) $x^2 - y^2 + 2x - 2y = 62$

(b) $x^2 + y^2 + 2x - 2y = 47$

(c) $x^2 + y^2 - 2x + 2y = 47$

(d) $x^2 + y^2 - 2x + 2y = 62$

**51.** The normal at the point $(bt_1^2, 2bt_1)$ on a parabola meets the parabola again in the point $(bt_2^2, 2bt_2)$, then :

(a) $t_2 = -t_1 - \frac{2}{t_1}$ (b) $t_2 = -t_1 + \frac{2}{t_1}$

(c) $t_2 = t_1 - \frac{2}{t_1}$ (d) $t_2 = t_1 + \frac{2}{t_1}$

**52.** The foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide. Then the value of $b^2$ is :

(a) 1 (b) 5

(c) 7 (d) 9

**53.** A tetrahedron has vertices at $O(0, 0, 0)$, $A(1, 2, 1)$, $B(2, 1, 3)$ and $C(-1, 1, 2)$. Then the angle between the faces $OAB$ and $ABC$ will be :

(a) $\cos^{-1}\left(\frac{19}{35}\right)$ (b) $\cos^{-1}\left(\frac{17}{31}\right)$

(c) 30° (d) 90°

**54.** The radius of the circle in which the sphere $x^2 + y^2 + z^2 + 2x - 2y - 4z - 19 = 0$ is cut by the plane $x + 2y + 2z + 7 = 0$ is :

(a) 1 (b) 2

(c) 3 (d) 4

**55.** The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if :

(a) $k = 0$ or $-1$ (b) $k = 1$ or $-1$

(c) $k = 0$ or $-3$ (d) $k = 3$ or $-3$

**56.** The two lines $x = ay + b, z = cy + d$ and $x = a'y + b', z = c'y + d'$ will be perpendicular, if and only if :

(a) $aa' + bb' + cc' + 1 = 0$

(b) $aa' + bb' + cc' = 0$

(c) $(a + a')(b + b') + (c + c') = 0$

(d) $aa' + cc' + 1 = 0$

**57.** The shortest distance from the plane $12x + 4y + 3z = 327$ to the sphere $x^2 + y^2 + z^2 + 4x - 2y - 6z = 155$ is :

(a) 26 (b) $11\frac{4}{13}$

(c) 13 (d) 39

**58.** Two systems of rectangular axes have the same origin. If a plane cuts them at distances $a, b, c$ and $a', b', c'$ from the origin, then :

(a) $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} + \frac{1}{a'^2} + \frac{1}{b'^2} + \frac{1}{c'^2} = 0$

(b) $\frac{1}{a^2} + \frac{1}{b^2} - \frac{1}{c^2} + \frac{1}{a'^2} + \frac{1}{b'^2} - \frac{1}{c'^2} = 0$

(c) $\frac{1}{a^2} - \frac{1}{b^2} - \frac{1}{c^2} + \frac{1}{a'^2} - \frac{1}{b'^2} - \frac{1}{c'^2} = 0$

(d) $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} - \frac{1}{a'^2} - \frac{1}{b'^2} - \frac{1}{c'^2} = 0$

59. $\vec{a}, \vec{b}, \vec{c}$ are three vectors, such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, $|\vec{a}|=1$, $|\vec{b}|=2$, $|\vec{c}|=3$, then $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$ is equal to :

(a) 0 (b) −7
(c) 7 (d) 1

60. If $\vec{u}$, $\vec{v}$ and $\vec{w}$ are three non-coplanar vectors, then $(\vec{u}+\vec{v}-\vec{w})\cdot[(\vec{u}-\vec{v})\times(\vec{v}-\vec{w})]$ equals :

(a) 0 (b) $\vec{u}\cdot\vec{v}\times\vec{w}$
(c) $\vec{u}\cdot\vec{w}\times\vec{v}$ (d) $3\vec{u}\cdot\vec{v}\times\vec{w}$

61. Consider points $A, B, C$ and $D$ with position vectors $7\hat{i}-4\hat{j}+7\hat{k}$, $\hat{i}-6\hat{j}+10\hat{k}$, $-\hat{i}-3\hat{j}+4\hat{k}$ and $5\hat{i}-\hat{j}+5\hat{k}$ respectively. Then $ABCD$ is a :

(a) square
(b) rhombus
(c) rectangle
(d) parallelogram but not a rhombus

62. The vectors $\vec{AB}=3\hat{i}+4\hat{k}$, and $\vec{AC}=5\hat{i}-2\hat{j}+4\hat{k}$ are the sides of a triangle $ABC$. The length of the median through $A$ is :

(a) $\sqrt{18}$ (b) $\sqrt{72}$
(c) $\sqrt{33}$ (d) $\sqrt{288}$

63. A particle acted on by constant forces $4\hat{i}+\hat{j}-3\hat{k}$ and $3\hat{i}+\hat{j}-\hat{k}$ is displaced from the point $\hat{i}+2\hat{j}+3\hat{k}$ to the point $5\hat{i}+4\hat{j}+\hat{k}$. The total work done by the forces is :

(a) 20 unit (b) 30 unit
(c) 40 unit (d) 50 unit

64. Let $\vec{u}=\hat{i}+\hat{j}$, $\vec{v}=\hat{i}-\hat{j}$ and $\vec{w}=\hat{i}+2\hat{j}+3\hat{k}$. If $\hat{n}$ is a unit vector such that $\vec{u}\cdot\hat{n}=0$ and $\vec{v}\cdot\hat{n}=0$, then $|\vec{w}\cdot\hat{n}|$ is equal to :

(a) 0 (b) 1
(c) 2 (d) 3

65. The median of a set of 9 distinct observations is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set :

(a) is increased by 2
(b) is decreased by 2
(c) is two times the original median
(d) remains the same as that of the original set

66. In an experiment with 15 observations on $x$, the following results were available

$$\Sigma x^2 = 2830,\ \Sigma x = 170.$$

One observation that was 20, was found to be wrong and was replaced by the correct value 30. Then the corrected variance is :

(a) 78.00 (b) 188.66
(c) 177.33 (d) 8.33

67. Five horses are in a race. Mr. $A$ selects two of the horses at random and bets on them. The probability that Mr. $A$ selected the winning horse, is :

(a) $\frac{4}{5}$ (b) $\frac{3}{5}$
(c) $\frac{1}{5}$ (d) $\frac{2}{5}$

68. Events $A, B, C$ are mutually exclusive events such that $P(A)=\frac{3x+1}{3}$, $P(B)=\frac{1-x}{4}$ and $P(C)=\frac{1-2x}{2}$. The set of possible values of $x$ are in the interval :

(a) $\left[\frac{1}{3}, \frac{1}{2}\right]$ (b) $\left[\frac{1}{3}, \frac{2}{3}\right]$
(c) $\left[\frac{1}{3}, \frac{13}{3}\right]$ (d) $[0, 1]$

69. The mean and variance of a random variable $X$ having a binomial distribution are 4 and 2 respectively, then $P(X=1)$ is :

(a) $\frac{1}{32}$ (b) $\frac{1}{16}$
(c) $\frac{1}{8}$ (d) $\frac{1}{4}$

70. The resultant of forces $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If $\vec{Q}$ is doubled, then $\vec{R}$ is doubled. If the direction of $\vec{Q}$ is reversed, then $\vec{R}$ is again doubled, then $P^2 : Q^2 : R^2$ is :

(a) 3 : 1 : 1 (b) 2 : 3 : 2
(c) 1 : 2 : 3 (d) 2 : 3 : 1

71. Let $R_1$ and $R_2$ respectively be the maximum ranges up and down an inclined plane and $R$ be the maximum range on the horizontal plane. Then $R_1, R, R_2$ are in :

(a) arithmetico-geometric progression (AGP)
(b) AP
(c) GP
(d) HP

72. A couple is of moment $\vec{G}$ and the force forming the couple is $\vec{P}$. If $\vec{P}$ is turned through a right angle, the moment of the couple thus formed is $\vec{H}$. If instead, the forces $\vec{P}$ is turned through an angle $\alpha$, then the moment of couple becomes :

(a) $\vec{G}\sin\alpha - \vec{H}\cos\alpha$

(b) $\vec{H}\cos\alpha + \vec{G}\sin\alpha$

(c) $\vec{G}\cos\alpha + \vec{H}\sin\alpha$

(d) $\vec{H}\sin\alpha - \vec{G}\cos\alpha$

**73.** Two particles start simultaneously from the same point and move along two straight lines, one with uniform velocity $\vec{u}$ and the other from rest with uniform acceleration $\vec{f}$. Let $\alpha$ be the angle between their directions of motion. The relative velocity of the second particle w.r.t. the first is least after a time :

(a) $\frac{u\sin\alpha}{f}$ (b) $\frac{f\cos\alpha}{u}$

(c) $u\sin\alpha$ (d) $\frac{u\cos\alpha}{f}$

**74.** Two stones are projected from the top of a cliff $h$ metres high, with the same speed $u$ so as to hit the ground at the same spot. If one of the stones is projected horizontally and the other is projected at an angle $\theta$ to the horizontal, then $\tan\theta$ equals :

(a) $\sqrt{\frac{2u}{gh}}$ (b) $2g\sqrt{\frac{u}{h}}$

(c) $2h\sqrt{\frac{u}{g}}$ (d) $u\sqrt{\frac{2}{gh}}$

**75.** A body travels a distance $s$ in $t$ seconds. It starts from rest and ends at rest. In the first part of the journey, it moves with constant acceleration $f$ and in the second part with constant retardation $r$. The value of $t$ is given by :

(a) $2s\left(\frac{1}{f}+\frac{1}{r}\right)$ (b) $\frac{2s}{\frac{1}{f}+\frac{1}{r}}$

(c) $\sqrt{2s(f+r)}$ (d) $\sqrt{2s\left(\frac{1}{f}+\frac{1}{r}\right)}$

# ANSWERS

## PHYSICS AND CHEMISTRY

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | (b) | 2. | (a) | 3. | (b) | 4. | (a) | 5. | (d) | 6. | (a) | 7. | (a) | 8. | (d) |
| 9. | (c) | 10. | (b) | 11. | (a) | 12. | (c) | 13. | (c) | 14. | (d) | 15. | (c) | 16. | (a) |
| 17. | (a) | 18. | (c) | 19. | (c) | 20. | (b) | 21. | (c) | 22. | (d) | 23. | (d) | 24. | (b) |
| 25. | (d) | 26. | (a) | 27. | (d) | 28. | (c) | 29. | (c) | 30. | (b) | 31. | (d) | 32. | (a) |
| 33. | (c) | 34. | (c) | 35. | (c) | 36. | (a) | 37. | (c) | 38. | (d) | 39. | (a) | 40. | (d) |
| 41. | (c) | 42. | (a) | 43. | (d) | 44. | (a) | 45. | (b) | 46. | (a) | 47. | (a) | 48. | (b) |
| 49. | (b) | 50. | (c) | 51. | (c) | 52. | (d) | 53. | (b) | 54. | (d) | 55. | (c) | 56. | (b) |
| 57. | (b) | 58. | (a) | 59. | (c) | 60. | (a) | 61. | (d) | 62. | (b) | 63. | (c) | 64. | (a) |
| 65. | (a) | 66. | (b) | 67. | (a) | 68. | (d) | 69. | (b) | 70. | (c) | 71. | (c) | 72. | (a) |
| 73. | (b) | 74. | (d) | 75. | (d) | 76. | (b) | 77. | (a) | 78. | (b) | 79. | (a) | 80. | (b) |
| 81. | (b) | 82. | (c) | 83. | (d) | 84. | (d) | 85. | (b) | 86. | (c) | 87. | (a) | 88. | (b) |
| 89. | (d) | 90. | (b) | 91. | (c) | 92. | (c) | 93. | (c) | 94. | (b) | 95. | (c) | 96. | (b) |
| 97. | (b) | 98. | (c) | 99. | (b) | 100. | (c) | 101. | (a) | 102. | (b) | 103. | (c) | 104. | (a) |
| 105. | (d) | 106. | (a) | 107. | (d) | 108. | (d) | 109. | (c) | 110. | (b) | 111. | (a) | 112. | (c) |
| 113. | (d) | 114. | (b) | 115. | (b) | 116. | (c) | 117. | (a) | 118. | (c) | 119. | (a) | 120. | (b) |
| 121. | (b) | 122. | (a) | 123. | (d) | 124. | (b) | 125. | (b) | 126. | (b) | 127. | (a) | 128. | (d) |
| 129. | (c) | 130. | (a) | 131. | (b) | 132. | (b) | 133. | (c) | 134. | (c) | 135. | (d) | 136. | (b) |
| 137. | (a) | 138. | (d) | 139. | (a) | 140. | (c) | 141. | (a) | 142. | (b) | 143. | (c) | 144. | (a) |
| 145. | (a) | 146. | (d) | 147. | (d) | 148. | (c) | 149. | (d) | 150. | (c) | | | | |

## MATHEMATICS

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | (c) | 2. | (c) | 3. | (d) | 4. | (a) | 5. | (b) | 6. | (c) | 7. | (c) | 8. | (b) |
| 9. | (a) | 10. | (b) | 11. | (b) | 12. | (a) | 13. | (a) | 14. | (b) | 15. | (b) | 16. | (c) |
| 17. | (d) | 18. | (a) | 19. | (a) | 20. | (b) | 21. | (a) | 22. | (*) | 23. | (a) | 24. | (b) |
| 25. | (c) | 26. | (d) | 27. | (c) | 28. | (d) | 29. | (c) | 30. | (c) | 31. | (a) | 32. | (b) |
| 33. | (b) | 34. | (c) | 35. | (b) | 36. | (b) | 37. | (c) | 38. | (c) | 39. | (d) | 40. | (d) |
| 41. | (c) | 42. | (c) | 43. | (b) | 44. | (b) | 45. | (a) | 46. | (b) | 47. | (d) | 48. | (d) |
| 49. | (a) | 50. | (c) | 51. | (a) | 52. | (c) | 53. | (a) | 54. | (c) | 55. | (c) | 56. | (d) |
| 57. | (c) | 58. | (d) | 59. | (b) | 60. | (b) | 61. | (*) | 62. | (c) | 63. | (c) | 64. | (d) |
| 65. | (d) | 66. | (a) | 67. | (d) | 68. | (a) | 69. | (a) | 70. | (b) | 71. | (d) | 72. | (c) |
| 73. | (d) | 74. | (d) | 75. | (d) | | | | | | | | | | |

(*) No option is correct in question paper.