1. TRIGONOMETRIC RATIOS

1. For $0 < \phi < < \pi/2$, if $x = \sum_{n=0}^{\infty} \cos^{2n}$, $y = \sum_{n=0}^{\infty} \sin^{2n} \phi$, $z = \sum_{n=0}^{\infty} \cos^{2n} \phi \sin^{2n} \phi$, then

(a) $xyz = xz + y$ (b*) $xyz = xy + z$ (c) $xyz = yz + x$ (d) None of these

2. If $K = \sin(\pi/18)\sin(5\pi/18)\sin(7\pi/18)$, then the numerical value of K is

(a*) 1/8 (b) 1/16 (c) 1/2 (d) None of these

3. If $A > 0$, $B > 0$ and $A = B = \pi/3$, then the maximum value of $\tan A \tan B$ is

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

4. The expression

$3\left[\sin^4\left(\frac{3\pi}{2}-\alpha\right)+\sin^4(3\pi-\alpha)\right] -2\left[\sin^6\left(\frac{\pi}{2}+\alpha\right)+\sin^6(5\pi-\alpha)\right]$ is equal to

(a) 0 (b*) 1 (c) 3 (d) $\sin 4\alpha + \cos 6\alpha$

5. $3(\sin x - \cos x)^4 + 6(\sin x + \cos x)^2 + 4(\sin^6 x + \cos^6 x) =$

(a) 11 (b) 12 (c*) 13 (d) 14

6. $\sec^2\theta = \frac{4xy}{(x+y)^2}$ is true, if and only if-

(a) $x + y \neq 0$ (b*) $x = y, x \neq 0$ (c) $x = y$ (d) $x \neq 0, y \neq 0$

7. The number of values of x where the function $f(x) = \cos x + \cos(\sqrt{2}x)$ attains its maximum is-

(a) 0 (b*) 1 (c) 2 (d) Infinite

8. Which of the following number(s) is rational -

(a) sin 15º (b) cos 15º (c*) sin15º cos 15º (d) sin 15º cos 75º

9. Let n be an odd integer. If $\sin n\theta = \sum_{f=0}^{n} b_r \sin^r \theta$ every value of θ, then

(a) $b^0 = 1, b_1 = 3$ (b*) $b_0 = 0, b_1 = n$

(c) $b_0 = -1, b_1 = n$ (d) $b_0 = 0, b_1 = n^2 + 3n = 3$

10. The function $f(x) = \sin^4 x + \cos^4 x$ increases if-

(a) $0 < x < \frac{\pi}{8}$ (b*) $\frac{\pi}{4} < x < \frac{3\pi}{8}$ (c) $\frac{3\pi}{8} < x < \frac{5\pi}{8}$ (d) $\frac{5\pi}{8} < x < \frac{3\pi}{4}$

11. In a triangle PQR, $\angle R = \frac{\pi}{2}$. If $\tan\left(\frac{P}{2}\right)$ and $\tan\left(\frac{Q}{2}\right)$ are the roots of the equation

$Ax^2 = bx + c = 0$ $(a \neq 0)$, then-

(a*) $a + b = 0$ (b) $b + c = a$ (c) $a + c = b$ (d) $b = c$

12. For a positive integer n,

Lot $f_n(\theta) = \left(\tan\frac{\theta}{2}\right)(1 + \sec\theta)(1 + \sec 2\theta)(1 + \text{se } 4\theta)\ldots(1 + \sec 2^n\theta)$. Then-

(a) $f_2\left(\frac{\pi}{16}\right) = 2$ (b*) $f_3\left(\frac{\pi}{32}\right) = 1$ (c) $f_4\left(\frac{\pi}{64}\right) = 0$ (d) None of these

13. Let f (θ) = sin θ (sin θ + sin 3θ). Then f(θ)
(a) ≥ 0 only when θ ≥ 0 (b) ≤ 0 for all real θ
(c*) ≥ 0 for all real θ (d) ≤ 0 only when θ ≤ 0

14. If $\alpha + \beta = \frac{\pi}{2}$ and β + γ = a, then tanα equals-
(a) 2(tanβ + tanγ) (b) tan β + tan γ
(c*) tan β + 2 tan γ (d) 2 tan β + tan γ

15. The maximum value of $(\cos \alpha_1).(\cos \alpha_2)\ldots\ldots\ldots(\cos \alpha_n)$,
Under the restrictions $0 \le \alpha_1, \alpha_{2\ldots}\,\alpha_n \le \frac{\pi}{2}$ and $(\cot \alpha_1).(\cot \alpha_2).(\cot \alpha_3)\ldots\ldots(\cot \alpha_n) = 1$ is
(a*) $\frac{1}{2^{n/2}}$ (b) $\frac{1}{2^n}$ (c) $\frac{1}{2n}$ (d) 1

16. If θ & ϕ are acute angles such that $\sin\theta = \frac{1}{2}$ and $\cos\phi = \frac{1}{3}$ then θ + ϕ lies in-
(a) $\left(\frac{\pi}{3}, \frac{\pi}{2}\right]$ (b*) $\left(\frac{\pi}{2}, \frac{2\pi}{3}\right]$ (c) $\left(\frac{2\pi}{2}, \frac{5\pi}{3}\right)$ (d) $\left(\frac{\pi}{6}\pi\right)$

17. $\cos(\alpha + \beta) = \frac{1}{e}$, cos (α – β) = 1 find no. of ordered pair of (α, β), – π ≥ α, β ≤ π
(a) 0 (b) 1 (c) 2 (d) 4

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ans.	a	a	b	b	c	b	b	c	b	b	a	c	c	c	a	b	d

2. TRIGONOMETRIC EQUATION

1. The number of solutions of the equation tan x + sec x = 2 cos x lying in the interval [0, 2π] is
(a) 0 (b) 1 (c*) 2 (d) 3

2. Let $2\sin^2 x + 3\sin x - 2 > 0$ and $x^2 - x - 2 < 0$ (x is measured in radians). Then x lies in the interval
(a) $\left(\frac{\pi}{6}, \frac{5\pi}{6}\right)$ (b) $\left(-1, \frac{5\pi}{6}\right)$ (c) (– 1, 2) (d*) $\left(\frac{\pi}{6}, 2\right)$

3. The number of all possible triplets (a_1, a_2, a_3) such that
$a_1 + a_2 \cos 2x + a_3 \sin^2 x = 0$ for all x is
(a) 0 (b) 1 (c) 2 (d*) infinite

4. The smallest positive root of the equation tan x – x = 0 lies on
(a) $\left(0, \frac{\pi}{2}\right)$ (b) $\left(\frac{\pi}{2}, \pi\right)$ (c*) $\left(\pi, \frac{3\pi}{2}\right)$ (d) $\left(\frac{3\pi}{2}, 2\pi\right)$

5. General value of θ satisfying equation $\tan^2\theta + \sec 2\theta = 1$ is

(a) $n\pi$ (b) $n\pi + \frac{\pi}{3}$ (c) $n\pi + \frac{\pi}{3}$ (d*) all of these

6. The parameter, on which the value of the determinant

$$\begin{vmatrix} 1 & a & a^2 \\ \cos(p-d)x & \cos px & \cos(p+d)x \\ \sin(p-d)x & \sin px & \sin(p+d)x \end{vmatrix}$$ does not depend upon is

(a)a (b) d (c*) p (d) x

7. The solution set of the system of equations : $x + y = \frac{2\pi}{3}$, $\cos x + \cos y = \frac{3}{2}$, where x and y are real in:

(a) a finite non-empty set (b*) null set
(c) ∞ (d) none of these

8. The number of value of x in the interval $[0, 5\pi]$ satisfying the equation $3\sin^3 x - 7\sin x + 2 = 0$ is
(a) 0 (b) 5 (c*) 6 (d) 10

9. The number of distinct real roots of $\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$ in the interval $[-\pi/4, \pi/4]$ is-

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

10. The number of integral values of k for which the equation $7\cos x + 5\sin x = 2k + 1$ has a solution is-
(a) 4 (b*) 8 (c) 10 (d) 12

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans.	c	d	d	c	d	c	b	c	c	b

3. INVERSE TRIGONOMETRIC FUNCTIONS

1. If $\sin^{-1}x = \frac{\pi}{5}$, $x \in (-1, 1)$, then $\cos^{-1}x =$

(a) $\frac{3\pi}{10}$ (b) $\frac{5\pi}{10}$ (c) $-\frac{3\pi}{10}$ (d) $\frac{9\pi}{10}$

2. $\tan(\cos^{-1} x)$ is equals to-

(a) $\frac{\sqrt{1-x^2}}{x}$ (b) $\frac{x}{1+x^2}$ (c) $\frac{\sqrt{1+x^2}}{x}$ (d) $\sqrt{1-x^2}$

3. If we consider only the principal values of the inverse trigonometric functions, then the value of

$\tan\left(\cos^{-1}\frac{1}{5\sqrt{2}} - \sin^{-1}\frac{4}{\sqrt{17}}\right)$ is

(a) $\frac{\sqrt{29}}{3}$ (b) $\frac{29}{3}$ (c) $\frac{\sqrt{3}}{29}$ (d) $\frac{3}{29}$

4. The number of real solution of $\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$ is-

(a) Zero (b) One (c) Two (d) Infinite

5. If $\sin^{-1}\left(x^2 - \frac{x^4}{2} + \frac{x^6}{4} - ....\right) = \frac{\pi}{2}$ for $0 < |x| < \sqrt{2}$, then x equals

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

6. For which value of x, $\sin(\cos^{-1}(x + 1)) = \cos(\tan^{-1}x)$

(a) 1/2 (b) 0 (c) 1 (d) –1/2

ANSWER KEY

Q.No.	**1**	**2**	**3**	**4**	**5**	**6**
Ans.	a	a	d	c	b	d

4. PROPERTIES OF TRIANGLE

1. If in a triangle ABC $\frac{2\cos A}{a} + \frac{\cos B}{b} + \frac{2\cos C}{c} = \frac{a}{bc} + \frac{b}{ca}$ then the value of the angle A.

(a) π/3 (b) π (c*) π /2 (d) π /6

2. In a ΔABC, if $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$ and the side a = 2, then are a of the triangle is

(a) 1 (b) 2 (c) $\frac{\sqrt{3}}{2}$ (d*) $\sqrt{3}$

3. In a Δ ABC, AD is the altitude from A. Given b > c, ∠ C = 23° and AD = $\frac{abc}{b^2 - c^2}$, then ∠ B.

(a) 67° (b*) 113° (c) 157° (d) None of these

4. The sides of a triangle inscribed in a given circle subtend angles α, β, γ at the centre. The minimum value of the A.M. of $\cos\left(\alpha + \frac{\pi}{2}\right)$, $\cos\left(\beta + \frac{\pi}{2}\right)$ and $\cos\left(\gamma + \frac{\pi}{2}\right)$ is equal to

(a) $\frac{\sqrt{3}}{2}$ (b*) $-\frac{\sqrt{3}}{2}$ (c) $-\frac{2}{\sqrt{3}}$ (d) $\sqrt{2}$

5. In a triangle ABC, ∠ B = $\frac{\pi}{3}$ and ∠ C = $\frac{\pi}{4}$, Let D divide BC internally in the ratio 1 : 3 Then $\frac{\sin \angle BAD}{\sin \angle CAD}$ equal to

(a*) $\frac{1}{\sqrt{6}}$ (b) $\frac{1}{3}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\sqrt{\frac{2}{3}}$

6. There exists at triangle ABC satisfying the conditions:

(a*) b sin A = a, A < $\frac{\pi}{2}$ or b sin A < a, A < $\frac{\pi}{2}$, b > a (b) b sin A > a, A < $\frac{\pi}{2}$

(c) b sin A > a, A < $\frac{\pi}{2}$ (d) None of these

7. If in a triangle PQR, sin P, sin Q and sin R are in A.P., then
(a) the altitudes are in A.P. (b*) the altitudes are in H.P.
(c) the medians are in G.P. (d) the medians are in A.P.

8. If the radius of circumcircle of an isosceles triangle PQR is equal to PQ (= PR), then the angle P is
(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d*) $\frac{2\pi}{3}$

9. If the vertices P, Q, R of a triangle PQR and rational points, then which of the following points of the triangle PQR is (are) always rational point(s) ?
(a*) Centroid (b) Incentre (c) Circumecentre (d) orthocentre

10. In a triangle PQR, $\angle R = \frac{\pi}{2}$. If tan $\left(\frac{P}{2}\right)$ and tan $\left(\frac{Q}{2}\right)$ are the roots of the equation $ax^2 + bx + c = 0$ $(a \neq 0)$, then
(a*) a + b = c (b) b + c = a (c) a + c = b (d) b = c

11. In a ΔABC, 2ac sin $\left(\frac{A-B+C}{2}\right)$ =
(a) $a^2 + b^2 - c^2$ (b*) $c^2 + a^2 - b^2$ (c) $b^2 - c^2 - a^2$ (d) $c^2 - a^2$ 0$- b^2$

12. If the angles of a triangle are in ratio 4 : 1 : 1 then the ratio of the longest side and perimeter of triangle is :
(a) $\frac{1}{2+\sqrt{3}}$ (b) $\frac{2}{\sqrt{3}-2}$ (c*) $\frac{\sqrt{3}}{2+\sqrt{3}}$ (d) none of these

13. Of the sides a, b, c of a triangle are such that a : b : c : : 1 : $\sqrt{3}$: 2, them A : B : C is-
(a) 3 : 2 : 1 (b) 3 : 1 : 2 (c) 1 : 3 : 2 (d*) 1 : 2 : 3

14. In any ΔABC having sides a, b, c opposite to angles A, B, C respectively, then-
(a*) a sin $\left(\frac{B-C}{2}\right)$ = (b – c) cos $\frac{A}{2}$ (b) a cos $\frac{A}{2}$ = (b – c) sin $\frac{B-C}{2}$
(c) a cos $\frac{A}{2}$ = (b + c) sin $\frac{B+C}{2}$ (d) a sin $\frac{B+C}{2}$ = (b + c) cos $\frac{A}{2}$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ans.	c	d	b	b	a	a	b	d	a	A	b	c	d	a

5. RADII OF CIRCLE

1. A regular polygon of nine sides, each of length 2 is inscribed in a circle. The radius of the circle is:
(a*) cosec $\left(\frac{\pi}{9}\right)$ (b) cosec $\left(\frac{\pi}{3}\right)$ (c) cot $\left(\frac{\pi}{9}\right)$ (d) tan $\left(\frac{\pi}{9}\right)$

2. In a triangle ABC, a : b : c = 4 : 5 : 6. The ratio of the radius of the circumcircle to that of the incircle is
(a*) 16/7 (b) 7/16 (c) 16/3 (d) none of these

3. Let $A_0A_1A_2A_3A_4A_5$ be a regular hexagon inscribed in a circle of unit radius. Then the product of the lengths of the line segments A_0A_1, A_0A_2, and A_0A_4 is-
(a) 3/4 (b) $3\sqrt{3}$ (c*) 3 (d) $3\sqrt{3}/2$

4. In a triangle ABC, let $\angle C = \frac{\pi}{2}$. If r is the in radius and R is the circumradius of the triangle, then 2(r + R) is equal to-
(a*) a + b (b) b + c (c) c + a (d) a + b + c

5. Which of the following pieces of data does **NOT** uniquely determine an acute angled triangle ABC (R being the radius of the circumcircle)-
(a) a, sin A, sin B (b) a, b, c
(c) a, sin B, R (d*) a, sin A, R

6. In any equilateral Δ, three circles of radii one are touching to the sides given as in the figure then area of the Δ
(a*) $6+4\sqrt{3}$ (b) $12+8\sqrt{3}$
(c) $7+4\sqrt{3}$ (d) $4+\frac{7}{2}\sqrt{3}$

ANSWER KEY

Q.No.	1	2	3	4	5	6
Ans.	a	a	c	a	d	a

6. COMPLEX NUMBER

1. The equation not representing a circle is given by-
(a) $R_e\left(\frac{1+z}{1-z}\right) = 0$ (b) $z\bar{z} + iz - i\bar{z} + 1 = 0$
(c) are $\left(\frac{z-1}{z+1}\right) = \frac{\pi}{2}$ (d*) $\left|\frac{z-1}{z+1}\right| = 1$

2. If z is a complex number such that z ≠ 0 and $R_e(z) = 0$, then-
(a) $R_e(z^2) = 0$ (b*) $I_m(z^2) = 0$ (c) $R_e(z^2) = I_m(z^2)$ (d) none of these

3. If α and β are different complex numbers with |β| = 1, then $\left|\frac{\beta-\alpha}{1-\alpha\beta}\right|$ is equal to-
(a) 0 (b) 1/2 (c*) 1 (d) 2

4. The smallest positive integer n for which $(1 + i)^{2n} = (1 - i)^{2n}$ is -
(a) 4 (b) 9 (c*) 2 (d) 12

5. If β and β are two fixed non-zero complex numbers and 'z' a variable complex number. If the lines $\alpha\bar{z} + \bar{\alpha}z + 1 = 0$ and $\beta\bar{z} + \bar{\beta}z - 1 = 0$ are mutually perpendicular, then-
(a) $\alpha\beta + \bar{\alpha}\bar{\beta} = 0$ (b) $\alpha\beta - \bar{\alpha}\bar{\beta} = 0$ (c) $\bar{\alpha}\beta - \alpha\bar{\beta} = 0$ (d*) $\alpha\bar{\beta} + \bar{\alpha}\beta = 0$

6. If $z_1 = 8 + 4i$, $z_2 = 6 + 4i$ and arg $\left(\frac{z - z_1}{z - z_2}\right) = \frac{\pi}{4}$, then z satisfies-

(a) $|z - 7 - 4i| = 1$ (b*) $|z - 7 - 5i| = \sqrt{2}$

(c) $|z - 4i| = 8$ (d) $|z - 7i| = \sqrt{3}$

7. If ω is an imaginary cube root of unity, then the value of sin $\left[(\omega^{10} + \omega 23)\pi - \frac{\pi}{4}\right]$ is-

(a) $-\frac{\sqrt{3}}{2}$ (b) $-\frac{1}{\sqrt{2}}$ (c*) $\frac{1}{\sqrt{2}}$ (d) $\frac{\sqrt{3}}{2}$

8. If z_1, z_2, z_3 are vertices of an equilateral triangle inscribed in the circle $|z| = 2$ and If $z_1 = 1 + I\sqrt{3}$, then-

(a*) $z_2 = -2, z_3 = 1 - i\sqrt{3}$ (b) $z_2 = 2, z_3 = 1 - i\sqrt{3}$

(c) $z_2 = -2, z_3 = -i\sqrt{3}$ (d) $z_2 = -1 - i\sqrt{3}$, $z_3 = -1 - I\sqrt{3}$ +

9. If ω (≠ 1) is a cube root of unity and $(1 + \omega)^7 = A + B\omega$, then A & b are respectively the numbers

(a) 0 , 1 (b*) 1, 1 (c) 1. 0 (d) –1, 1

10. Let z & ω be two non zero compelx numbers such that $|z| = |\omega|$ and Arg z + Arg ω = π, then z equal:

(a) ω (b) – ω (c) $\overline{\omega}$ (d*) $-\overline{\omega}$

11. Let z & ω be two complex numbers such that $|z| \le 1$, $|\omega| \le 1$ and $|z + i\omega| = |z - i\overline{\omega}| = 2$, then z equals:

(a) 1 or i (b) i or – i (c*) 1 or –1 (d) i or – 1

12. If (ω ≠ 1) is a cube root of unity then

$$\begin{vmatrix} 1 & 1+i+\omega^2 & \omega^2 \\ 1-i & -1 & \omega^2-1 \\ -i & -i+\omega-1 & -1 \end{vmatrix} =$$

(a*) 0 (b) 1 (c) (d) ω

13. The value of the expression $1.(2 - \omega).(2 - \omega^2) + 2.(3 - \omega)(3 - \omega^2) + \ldots\ldots\ldots + (n - 1)(n - \omega)(n - \omega^2)$, where ω is an imaginary cube root of unity is-

(a) $\left(\frac{n(n+1)}{2}\right)^2$ (b*) $\left(\frac{n(n+1)}{2}\right)^2 - n$

(c) $\left(\frac{n(n+1)}{2}\right)^2 + n$ (d) none of the above

14. $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix} = x + iy$, then

(a) x = 3, y = 1 (b) x = 1, y = 3 (c) x = 0, y = 3 (d*) x = 0, y = 0

15. If ω is an imaginary cube root of unity, then $(1 + \omega - \omega^2)^7$ equals

(a) 128 ω (b) – 128 ω (c) $128\,\omega^2$ (d*) $-128\,\omega^2$

16. The value of the sum $\sum_{n=1}^{13}(i^n + i^{n+1})$, where = $\sqrt{-1}$ equals

(a) i (b*) i – 1 (c) – i (d) = 0

17. If I = $\sqrt{-1}$, then 4 + 5 $\left(-\frac{1}{2}+\frac{-\sqrt{3}}{2}\right)^{334}$ + 3 $\left(-\frac{1}{2}+\frac{\sqrt{3}}{2}\right)^{365}$ is equal to

(a) 1 – i $\sqrt{3}$ (b) – 1 + I $\sqrt{3}$ (c*) i $\sqrt{3}$ (d) – i $\sqrt{3}$

18. If z_1, z_2, z_3 are complex numbers such that $|z_1| = |z_2| = |z_3| = \left|\frac{1}{z_1}+\frac{1}{z_2}+\frac{1}{z_3}\right| = 1$, then $|z_1 + z_2 + z_3|$ is-

(a*) equal to 1 (b) less than 1 (c) greater than 3 (d) equal to 3

19. If arg (z) < 0, then arg (–z)–arg(z) =

(a*) π (b) $-\pi$ (c) $-\frac{\pi}{2}$ (d) $\frac{\pi}{2}$

20. The complex numbers z_1, z_2 and z_3 satisfying $\frac{z_1 - z_3}{z_2 - z_3} = \frac{1 - i\sqrt{3}}{2}$ are the vertices of a triangles which is

(a) of area zero (b) right angled isosceles
(c*) equilateral (d) obtuse angled isosceles

21. If z_1 and z_2 be the nth roots of unity which subtend right angle at the origin. Then n must be of the form
(a) 4 k + 1 (b) 4k + 2 (c) 4k + 3 (d*) 4k

22. For all complex numbers z_1, z_2 satisfying $|z_1| = 12$ and $|z_3 – 3 – 4i| = 5$, then minimum value of $|z_1 – z_2|$ is -
(a) 0 (b*) 2 (c) 7 (d) 17

23. Let $\omega = – 1/2 + i\sqrt{3}/2$. Then the value of the determinant $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1-\omega^2 & \omega^2 \\ 1 & \omega^2 & \omega^4 \end{vmatrix}$ is -

(a) 3ω (b*) $3\omega(\omega - 1)$ (c) $3\omega^2$ (d) $3\omega(1 – \omega)$

24. If |z| = 1, z ≠ – 1 and w = $\frac{z-1}{z+1}$ then real part of w = ?

(a) $\frac{-1}{|z+1|^2}$ (b) $\frac{1}{|z+1|^2}$ (c) $\frac{2}{|z+1|^2}$ (d*) 0

25. If ω is cube root of unity (ω ≠ 1) then the least value of n, where n is positive integer such that $(1 \ \omega^2)^n = (1 + \omega^4)^n$ is
(a) 2 (b*) 3 (c) 2 (d) 3

26. a, b, c are variable integers not all equal and w ≠ 1, w is cube root of unity, then minimum value of x = $|z + bw + cw^2|$ is
(a) 0 (b*) 1 (c) 2 (d) 3

27. Four points P(–1, 0) Q (1, 0), R ($\sqrt{2}$ – 1, $\sqrt{2}$), S ($\sqrt{2}$ – 1, – $\sqrt{2}$) are given on a complex plane then equation of the locus of the shaded region excluding the boundaries

(a*) $|z + 1| > 2$ & $\arg(z + 1) < \frac{\pi}{4}$ (b) $|z + 1| > 2$ &$|\arg(2 + 1)| < \frac{\pi}{2}$

(c) $|z - 1| > 2$ & $|\arg(z - 1)| < \frac{\pi}{4}$ (d) $|z - 1| > 2$ &$|\arg(2 - 1)| < \frac{\pi}{2}$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	d	b	c	c	d	b	c	a	b	d	c	a	b	d	d

Q.No.	16	17	18	19	20	21	22	23	24	25	26	27
Ans.	b	c	a	a	c	d	b	b	d	b	b	a

7. PROGRESSIONS

1. Let a_n be n^{th} term of the G.P. of positive numbers. Let $\sum_{n=1}^{100} a_{2n} = \alpha$ and $\sum_{n=1}^{100} a_{2n-1} = \beta$, such that $\alpha \neq \beta$ then the common ratio is-

(a*) α/β (b) β/α (c*) $\sqrt{(\alpha/\beta)}$ (d) $\sqrt{(\beta/\alpha)}$

2. If the sum of first n natural numbers is 1/5 times the sum of their squares, then the value of n is-

(a) 5 (b) 6 (c*) 7 (d) 8

3. If ratio of H.M. and G.M. between two positive numbers a and b (a > b) is 4 : 5, then a : 5, then a : b is -

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

4. If f(x) is a function satisfying f(x + y) = f(x) f(y) for all x, y $\in$ N such that f(1) = 3 and $\sum_{x=1}^{n} f(x) = 120$,Then the value of n is-

(a*) 4 (b) 5 (c) 6 (d) None of these

5. $\log_3 2$, $\log_6 2$ and $\log_{12} 2$ are in-

(a) A.P. (b) G.P. (c*) H.P. (d) None of these

6. For $0 < \phi < \pi/2$ if $x = \sum_{n=0}^{\infty} \cos^{2n}\phi$, $y = \sum_{n=0}^{\infty} \sin^{2n}\phi$; $z = \sum_{n=0}^{\infty} \cos^{2n}\phi \sin^{2n}\phi$, the-

(a) xyz = xz + y (b*) zyz = xy + z (c) xyz = yz + x (d) None of these

7. If $\ell n(a + c)$, $\ell n(c - a)$, $\ell n(a - 2b + c)$ are in A.P., then-

(a) a, b, c are in A.P. (b) a^2, b^2, c^2 are in A.P.

(c) a, b, c are in G.P. (d*) a, b, c are in H.P.

8. For a real number x,[x], denotes the integral part of x. The value of

$\left[\frac{1}{2}\right] + \left[\frac{1}{2} + \frac{1}{100}\right] + \left[\frac{1}{2} + \frac{2}{100}\right] + ... + \left[\frac{1}{2} + \frac{99}{100}\right]$ is

(a) 49 (b*) 50 (c) 48 (d) 51

9. If the sum of n terms of an AlP. Is nP + $\frac{1}{2}$ n (n – 1) Q then its common difference is-

(a) P + Q (b) 2P + 3Q (c) 2Q (d*) Q

10. If p,q, r in A.P. and are positive, the roots of the quadratic equation $px^2 + qx + r = 0$ are all real for-

(a*) $\left|\frac{r}{p} - 7\right| \geq \sqrt{3}$ (b) $\left|\frac{p}{r} - 7\right| < 4\sqrt{3}$

(c) all p and r (d) No. p and r

11. If cos (x – y), cos x and cos (x + y) are in H.P., then cos x sec (y/2) equals-

(a) 1 (b) 2 (c*) $\sqrt{2}$ (d) None of these

12. If x be the AM and y,z be two GM's between two positive numbers, then $\frac{y^3 + z^3}{xyz}$ is equal to-

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

13. Let T_r be the rth term of an A.P., for r = 1, 2, 3,……..if for some positive integers m, n we have $T_m = \frac{1}{n}$ and $T_n = \frac{1}{m}$, then T_{mn} equals-

(a) $\frac{1}{mn}$ (b) $\frac{1}{m} + \frac{1}{n}$ (c*) 1 (d) 0

14. If x > 1, y > 1, z > 1 are in G.P., then $\frac{1}{1+\ell nx}, \frac{1}{1+\ell ny}, \frac{1}{1+\ell n\ z}$ are in-

(a) A.P. (b) H.P. (c*) G.P. (d) None of these

15. Let $a_1, a_2, \ldots a_{10}$ be in A.P. and $h_1, h_2, \ldots h_{10}$ be in H.P. If $a_1 = h_1 = 2$ and $a_{10} = h_{10} = 3$, then $a_4 h_7$ is-

(a) 2 (b) 3 (c) 5 (d*) 6

16. The harmonic mean of the root of the equation $\left(5+\sqrt{2}\right)x^2 - \left(4+\sqrt{5}\right)x + 8 + \sqrt{5} = 0$ is-

(a) 2 (b*) 4 (c) 6 (d) 8

17. If x_1, x_2, x_3 as well as y_1, y_2, y_3 and in G.P. 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

18. The sum of the integers from 1 to 100 which are not divisible by 3 or 5 is-

(a) 2489 (b) 4735 (c) 2317 (d*) 2632

19. Consider an infinite geometric series with first term a and common ratio r. If its sum is 4 and the second term is $\frac{3}{4}$, then-

(a) $a = \frac{7}{4}, r = \frac{3}{7}$ (b) $a = 2, r = \frac{3}{8}$

(c) $a = \frac{3}{2}, r = \frac{1}{2}$ (d*) $a = 3, r = \frac{1}{4}$

20. Let α, β be the roots of $x^2 - x + p = 0$ and γ, δ be the roots of $x^2 - 4x + q = 0$. If α, β, γ, δ are in G.P., then the integral values of p and q respectively, are-

(a*) –2, – 32 (b) – 2, 3 (c) – 6, 3 (d) – 6,–32

21. Let the positive numbers a, b, c, d be in A.P. Then abc, abd, acd, bcd are-
(a) Not in A.P./G.P./H.P. (b) in A.P.
(c) in G.P. (d*) in H.P.

22. If the sum of the first 2n terms of the A.P. 2, 5, 8,….. is equal to the sum of the first n terms of the A.P. 57, 59, 61,….. then n equals-
(a) 10 (b) 12 (c*) 11 (d) 13

23. If $a_1, a_2, \ldots\ldots, a_n$ are positive real numbers whose product is a fixed number c, then the minimum value of $a_1 + a_2 + \ldots\ldots\ldots + a_{n-1} + a_n$ is-
(a*) $n\,(c)^{1/n}$ (b) $(n + 1)c^{1/n}$ (c) $2nc^{1/n}$ (d) $(n + 1)\,(2n)^{1/n}$

24. An infinite G.P., with first term x & sum of the series is 5 then-
(a) $x \geq 10$ (b*) $0 < x < 10$ (c) $x < -10$ (d) $-10 < c < 0$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	a	c	c	a	c	b	d	b	d	a	c	b	c	b	d

Q.No.	16	17	18	19	20	21	22	23	24
Ans.	b	a	d	d	a	d	c	a	b

8. PERMUTATION & COMBINATION

1. If n is an integer between 0 an d21; then the minimum value of n ! (21 – n)! is-
(a) 9! 12! (b) 10! 11! (c) 20! (d) 2!

2. The number of divisors of 9600 including 1 and 9600 are-
(a) 60 (b) 58 (c) 48 (d) 46

3. A polygon has 44 diagonals, then the number of its sides are-
(a) 11 (b) 7 (c) 8 (d) none of these

4. An n-digit number is a positive number with exactly n digits. Nine hundred distinct n-digit numbers are to be formed using only the three digits 2, 5, and 7. The smallest value of n for which this is possible is-
(a) 6 (b) 7 (c) 8 (d) 9

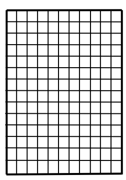
5. How many different nine digit numbers can be formed from the number 223355888 by rearranging its digits so that odd digits occupy even position ?
(a) 60 (b) 36 (c) 160 (d) 180

6. ${}^nC_1 + 2\,{}^nC_{r+1} + {}^nC_{r+2}$ is equal to $(2 \leq r \leq n)$
(a) $2.\ {}^nC_{r+2}$ (b) ${}^{n+1}C_{r+1}$ (c) ${}^{n+2}C_{r+2}$ (d) none of these

7. The number of arrangement of the letters of the word BANANA in which the two N's do nto appear adjacently is-
(a) 40 (b) 60 (c) 80 (d) 100

8. No. of points with integer coordinates lie inside the triangle whose vertices are (0, 0), (0, 21), (21, 0) is :
(a) 190 (b) 185 (c) 210 (d) 230

9. A rectangle has sides of (2m – 1) & (2n – 1) units as shown in the figure composed of squares having edge length one unit then no. of rectangles which have odd unit length



(a) $m^2 - n^2$ (b) $m\,(m + 1)\,n\,(n + 1)$ (c) 4^{m+n-2} (d) m^2n^2

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9
Ans.	b	c	a	b	a	c	a	a	d

9. BINOMIAL THEOREM

1. If the sum of the coefficients in the expansion of $(\alpha^2x^2 - 2\alpha x + 1)^{51}$ vanishes, then the value of α is-
(a) 0 (b) –1 (c*) 1 (d) –2

2. The expansion $[x + (x^3 - 1)^{1/2}]^5 = [x - (x^3 - 1)^{1/2}]^5$ is a polynomial of degree-
(a) 5 (b) 6 (c*) 7 (d) 8

3. If the rth term in the expansion of $(x/3 - 2/x^2)^{10}$ contains x^4, then r is equal to-
(a) 2 (b*) 3 (c) 4 (d) 5

4. The coefficient of x^{53} in the expansion $\sum_{m=0}^{100} {}^{100}C_m (x-3)^{100-m} 2^m$ is -
(a) ${}^{100}C_{47}$ (b) ${}^{100}C_{53}$ (c*) $-{}^{100}C_{53}$ (d) $-{}^{100}C_{100}$

5. The value of $C_0 + 3C_1 + 5C_2 + 7C_3 + \ldots\ldots + (2n + 1)\, c_n$ is equal to-
(a) 2^n (b) $2^n + n.2^{n-1}$ (c*) $2^n.(n + 1)$ (d) None of these

6. The largest term in the expansion of $(3 + 2x)^{50}$ where x = 1/5 is-
(a) 5^{th} (b) 51^{th} (c*) 6^{th} and 7^{th} (d) 8^{th}

7. $C_0^2 - C_1^2 + C_2^2 \ldots\ldots\ldots(-1)C_n^2$, where n is an even integer is
(a) ${}^{2n}C_n$ (b) $(-1)^n\, {}^{2n}C_n$ (c) $(-1)^n\, {}^{2n}C_{n-1}$ (d*) None of these

8. The co-efficient of the term independent of x in the expansion of $\left(\sqrt{\frac{x}{3}} + \frac{3}{2x^2}\right)^{10}$ is
(a) 9/4 (b) 3/4 (c*) 5/4 (d) 7/4

9. The sum of the rational terms in the expansion of $\left(\sqrt{2} + 3^{1/5}\right)^{10}$ is-
(a*) 41 (b) 42 (c) 40 (d) 43

10. If $a_n = \sum_{r=0}^{n} \frac{1}{{}^nC_1}$ then $\sum_{r=0}^{n} \frac{r}{{}^nC_1}$ equals-
(a) $(n - 1)\, a_n$ (b) na_n (c*) $1/2\; na_n$ (d) None of these

11. If n is an odd natural number, then $\sum_{r=0}^{n} \frac{(-1)^r}{{}^nC_r}$ equal
(a*) 0 (b) 1/n (c) n/2n (d) none of these

12. If in the expansion of $(1 + x)^m (1 - x)^n$, the coefficients of x and x^2 are 3 and -6 respectively, then m is-
(a) 6 (b) 9 (c*) 12 (d) 24

13. For $2 \le r \le n$, $\binom{n}{r} + 2\binom{n}{r-1} + \binom{n}{r-2} = \ldots\ldots\ldots$
(a) $\binom{n+1}{1-1}$ (b*) $2\binom{n+1}{r+1}$ (c) $2\binom{n+2}{r}$ (d) $\binom{n+2}{r}$

14. In the binomial expansion of $(a-b)^n$, $n \ge 5$, the sum of the 5^{th} and 6^{th} terms is zero. Then $\frac{a}{b}$ equals-

(a) $\frac{n-5}{6}$ (b*) $\frac{n-4}{5}$ (c) $\frac{5}{n-4}$ (d) $\frac{6}{n-5}$

15. Find coefficient of t^{24} in the expansion of $(1+t^2)^{12}(1+t^{12})(1+t^{24})$ is

(a*) ${}^{12}C_6 + 2$ (b) ${}^{12}C_6 + 1$ (c) ${}^{12}C_6 + 3$ (d) ${}^{12}C_6$

16. If ${}^{n-1}C_r = (k^2-3)\,{}^nC_{r+1}$, then k lies between

(a) $(-\infty, -2)$ (b) $(2, \infty)$ (c) $\left[-\sqrt{3}, \sqrt{3}\right]$ (d*) $\left(\sqrt{3}, 2\right]$

17. $\binom{30}{0}\binom{30}{10} - \binom{30}{1}\binom{30}{11} + \ldots\ldots\ldots\ldots + \binom{30}{20}\binom{30}{30} =$

(a*) $\binom{30}{10}$ (b) $\binom{60}{20}$ (c) $\binom{31}{10}$ (d) $\binom{31}{11}$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ans.	c	c	b	c	c	c	d	c	a	c	a	c	b	b	a	d	a

10. QUADRATIC EQUATION

1. If $e^{\{(\sin^2 x + \sin^4 x + \sin^6 x \ldots\ldots\infty)\ell n\ 2\}}$ satisfies the equation $x^2 - 9x + 8 = 0$, find the value of $\frac{\cos x}{\cos x + \sin x}$, $0 < x < \frac{\pi}{2}$

(a*) $\frac{1}{1+\sqrt{3}}$ (b) $\frac{1}{1-\sqrt{3}}$ (c) $\frac{2}{1-\sqrt{2}}$ (d) None of these

2. If the roots of the equation $(x-a)(x-b) - k = 0$ be c & d then find the equation whose roots are a & b.

(a*) $(x-c)(x-d) + k = 0$ (b) $(x+c)(x-a) + k = 0$

(c) $(x-c) + (x-a) = 0$ (d) None of these

3. The set of values of p for which the roots of the equation $3x^2 = 2x + p(p-1) = 0$ are of opposite sign is-

(a) $(-\infty, 0)$ (b*) $(0, 1)$ (c) $(1, \infty)$ (d) $(0, \infty)$

4. Let $p,q \in \{1, 2, 3, 4\}$. The number of equations of the form $px^2 + qx + 1 = 0$ having real roots is-

(a) 15 (b) 9 (c*) 7 (d) 8

5. Let α and β be the roots of the equation $x^2 + x + 1 = 0$. The equation whose roots are α^{19}, β^7 is

(a) $x^2 - x - 1$ (b) $x^2 - x + 1 = 0$ (c) $x^2 + x - 1 = 0$ (d*) $x^2 + x + 1 = 0$

6. If p,q are roots of the equation $x^2 + px + q = 0$, then-

(a) $p = 1$ (b) $p = -2$ (c*) $p = 1$ or 0 (d) $p = -2$ or 0

7. Let p and q are roots of the equation $x^2 - 2x + A = 0$ and r, s are roots of $x^2 - 18x + B = 0$ if $p < q < r < s$ are in A.P. then the value of A and B are-

(a) –7, –33 (b) –7, –37 (c*) –3, 77 (d) None of these

8. The equation $\sqrt{(x+1)} - \sqrt{(x-1)} = \sqrt{(4x-1)}$ has-

(a*) No solution (b) One solution (c) Two solutions (d) More than 2 soluions

9. The sum of all real roots of the equation $|x-2|^2 + |x-2| - 2 = 0$ is
(a) 2 (b*) 4 (c) 1 (d) None of these

10 The number of values of x in the interval $[0, 5\pi]$ satisfying the equation $3\sin^2 x - 7\sin x + 2 = 0$ is-
(a) 0 (b) 5 (c*) 6 (d) 10

11. If the roots of the equation $x^2 - 2ax + a^2 + a - 3 = 0$ are real and less than 3, then-
(a*) $a < 2$ (b) $2 \le a \le 3$ (c) $3 < a \le 4$ (d) $a > 4$

12. The harmonic mean of the roots of the equation $(5+\sqrt{2})\,x^2 - (4+\sqrt{5})\,x + 8 + 2\sqrt{5} = 0$ is-
(a) 2 (b*) 4 (c) 6 (d) 8

13. In a ΔPQR, $\angle R = \frac{\pi}{2}$. If $\tan\frac{P}{2}$ and $\tan\frac{Q}{2}$ are the roots of the equation $ax^2 + bx + c = 0$ $(a \ne 0)$, then-
(a*) $a + b = c$ (b) $b + c = a$ (c) $c + a = b$ (d) $b = c$

14. For the equation $3x^2 + px + 3 = 0$, $p > 0$, if one of the roots is square of the other, then p is equal to-
(a) 1/3 (b) 1 (c*) 3 (d) 2/3

15. If α and β $(\alpha < \beta)$, are the roots of the equation $x^2 + bx + c = 0$, where $c < 0 < b$, then
(a) $0 < \alpha < \beta$ (b*) $\alpha < 0 < \beta < |\alpha|$ (c) $\alpha < \beta < 0$ (d) $\alpha < 0 < |\alpha| < \beta$

16. If $b > a$, then the equation $(x-a)(x-b) - 1 = 0$, has-
(a) both roots in $[a, b]$
(b) both roots in $(-\infty, a)$
(c) both roots in $(b, +\infty)$
(d*) one root in $(-\infty, a)$ and other in $(b, +\infty)$

17. Let α, β be the roots of $x^2 - x + p = 0$ and γ, δ be the roots of $x^2 - 4x + q = 0$. If $\alpha, \beta, \gamma, \delta$ are in G.P., then the integral values of p and q respectively, are-
(a*) –2, – 32 (b) –2, 3 (c) –6, 3 (d) –6, –32

18. The set of all real numbers x for which $x^2 - |x+2| + x > 0$, is-
(a) $(-\infty, -2) \cup (2, \infty)$
(b*) $(-\infty, -\sqrt{2}) \cup (\sqrt{2}, \infty)$
(c) $(-\infty, -1) \cup (1, \infty)$
(d) $(\sqrt{2}, \infty)$

19. If one root of the equation $x^2 + px + q = 0$ is square of the other then for any p & q, it will satisfy the relation-
(a*) $p^3 - q(3p-1) + q^2 = 0$
(b) $p^3 - q(3p+1) + q^2 = 0$
(c) $p^3 + q(3p-1) + q^2 = 0$
(d) $p^3 + q(3p+1) + q^2 = 0$

20. Let $x^2 + 2ax + 10 - 3a > 0$ for every real value of x, then-
(a) $a > 5$ (b) $a < -5$ (c*) $-5 < a < 2$ (d) $2 < a < 5$

21. α, β are roots of equation $ax^2 + bx + c = 0$ and $\alpha + \beta$, $\alpha^2 + \beta^2$, $\alpha^2 + \beta^3$ are in G.P., $\Delta = b^2 - 4ac$, then
(a) $\Delta b = 0$ (b) $bc \ne 0$ (c) $\Delta \ne 0$ (d*) $\Delta = 0$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Ans.	a	a	b	c	d	c	c	a	b	c	a	b	a	c	b	d	a	b	a	c	d

11. LOGARITHMS & MODULUS FUNCTION

1. The domain of the function $\sqrt{(\log_{0.5} x)}$ is-

(a*) $(1, \infty)$ (b) $(0, \infty)$ (c) $(0, 1)$ (d) $(0.5, 1)$

2. The number $\log_2 7$ is-
(a) an integer (b) a rational number (c*) an irrational number (d) a prime number

3. Find the no. of solution $\log_4 (x - 1) = \log_2 (x - 3)$
(a) 3 (b*) 1 (c) 2 (d) 0

4. For all $x \in (0, 1)$
(a) $e^x < 1 + x$ (b*) $\log_e (1 + x) < x$ (c) $\sin x > x$ (d) $\log_e x > x$

5. The set of all real numbers x for which $x^2 - |x + 2| + x > 0$, is-
(a) $(-\infty, -1) \cup (2, \infty)$ (b*) $(-\infty, -\sqrt{2}) \cup (\sqrt{2}, \infty)$
(c) $(-\infty, -1) \cup (1, \infty)$ (d) $(\sqrt{2}, \infty)$

ANSWER KEY

Q.No.	1	2	3	4	5
Ans.	c	c	b	b	b

12. POINT

1. If the sum of the distances of a point from two perpendicular lines in a plane is 1, then its locus is
(a*) square (b) circle (c) straight line (d) two intersecting lines

2. If P (1, 0), Q (–1, 0) and R (2, 0) are three given points, then the locus of S satisfying the relation $SQ^2 + SR^2 = 2SP^2$ is
(a) a st. line || to x-axis (b*) a circle thro' the origin
(c) a circle with centre at the origin (d) a st. line || to y-axis

3. The orthocenter of the triangle with vertices $\left[2, \frac{(\sqrt{3}-1)}{2}\right]$, $\left(\frac{1}{2}, -\frac{1}{2}\right)$ and $\left(2 - \frac{1}{2}\right)$ is-

(a) $\left[\frac{3}{2}, \frac{\sqrt{3}-3}{6}\right]$ (b*) $\left[2, -\frac{1}{2}\right]$ (c) $\left[\frac{5}{4}, -\frac{\sqrt{3}-2}{4}\right]$ (d) $\left[\frac{1}{2}, -\frac{1}{2}\right]$

4. The orthocenter of the triangle formed by the lines xy = 0 and x + y = 1 is
(a) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{1}{3}, \frac{1}{3}\right)$ (c*) (0, 0) (d) $\left(\frac{1}{4}, \frac{1}{4}\right)$

5. The diagonals of parallelogram PQRS are along the lines x + 3y = 4 and 6x – 2y = 7. Then PQRS must be a
(a) rectangle (b) square (c) cyclic quadrilateral (d*) rhombus

6. If the vertices P, Q, R of a triangle PQR are rational points, which of the following points of the triangle PQR is (are) not always rational points (s) ?
(a) Centroid (b*) Incentre (c) Circumcentre (d) Orthocentre

7. If P (1, 2), Q (4, 6) R (5, 7) and S(a, b) are the vertices of a parallelogram PQRS, then
(a) a = b, b = 4 (b) a = 3, b = 4 (c*) a = 2, b = 3 (d) a = 3 , b = 5

8. If x_1, x_2, x_3 as well as y_1, y_2, y_3 are in G.P. wih the same common ratio, then the points
$(x_1, y_1), (x_2, y_2)$ and (x_3, y_3)

(a*) lie on straight line (b) lie on an ellipse
(c) lie on a circle (d) are vertices of a triangle

9. The incentre of the triangle with vertices $(1, \sqrt{3})$, (0, 0) and (2, 0) is
(a) $\left(1, \frac{\sqrt{3}}{2}\right)$ (b) $\left(\frac{2}{3}, \frac{1}{\sqrt{3}}\right)$ (c) $\left(\frac{2}{3}, \frac{\sqrt{3}}{2}\right)$ (d*) $\left(1, \frac{1}{\sqrt{3}}\right)$

10. Orthocentre of the triangle whose vertices are A (0, 0), B (3, 4) &C (4, 0) is:
(a*) $\left(3, \frac{3}{4}\right)$ (b) $\left(3, \frac{5}{4}\right)$ (c) (3, 12) (d) (2, 0)

ANSWER KEY

Q.No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans.	a	d	b	c	d	b	c	a	d	a

13. STRAIGHT LINE

1. The equation of the lines through the points (2, 3) and making an intercept of length 2 units between the lines y + 2x = 3 and y + 2x + 5 are
(a) x + 3 = 0, 3x + 4y = 12 (b) y – 2 = 0, 4x – 3y = 6 (c*) x – 2 = 0, 3x + 4y = 18 (d) None of these

2. let the algebraic sum of the perpendicular distances from the points A (2, 0) (0, 2) C(1, 1) to a variable line be zero. Then all such lines:
(a) passes through the point (–1, 1) (b*) passes through the fixed point (1, 1)
(c) touches some fixed circle (d) None of these

3. If one of the diagonals of a square is along the line x = 2y and one of its vertices is (3, 0) then its sides through this vertex are given by the equations
(a*) y – 3x + 9 = 0, 3y + x – 3 = 0 (b) y + 3x + 9 = 0, 3y + x – 3 = 0
(c) $3x^2 – 3y^2 + 8xy + 10x + 15y + 20 = 0$ (d) $3x^2 – 3y^2 – 8xy – 10x – 15y – 20 = 0$

4. All points lying inside the triangle formed by the points (1, 3), (5, 0), (–1, 2) satisfy:
(a*) $3x + 2y \geq 0$ (b) $2x + y – 13 \geq 0$ (c) $–2x + y \geq 0$ (d) None of these

5. Let PQR be a right angled isosceles triangle, right angled at P(2, 1). If the equation of the line QR is 2x + y = 3, then the equation representing the pair of lines PQ and PR is-
(a) $3x^2 – 3y^2 + 8xy + 20x + 10y + 25 = 0$ (b*) $3x^2 – 3y^2 + 8xy – 20x – 10y + 25 = 0$
(c) $3x^2 – 3y^2 + 8xy + 10x + 15y + 29 = 0$ (d) $3x^2 – 3y^2 – 8xy – 10x – 15y – 20 = 0$

6. Let PS be the median of the triangle with vertices P(2, 2), Q(6, –1) and R(7, 3). The equation of the line passing through (1, –1) and parallel to PS is-
(a) 2x – 9y – 7 = 0 (b) 2x – 9y – 11 = 0 (c)2x + 9y – 11 = 0 (d*) 2x + 9y + 7 = 0

7. Find the number of integer value of m which makes the x coordinates of point of intersection of lines. 3x + 4y = 9 and y = mx + 1 integer.
(a*) 2 (b) 0 (c) 4 (d) 1

8. Area of the parallelogram formed by the linen y = mx, y = mx + 1, y = nx, y = nx + 1 is
(a) $|m + n|/(m – n)^2$ (b) 2/|m + n| (c) 1/|m + n| (d*) 1/|m – n|

9. A straight line through the origin O meets the parallel lines $4x + 2y = 9$ and $2x + y + 6 = 0$ at the points P and Q respectively. Then the point O divides the segment PQ in the ratio-
(a) 1 : 2 (b*) 3 : 4 (c) 2 : 1 (d) 4 : 3

10. Let $P = (-1, 0)$, $Q = (0, 0)$ and $R = (3, \ 3\sqrt{3})$ be three points. Then the equation of the bisector of the angle PQR is-
(a) $(\sqrt{3}/2)x + y = 0$ (b) $x + \sqrt{3}x = 0$
(c*) $\sqrt{3}x + y = 0$ (d) $x + (\sqrt{3}/2)y = 0$

11. Let $0 \alpha < \pi/2$ be a fixed angle. If $P = (\cos\theta, \sin\theta)$ and $Q = (\cos(\alpha - \theta)), \sin(\alpha - \theta))$ then Q is obtained from P by-
(a) clockwise rotation around origin through an angle α
(b) anticlockwise rotation around origin through an angle α
(c) reflection in the line through origin with slope $\tan\alpha$
(d*) reflection in the line through origin with slope $\tan\alpha/2$

12. A pair of st. linen $x^2 - 8x + 12 = 0$ & $y^2 - 14y + 45 = 0$ are forming a square. What is the centre of circle inscribed in the square:
(a) (3, 2) (b) (7, 4) (c*) (4, 7) (d) (0, 1)

13. Area of the triangle formed by the line $x + y = 3$ and the angle bisector of the pair of lines $x^2 - y^2 + 2y = 1$, is-
(a) 1 (b) 3 (c*) 2 (d) 4

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Ans.	c	b	a	a	b	d	a	d	b	c	d	c	c

14. CIRCLE

1. The centre of the circle passing through points (0, 0), (1,0) and touching the circle $x^2 + y^2 = 9$ is
(a) (3/2, 1/2) (b) (1/2, 3/2) (c) (1/2, 1/2) (d) $(1/2, -2^{1/2})$

2. The equation of the circle which touches both the axes and the straight line $4x + 3y = 6$ in the first quadrant and lies below it is
(a) $4x^2 + 4y^2 - 4x - 4y + 1 = 0$ (b) $x^2 + y^2 - 6x - 6y + 9 = 0$
(c) $x^2 + y^2 - 6x - y + 9 = 0$ (d) $4(x^2 + y^2 - x - 6y) + 1 = 0$

3. The slope of the tangent at the point (h, h) of the circle $x^2 + y^2 = a_2$ is-
(a) 0 (b) 1 (c) –1 (d) depends on h

4. The co-ordinates of the point at which the circles $x^2 + y^2 - 4x - 2y - 4 = 0$ and $x^2 + y^2 - 12x - 8y - 36 = 0$ touch each other are-
(a) (3, – 2) (b) (–2, 3) (c) (3, 2) (d) None of these

5. Given that two circles $x^2 + y^2 = r^2$ and $x^2 + y^2 - 10x + 16 = 0$, the value of r such that they intersect in real and distinct points is given by-
(a) $2 < r < 8$ (b) r = 2 ro r = 8 (c) (3, 2) (d) None of these

6. The distance from the centre of the circle $x^2 + y^2 = 2x$ to the straight line passing through the points of intersection of the two circles. $x^2 + y^2 + 5x - 8y + 1 = 0$ and $x^2 + y^2 - 3x + 7y - 25 = 0$ is-
(a) 1 (b) 3 (c) 2 (d) 1/3

7. The intercept on the line $y = x$ by the circle $x^2 + y^2 - 2x = 0$ is AB. Equation of the circle with AB as a diameter is-
(a) $x^2 + y^2 + x + y = 0$ (b) $-x^2 + y^2 = x - y = 0$
(c) $x^2 + y^2 - x - y = 0$` (d) None of these

pankaj.baluja@mathematicsonline.co.in
Visit us at: www.mathematicsonline.co.in

8. The angle between a pair of tangents from a point P to the circle $x^2 + y^2 + 4x - 6y + 9\sin^2\alpha + 13\cos^2\alpha = 0$ is 2α. The equation of the locus of P is-
(a) $x^2 + y^2 + 4x - 6y + 4 = 0$ (b) $x^2 + y^2 + 4x - 6y - 9 = 0$
(c) $x^2 + y^2 + 4x - 6y - 4 = 0$ (d) $x^2 + y^2 + 4x - 6y + 9 = 0$

9. Two vertices of an equilateral triangle are (–1, 0) and (1, 0) and its circumcircle is-
(a) $x^2 + \left(y - \frac{1}{\sqrt{3}}\right)^2 = \frac{4}{3}$ (b) $x^2 - \left(y + \frac{1}{\sqrt{3}}\right) = \frac{4}{3}$
(c) $x^2 + \left(y - \frac{1}{\sqrt{3}}\right)^2 = \frac{4}{3}$ (d) None of these

10. If a circle passes thro' the points of intersection of the co-ordinate axes with the lines $\lambda x - y + 1 = 0$ and $x - 2y + 3 = 0$, then the value of λ is-
(a) 2 (b) 4 (c) 6 (d) 3

11. The number of common tangents to the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 6x - 8y = 24$ is
(a) 0 (b) 1 (c) 3 (d) 4

12. If two distinct chords drawn from the point (p,q) on the circle $x^2 + y^2 = px + qy$ (where $pq \neq 0$) are bisected by the x-axis then
(a) $p^2 = q^2$ (b) $p^2 = 8q^2$ (c) $p^2 < 8q^2$ (d) $p^2 > 8q^2$

13. Let L_1 be a straight line passing through the origin and L_2 be the straight line $x + y = 1$. If the intercepts made by the circle $x^2 + y^2 - x + 3y = 0$ on L_1 and L_2 are equal, then which of the following equations can represent L_1
(a) $x + y = 0$ (b) $x - y = 0$ (c) $x + 7y = 0$ (d) None of these

14. If the circles $x^2 + y^2 + 2x + 2ky + 6 = 0$ and $x^2 + y^2 + 2ky + k = 0$ intersect orthogonally, then k is-
(a) 2 or –3/2 (b) –2 or –3/2 (c) 2 or 3/2 (d) –2 or 3/2

15. The triangle PQR is inscribed in the circle $x^2 + y^2 = 25$. If Q and R have co-ordinates (3, 4) and (–4, 3) respectively, then angle QPR is equal to-
(a) $\pi/2$ (b) $\pi/3$ (c) $\pi/4$ (d) $\pi/6$

16. Let PQ and RS be tangents at the extremities of the diameter PR of a circle of radius r. if PS and RQ intersect at a point X on the circumference of the circle, then 2r equals
(a) $\sqrt{PQ.RS}$ (b) $\frac{PQ+RS}{2}$ (c) $\frac{2PQ.RS}{PQ+RS}$ (d) $\sqrt{\frac{PQ^2+RS^2}{2}}$

17. If the tangent at the point P on the circle $x^2 + y^2 + 6x + 6y = 2$ meets the straight line $5x - 2y + 6 = 0$ at a point Q on the y-axis, then the length of PQ is-
(a) 4 (b) $2\sqrt{5}$ (c) 5 (d) 3

18. If $a > 2b > 0$ then the positive value of m for which $y = mx - b\sqrt{1+m^2}$ is a common tangent to $x^2 + y^2 = b^2$ and $(x - a) + y^2 = b^2$ is-
(a) $\frac{2b}{\sqrt{a^2-4b^2}}$ (b) $\frac{\sqrt{a^2-4b^2}}{2b}$ (c) $\frac{2b}{a-2b}$ (d) $\frac{b}{a-2b}$

19. Diameter of the given circle $x^2 + y^2 - 2x - 6y + 6 = 0$ is the chord of another circle C having centre (2, 1), the radius of the circle C is-

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

20. Locus of the centre of circle touching to the x-axis & the circle $x^2 + (y - 1)^2 = 1$ externally is
(a) $\{(0, y); y \le 0\} \cup (x^2 = 4y)$ (b) $\{(0, y); \le 0\} \cup (x^2 = y)$
(c) $\{(x, y); y \le y\} \cup (x^2 = 4y)$ (d) $\{(0, y); y \ge 0\} \cup (x^2 + (x^2 + (y - 1)^2 = 4$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	d	a	c	d	a	c	c	d	a	a	b	d	c	a	c	a	c	a	c	a

15. PARABOLA

1. The point of intersection of the tangents at the ends of the latus retum of the parabola $y^2 = 4x$ is…
(a) (–1, 0) (b) (1, 0) (c) (0,1) (d) None of these

2. Consider a circle with centre lying on the focus of the parabola $y^2 = 2px$ such that it touches the directrix of the parabola. Then a point of intersection of the circle and the parabola is
(a) (p/2, p) (b) (–p/2, p) (c) (–p/2, –p) (d) None of these

3. The curve described parametrically by $x = t^2 + t + 1$, $y = t^2 - t + 1$ represents-
(a) a pair of st. lines (b) an ellipse
(c) a parabola (d) a hyperbola

4. If $x + y = k$ is normal to $y^2 = 12x$, then k is-
(a) 3 (b) 9 (c) –9 (d) –3

5. If the line $x - 1 = 0$ is the directrix of the parabola $y^2 - kx + 8 = 0$, then one of the values of k is-
(a) 1/8 (b) 8 (c) 4 (d) 1/4

6. Above x-axis, the equation of the common tangents to the circle $(x - 3)^2 + y^2 = 9$ and parabola $y^2 = 4x$ is-
(a) $\sqrt{3}y = 3x + 1$ (b) $\sqrt{3}y = -(x + 3)$ (c) $\sqrt{3}y = x + 3$ (d) $\sqrt{3}y = -(3x + 1)$

7. The equation of the directrix of the parabola $y^2 + 4y + 4x + 2 = 0$ is-
(a) $x = -1$ (b) $x = 1$ (c) $x = -\frac{3}{2}$ (d) $x = \frac{3}{2}$

8. The locus of the mid-point of the line segment joining the focus to a moving point on the parabola $y^2 = 4ax$ is another parabola with directrix-
(a) $x = -a$ (b) $x = -a/2$ (c) $x = 0$ (d) $x = a/2$

9. If focal chord of $y^2 = 16x$ touches $(x - 6)^2 + y^2 = 2$ then slope of such chord is-
(a) 1, –1 (b) $2, -\frac{1}{2}$ (c) $\frac{1}{2}, -2$ (d) 2, – 2

10. Angle between the tangents drawn from (1, 4) to the parabola $y^2 = 4x$ is-
(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{4}$

11. A tangent at any point P (1, 7) the parabola $y = x^2 + 6$, which is touching to the circle $x^2 + y^2 + 16x + 12y + c = 0$ at point Q, then Q = is
(a) (–6, –7) (b) (–10, –15) (c) (–9, –7) (d) (–6, –3)

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11
Ans.	a	a	c	b	c	c	d	c	a	b	a

16. FUNCTION

1. If function f(x) = $\frac{1}{2} - \tan\left(\frac{\pi x}{2}\right)$; (–1 < x < 1) and g (x) = $\sqrt{3+4x-4x^2}$, then the domain of gof is-

(a) (–1, 1) (b*) $\left[-\frac{1}{2},\frac{1}{2}\right]$ (c) $\left[-1,\frac{1}{2}\right]$ (d) $\left[-\frac{1}{2},-1\right]$

2. If f(x) = cos $[\pi^2]$x + cos $[-\pi^2]$x, where [x] stands for the greatest integer function, then

(a*) $f\left(\frac{\pi}{2}\right) = -1$ (b) f(π) = 1 (c) $f\left(\frac{\pi}{4}\right) = 2$ (d) None of these

3. The value of b and c for which the identity f(x + 1) – f(x) = 8x + 3 is satisfied, where f(x) = $bx^2 + cx + d$, are

(a) b = 2, c = 1 (b*) b = 4, c = – 1 (c) b = – 1, c = 4 (d) None

4. Let f(x) = sin x and g(x) = ℓn|x|. If the ranges of the composities functions fog and gof are R_1 and R_2 respectively, then-

(a) $R_1 = \{u: -1 < u < 1\}, R_2 = \{v : -\infty < v < 0\}$
(b) $R_1 = \{u : -\infty < u \le 0\}, R_2 = \{v: -1 \le v \le 1\}$
(c) $R_1 = \{u: -1 < u < 1\}, R_2 = \{v : -\infty < v < 0\}$
(d*) $R_1 = \{u: -1 \le u \le 1\}, R_2 = \{v : -\infty < v \le 0\}$

5. Let 2 $\sin^2 x$ + 3 sin x – 2 > 0 and $x^2 - x - 2 < 0$ (x is measured in radians). Then x lies in the interval

(a) $\left(\frac{\pi}{6},\frac{5\pi}{6}\right)$ (b) $\left(-1,\frac{5\pi}{6}\right)$ (c) (–1, 2) (d*) $\left(\frac{\pi}{6},2\right)$

6. Let f(x) = $(x + 1)^2 - 1$, (x ≥ – 1). Then the set S = {x : f (x) = $f^{-1}(x)$} is-

(a) Empty (b*) {0, –1}

(c) {0, 1, –1} (d) $\left\{0,-1,\frac{-3+i\sqrt{3}}{2},\frac{-3-i\sqrt{3}}{2}\right\}$

7. If f(1) = 1 and f(n + 1) = 2f(n) + 1 if n ≥ 1, then f(n) is-

(a) 2^{n+1} (b) 2^n (c*) $2^n - 1$ (d) $2^{n-1} - 1$

8. Let f : R → R be given by f(x) = $(x + 1)^2 - 1$. Then $f^{-1}(x)$ =

(a*) $-1 + \sqrt{x+1}$
(b) $-1 - \sqrt{x+1}$
(c) does not exist because if not one-one
(d) does not exist because f is not onto

9. If f is an even function defined on the interval (–5, 5), then the real values of x satisfying the equation f(x) = f $\left(\frac{x+1}{x+2}\right)$

(a*) $\frac{-1\pm\sqrt{5}}{2}, \frac{-3\pm\sqrt{5}}{2}$ (b) $\frac{-1\pm\sqrt{3}}{2}, \frac{-3\pm\sqrt{3}}{2}$
(c) $\frac{-2\pm\sqrt{5}}{2}$ (d) None of these

10. Let f(x) = [x] sin $\left(\frac{\pi}{[x+1]}\right)$, where [.] denotes the greatest integer function. The domain of f is……
(a) $\{x \in R | x \in [-1, 0)\}$ (b) $\{x \in R | x \notin [1, 0)\}$
(c*) $\{x \in R | x \notin [-1, 0)\}$ (d) None of these

11. If f(x) = $\sin^2 x + \sin^2 \cos x \cos\left(x+\frac{\pi}{3}\right)$ and g $\left(\frac{5}{4}\right)$ = 1, then (gof) (x) =
(a) – 2 (b) – 1 (c) 2 (d*) 1

12. If g (f(x)) = |sin x| and f(g(x)) = $(\sin\sqrt{x})^2$, then
(a*) f(x) = $\sin^2 x$, g(x) = $\sqrt{x}$ (b) f(x) = sin x, g(x) = |x|
(c) f(x) = x^2, g(x) = sin $\sqrt{x}$ (d) f and g cannot be determined

13. If f(x) = 3x – 5, then $f^{-1}(x)$
(a) is given by $\frac{1}{3x-5}$
(b*) is given by $\frac{x+5}{3}$
(c) does not exist because f is not one-one
(d) does not exist because f is not onto

14. If the function f:[1, ∞] → [1, ∞) is defined by f(x) = $2^{x(x-1)}$, then f^{-1} (x) is
(a) $\left(\frac{1}{2}\right)^{x(x-1)}$ (b*) $\frac{1}{2}(1+\sqrt{1+4\log_2 x})$ (c) $\frac{1}{2}(1-\sqrt{1+4\log_2 x})$ (d) not defined

15. The domain of definition of the function y(x) given by the equation $2^x + 2^y = 2$ is-
(a) $0 < x \le 1$ (b) $0 \le x \le 1$ (c) $-\infty < x \le 0$ (d*) $-\infty < x < 1$

16. Let f(θ) = sinθ (sinθ + sin3θ), then f(θ)
(a) ≥ 0 only when θ ≥ 0 (b) ≤ 0 for all θ
(c*) ≥ 0 for all real θ (d) ≤ 0 only when θ ≤ 0

17. The number of solutions of $\log_4 (x-1) = \log_2 (x-3)$ is-
(a) 3 (b*) 1 (c) 2 (d) 0

18. Let f(x) = $\frac{\alpha x}{x+1}$, x ≠ – 1, then for what value of α, f{f(x)} = x.
(a) $\sqrt{2}$ (b) – $\sqrt{2}$ (c) 1 (d*) – 1

19. The domain of definition of f(x) = $\dfrac{\log_2(x+3)}{x^2+3x+2}$ is-

(a) R/{–2, –2} (b) (–2, ∞) (c) R/{–1, –2, –3} (d*) (–3, ∞)/{–1, –2}

20. If f : [1, ∞) → [2, ∞) is given by f(x) = x + $\dfrac{1}{x}$ then $f^{-1}(x)$ equals-

(a*) $\dfrac{x+\sqrt{x^2-4}}{2}$ (b) $\dfrac{x}{1-x^2}$ (c) $\dfrac{x-\sqrt{x^2-4}}{2}$ (d) 1 + $\sqrt{x^2-4}$

21. Suppose f(x) = $(x + 1)^2$ for x ≥ – 1. If g(x) is the function whose graph is the reflection of the graph of f(x) with respect to the line y = x, then g(x) equals-

(a) – $\sqrt{x}$ – 1, x ≥ 0 (b) $\dfrac{1}{(x+1)^2}$, x > – 1

(c) $\sqrt{x+1}$, x ≥ – 1 (d*) $\sqrt{x}$ – 1, x ≥ 0

22. Let function f : R → R be defined by f(x) = 2x + sin x for x ∈ R. Then f is-

(a*) one to one and onto (b) one to one but NOT onto

(c) onto but NOT one to one (d) neither one to one onto

23. Let f(x) = $\dfrac{x}{1+x}$ defined as [0, ∞) → [0, ∞), f(x) is-

(a)one one & onto (b*) one-one but not onto

(c) not one-one but onto (d) neither one-one nor onto

24. Find the range of f(x) = $\dfrac{x^2+x+2}{x^2+x+1}$ is-

(a) (1, ∞) (b) $\left(1, \dfrac{11}{7}\right]$ (c*) $\left(1, \dfrac{7}{3}\right]$ (d) $\left(1, \dfrac{7}{5}\right]$

25. Domain of f(x) = $\sqrt{\sin^{-1}(2x)+\pi/6}$ is-

(a*) $\left[-\dfrac{1}{4}, \dfrac{1}{2}\right]$ (b) $\left[-\dfrac{1}{2}, \dfrac{1}{2}\right]$ (c) $\left[-\dfrac{1}{4}, \dfrac{1}{4}\right]$ (d) $\left[-\dfrac{1}{2}, \dfrac{1}{4}\right]$

26. Let f(x) = sin x + cos x & g (x) = x^2 – 1, then g(f(x)) will be invertible for the domain-

(a) x ∈ [0, π] (b*) x ∈ $\left[-\dfrac{\pi}{4}, \dfrac{\pi}{4}\right]$ (c) x ∈ $\left[0, \dfrac{\pi}{2}\right]$ (d) x ∈ $\left[-\dfrac{\pi}{2}, 0\right)$

27. f(x) = $\begin{cases} x & x \in Q \\ 0 & x \notin Q \end{cases}; g(x) = \begin{cases} 0 & x \in Q \\ x & x \notin Q \end{cases}$

then (f – g) is

(a*) one – one, onto (b) neither one-one, nor onto

(c) one-one but not onto (d) onto but not one-one

28. f : R → R, f $\left(\dfrac{1}{n}\right)$ = 0 n ∈ I, n ≥ 1 then

(a) f(x) = 0 for x ∈ [0, 1] (b) f(x) = 0 for x ∈ R (c*) f(0) = 0 = f ' (0) (d) f(x) = 0 = f ' (x) can not be

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	b	a	b	d	d	b	c	a	a	c	d	a	b	b	D

Q.No.	16	17	18	19	20	21	22	23	24	25	26	27	28
Ans.	c	b	d	d	a	d	a	b	c	a	b	a	c

17. LIMITS

1. $\lim\limits_{x\to\pi/4} \dfrac{\sqrt{2}\cos x - 1}{\cot x - 1} =$

(a) $\dfrac{1}{\sqrt{2}}$ (b*) $\dfrac{1}{2}$ (c) $\dfrac{1}{2\sqrt{2}}$ (d) 1

2. $\lim\limits_{x\to\infty} \dfrac{(2x+1)^{40}(4x-1)^{5}}{(2x+3)^{45}} =$

(a) 16 (b) 24 (c*) 32 (d) 8

3. $\lim\limits_{x\to 0} \dfrac{\sqrt{\frac{1}{2}(1-\cos 2x)}}{x} =$

(a) 1 (b) –1 (c) 0 (d*) None

4. $\lim\limits_{x\to\infty} \dfrac{x^n}{e^x} = 0$ for

(a) no value of n (b*) n is any whole number
(c) n = 0 only (d) n = 2 only

5. $\lim\limits_{x\to 0} \left[\dfrac{x}{\tan^{-1} 2x}\right] =$

(a) 0 (b*) $\dfrac{1}{2}$ (c) 2 (d) ∞

6. $\lim\limits_{x\to 0} \left\{\tan\left(\dfrac{\pi}{4} + x\right)\right\}^{1/x} =$

(a) 1 (b) – 1 (c*) e^2 (d) e

7. $\lim\limits_{x\to 0}\left(\dfrac{1+5x^2}{1+3x^2}\right)^{1/x^2} =$

(a) e^2 (b) e (c) e^{-2} (d*) e^{-1}

8. The value of $\lim\limits_{h\to 0}\dfrac{\log(1+2h)-2\log(1-h)}{h^2}$ is-

(a*) 1 (b) –1 (c) 0 (d) None of these

9. $\lim\limits_{x\to 1}\dfrac{\sqrt{1-\cos 2(x-1)}}{x-1} =$

(a*) Does not exist because LHL ≠ RHL (b) Exists and it equals $-\sqrt{2}$

(c) Does not exist because $x - 1 \to 0$ (d) Exists and it equals $\sqrt{2}$

10. $\lim\limits_{x\to 0}\dfrac{x\tan 2x - 2x\tan x}{(1-\cos 2x)^2}$ is-

(a*) $\dfrac{1}{2}$ (b) – 2 (c) 2 (d) $-\dfrac{1}{2}$

11. For $x \in R$, $\lim\limits_{x\to\infty}\left(\dfrac{x-3}{x+2}\right)^x =$

(a) e (b) e^{-1} (c*) e^{-5} (d) e^5

12. $\lim\limits_{x\to 0}\dfrac{\sin(\pi\cos^2 x)}{x^2}$ equals-

(a) $-\pi$ (b*) π (c) $\dfrac{\pi}{2}$ (d) 1

13. The value of integer n; for which $\lim\limits_{x\to 0}\dfrac{(\cos x - 1)\ (\cos x - e^x)}{x^n}$ is a finite non zero number-

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

14. Let $f : R \to R$ such that f(1) = 3 and f '(1) = 6. then $\lim\limits_{x\to 0}\left(\dfrac{f(1+x)}{f(1)}\right)^{1/x}$ equals-

(a) 1 (b) $e^{1/2}$ (c*) e^2 (d) e^3

15. If $\lim\limits_{x\to 0}\dfrac{(\sin nx)\ [(a-n)nx - \tan x]}{x^2} = 0$ then the value of a is-

(a) $\dfrac{1}{n+1}$ (b) $\dfrac{n}{n+1}$ (c*) $n+\dfrac{1}{n}$ (d) n

16. If f(x) is a differentiable function and f '(2) = 6, f '(1) = 4, f '(c) represents the differentiation of f(x) at x = c, then $\lim\limits_{x\to 0}\dfrac{f(2+2h+h^2)-f(2)}{f(1+h^2+h)-f(1)}$

(a) may exist (b) will not exist (c*) is equal to 3 (d) is equal to – 3

17. Let f(x) be strictly increasing and differentiable, then $\lim_{x\to 0}\dfrac{f(x^2)-f(x)}{f(x)-f(0)}$ is-

(a) 1 (b*) – 1 (c) 0 (d) 2

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ans.	b	c	d	b	b	c	a	b	a	a	c	b	c	c	c	c	b

18. CONTINUITY

1. If f(x) = $\begin{cases} \dfrac{1-\cos 4x}{x^2} & ,\text{when } x < 0 \\ a & ,\text{when } x = 0 \\ \dfrac{\sqrt{x}}{\sqrt{(16+\sqrt{x})}-4} & ,\text{when } x > 0 \end{cases}$ is continuous at x = 0, then the value of 'a' will be-

(a) 8 (b) – 8 (c) 4 (d) None

2. The following functions are continuous on (0, π)

(a) tan x

(b) $\begin{cases} x \sin x \;; & 0 < x \le \pi/2 \\ \dfrac{\pi}{2}\sin(\pi + x); & \dfrac{\pi}{2} < x < \pi \end{cases}$

(c) $\begin{cases} 1, & 0 < x \le \dfrac{3\pi}{4} \\ 2\sin\dfrac{2}{9}x, & \dfrac{3\pi}{4} < x < \pi \end{cases}$

(d) None of these

3. If f(x) = $\begin{cases} x\sin x & ,\text{when } 0 < x \le \dfrac{\pi}{2} \\ \dfrac{\pi}{2}\sin(\pi + x) & ,\text{when } \dfrac{\pi}{2} < x < \pi \end{cases}$, then-

(a) f(x) is discontinuous at x = $\dfrac{\pi}{2}$ (b) f(x) is continuous at x = $\dfrac{\pi}{2}$

(c) f(x) is continuous at x = 0 (d) None of these

4. The function f(x) = [x] cos {(2x – 1)/2}π, [] denotes the greatest integer function, is discontinuous at

(a) all x (b) all integer points (c) no x (d) x which is not an integer

5. Let f(x) be defined for all x > 0 and be continuous. Let f(x) satisfy $f\left(\frac{x}{y}\right) = f(x) - f(y)$ for all x, y & f(e) = 1

(a) f(x) is bounded (b) $f\left(\frac{1}{x}\right) \to 0$ as $x \to 0$

(c) $x\, f(x) \to 1$ as $x \to 0$ (d) f(x) = log x

6. The function $f(x) = [x]^2 = [x^2]$ (where [y] is the greatest integer less than or equal to y), is discontinuous at-
(a) All integers (b) All integers except 0 and 1
(c) All integers except 0 (d) All integers except 1

ANSWER KEY

Q.No.	**1**	**2**	**3**	**4**	**5**	**6**
Ans.	a	c	a	c	d	d

19. DIFFERENTIATION

1. The derivative of function $\cot^{-1} [(\cos 2x)^{1/2}]$ at $x = \frac{\pi}{6}$ is

(a*) $(2/3)^{1/2}$ (b) $(1/3)^{1/2}$ (c) $3^{1/2}$ (d) $6^{1/2}$

2. Indicate the correct alternative:
Let [x] denote the greater integer ≤ x and $f(x) = [\tan^2 x]$, then
(a) $\lim_{x\to 0} f(x)$ does not exist (b*) f(x) is continous at x = 0
(c) f(x) is not differentiable at x = 0 (d) f ’(0) = 1

3. If $y = \sec \tan^{-1} x$ then $\frac{dy}{dx}$ =

(a) $x/(1 + x^2)$ (b) $x\sqrt{(1+x^2)}$ (c) $1/\sqrt{(1+x^2)}$ (d*) $x/\sqrt{(1+x^2)}$

4. If $f(x) = \tan^{-1}\sqrt{\frac{1+\sin x}{1-\sin x}}$ $0 \le x \le \pi/2$, the f’ (π/6) is

(a) $-\frac{1}{4}$ (b) $-\frac{1}{2}$ (c) $\frac{1}{4}$ (d*) $\frac{1}{2}$

5. g(x) = x f(x), where $f(x) = \begin{cases} x\sin(1/x), & x \ne 0 \\ 0 & x = 0 \end{cases}$ at x = 0

(a*) g is differentiable but g’ is not continuous
(b) both f and g are differentiable
(c) g is diffentiable but g’ is continuous
(d) None of these

6. Let $f\left(\frac{x+y}{2}\right) = \frac{f(x)+f(y)}{2}$ for all real x and y and f ’ (1) = – 1, then f ’(2) =

(a) 1/2 (b) 1 (c*) –1 (d) –1/2

7. Let f (x) = $\begin{vmatrix} x^3 & \sin x & \cos x \\ 6 & -1 & 0 \\ p & p^2 & p^3 \end{vmatrix}$ where p is a constant. Then $\frac{d^3}{dx^3}$ [f(x)] at x = 0 is

(a) p (b) $p + p^3$ (c) $p + p^2$ (d*) Independent of p

8. Let F(x) = f(x) g(x) h(x) for all real x, where f(x), g(x) and h(x) are differentiable functions at some point x_0. F' (x_0) = 21 $F(x_0)$, f '(x_0) = 4$f(x_0)$, g'(x_0) = – 7$g(x_0)$ and h'(x_0) = K$h(x_0)$, then K =

(a) 12 (b*) 24 (c) 6 (d) 18

9. Let h(x) = min {x, x^2}, for every real number of x. Then-

(a*) h is not differentiable at two values of x

(b) h is differentiable for all x

(c) h' (x) = 0, for all x > 1

(d) None of these

10. The function f(x) = $(x^2 - 1)\,|x^2 - 3x + 2| + \cos(|x|)$ is not differentiable at.

(a) – 1 (b) 0 (c) 1 (d*) 2

11. If $x^2 + y^2 = 1$, then

(a) $yy'' - 2(y')^2 + 1 = 0$ (b*) $yy'' + (y')^2 + 1 = 0$

(c) $yy'' - (y')^2 - 1 = 0$ (d) $yy'' + 2(y')^2 + 1 = 0$

12. Let f : R → R is a function which is defined by f (x) = max {x x^3} set of points on which f(x) is not differentiable is

(a) {–1, 1} (b*) {–1, 0} (c) {0, 1} (d) {–1, 0, 1}

13. Find left and hand derivative at x = k, k ∈ I.f(x) = [x] sin (πx)

(a*) $(-1)^k (k-1)\pi$ (b) $(-1)^{k-1} (k-1)\pi$

(c) $(-1)^k (k-1)\pi$ (d) $(-1)^{k-1} (k-1)\pi$

14. Which of the following functions is differentiable at x = 0 ?

(a) cos (|x|) + |x| (b) cos (|x|) – |x| (c) sin (|x|) + |x| (d*) sin (|x|) – |x|

15. Let f : R → R be such that f(1) = 3 and f '(1) = 6. Then $\lim_{x\to 0}\left(\frac{f(1+x)}{f(1)}\right)^{1/x}$ equals-

(a) 1 (b) $e^{1/2}$ (c*) e^2 (d) e^3

16. The domain of the derivative of the function f(x) = $\begin{cases} \tan^{-1} x & \text{if } |x| \le 1 \\ \frac{1}{2}(|x|-1) & \text{if } |x| > 1 \end{cases}$ is-

(a*) R – {0} (b) R – {1} (c) R – {– 1} (d) R – {–1, 1}

17. Let y be a function of x, such that log (x + y) – 2xy = 0, then y'(0) is-

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

18. If x cos y + y cos x = π, then y' (0) =

(a*) π (b) – π (c) 0 (d) 1

19. S is a set of polynomial of degree less then or equal to 2

f(0) = 0

f(1) = 1

f ' (x) > 0; ∈ [0, 1] then set S =

(a) ϕ (b) $ax + (1 - a)x^2$; a ∈ R

(c) $ax + (1 - a)x^2$; 0 < a < ∞ (d*) $ax + (1 - a)x^2$; 0 < a < 2

20. If f (1) = 1; f(2) = 4, f(3) = 9 & f is twice differentiable then
(a*) $f''(x) =$ for all $x \in [1, 3]$ (b) $f''(x) = f'(x) = 5$; $x \in [1, 3]$
(c) $f''(x) = 2$ for only $x \in [1, 3]$ (d) $ax + (1 - a)x^2$; for $x \in (1, 3)$

21. $f(x) = ||x| - 1|$ is not differentiable at x =
(a*) 0, ± 1 (b) ± 1 (c) 0 (d) 1

ANSWER KEY

Q.No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Ans.	a	b	d	d	a	c	d	b	a	d	b	d	a	d	c

Q.No.	**16**	**17**	**18**	**19**	**20**	**21**
Ans.	d	b	a	d	a	a

20. TANGENT & NORMAL

1. The co-ordinates of the point on the curve $y = x^2 + 3x + 4$ the tangent at which passes through the origin is equal to
(a*) (2, 14) (–2, 2) (b) (2, 14), (–2, –2)
(c) (2, 14) (2, 2) (d) None of these

2. If the parametric equation of a curve is given by $x = e^t \cos t$, $y = e^t \sin t$ then the tangent to the curve at the point $t = \pi/4$ makes with the axis of x the angle
(a) 0 (b) $\pi/4$ (c) $\pi/3$ (d*) $\pi/2$

3. The curve $y - e^{xy} + x = 0$ has a vertical tangent at the point-
(a) (1, 1) (b) at no point (c) (0, 1) (d*) (1, 0)

4. If $y = 4x - 5$ is tangent to the curve $y^2 = px^3 + q$ at (2, 3), then
(a*) p = 2, q = – 7 (b) p = –2, q = 7 (c) p = – 2, q = – 7 (d) p = 2, q = 7

5. The curve $y = ax^3 + bx^2 + cx + 5$ touches the x-axis at P(–2, 0) and cuts the y-axis at a point Q where its gradient is 3. The a, b, c are respectively
(a*) –1/2, –3/4, 3 (b) 3, –1/2, –4 (c) –1/2, –7/4, 2 (d) None of these

6. Let C be the curve $y^3 - 3xy + 2 = 0$. If H be the set of points on the curve C, where tangent is horizontal and V is the set of points on the curve C where the tangent is vertical, then
H = … V =…
(a*) ϕ, (1, 1) (b) ϕ, (2, 1) (c) ϕ, (0, 1) (d) None of these

7. On the ellipse $4x^2 + 9y^2 = 1$, the points at which the tangents are parallel to the line 8x = 9y are-
(a) $\left(\frac{2}{5}, \frac{1}{5}\right)$ or $\left(\frac{1}{5}, \frac{2}{5}\right)$ (b*) $\left(-\frac{2}{5}, \frac{1}{5}\right)$ or $\left(\frac{2}{5}, -\frac{1}{5}\right)$
(c) $\left(-\frac{2}{5}, -\frac{1}{5}\right)$ (d) $\left(-\frac{1}{5}, -\frac{2}{5}\right)$

8. If x + y = K is normal to $y^2 = 12$, then K is-
(a) 3 (b*) 9 (c) – 9 (d) – 3

9. If the normal to the curve y = f(x) at the point (3, 4) makes an angle $3\pi/4$ with the positive x-axis, then $f'(3) =$

(a) –1 (b) $-\frac{3}{4}$ (c) $\frac{4}{3}$ (d*) 1

10. The triangle formed by the tangent to the curve $f(x) = x^2 + bx - b$ at the point (1, 1) and the co-ordinate axis, lies in the first quadrant. If its area is 2, then the value of b is
(a) –1 (b) 3 (c*) –3 (d) 1

11. The point(s) on the curve $y^3 + 3x^2 = 12y$ where the tangent is vertical, is (are)
(a) $\left(\pm\frac{4}{\sqrt{3}}, -2\right)$ (b) $\left(\pm\sqrt{\frac{11}{3}},\ 1\right)$ (c) (0, 0) (d*) $\left(\pm\frac{4}{\sqrt{3}},\ 2\right)$

12. The equation of the common tangent to the curves $y^2 = 8x$ and $xy = -1$ is-
(a) 3y = 9x + 2 (b) y = 2x + 1 (c) 2y = x + 8 (d*) y = x + 2

13. According to mean value theorem in the interval $x \in [0, 1]$ which of the following does not follow-

(a*) $f(x) = \frac{1}{2} - x \quad ; x < \frac{1}{2}$
$\quad = \left(\frac{1}{2} - x\right)^2 \quad ; x \ge \frac{1}{2}$

(b) $f(x) = \frac{\sin x}{x} \quad ; x \ne 0$
$\quad = 1 \quad ; \ x = 0$

(c) f(x) = x|x| (d) f(x)= |x|

14. If focal chord of $y^2 = 16x$ touches $(x-6)^2 + y^2 = 2$ then slope of such chord is
(a*) 1, –1 (b) 2, $-\frac{1}{2}$ (c) $\frac{1}{2}$, –2 (d) 2, –2

15. Let $f(x) = x^\alpha \log x$ for $x > 0$ & $f(0) = 0$ follows Rolle's theorem for [0, 1] then α is-
(a) –2 (b) –1 (c) 0 (d*) 1/2

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	a	d	d	a	a	a	b	b	d	c	d	d	a	a	d

21. MONOTONICITY

1. If f(x) = $\begin{cases} 3x^2 + 12x - 1, & -1 \le x \le 2 \\ 37 - x, & 2 < x \le 3 \end{cases}$ then f(x) is-
(a) Increasing in [–1, 2] (b) Continuous in [–1, 3]
(c) Greatest at x = 2 (d*) All above correct

2. The function f defined by $f(x) = (x + 2)e^{-x}$ is-
(a) Decreasing for all x
(b) Decreasing in $(-\infty, -1)$ and increasing $(-1, \infty)$
(c) Increasing for all x
(d*) Decreasing in $(-1, \infty)$ and increasing in $(-\infty, -1)$

3. Function f(x) = $\frac{\log\ (\pi + x)}{\log\ (e + x)}$ is decreasing in the interval-
(a) $(-\infty,\infty)$ (b*) $(0, \infty)$ (c) $(-\infty, 0)$ (d) No where

4. If $f(x) = \dfrac{x}{\sin x}$ and $g(x) = \dfrac{x}{\tan x}$, where $0 < x \le 1$, then in this interval-
(a) Both f(x) and g(x) are increasing functions
(b) Both f(x) and g(x) are decreasing function
(c*) f(x) is an increasing function
(d) g(x) is an increasing function

5. Let $h(x) = f(x) - (f(x))^2 + (f(x))^3$ for every real number x. Then-
(a*) h is increasing whenever f is increasing
(b) h is increasing whenever f is decreasing
(c) h is decreasing whenever f is increasing
(d) nothing can be said in general

6. The function f(x) is defined by $f(x) = (x + 2)\, e^{-x}$ is-
(a) $0 < x < \dfrac{\pi}{8}$ (b) $\dfrac{\pi}{4} < x < \dfrac{3\pi}{8}$ (c) $\dfrac{3\pi}{8} < x < \dfrac{5\pi}{8}$ (d*) $\dfrac{5\pi}{8} < x < \dfrac{3\pi}{4}$

7. The function $f(x) = \sin^4 x + \cos^4 x$ increases if-
(a) $0 < x < \dfrac{\pi}{8}$ (b*) $\dfrac{\pi}{4} < x < \dfrac{3\pi}{8}$ (c) $\dfrac{3\pi}{8} < x < \dfrac{5\pi}{8}$ (d) $\dfrac{5\pi}{8} < x < \dfrac{3\pi}{4}$

8. Let $f(x) = \int e^x (x-1)\ (x-2) dx$. Then f decreases in the interval-
(a) $(-\infty, -2)$ (b) $(-2, -1)$ (c*) $(1, 2)$ (d) $(2, +\infty)$

9. Consider the following statement **S** and **R**-
S : Both sin x and cos x are decreasing function in the interval $\left(\dfrac{\pi}{2}, \pi\right)$
R : If a differentiable function decreases in an interval (a, b), then its derivative also decreases in (a, b) Which of the following is true ?
(a) Both S and R are wrong
(b) Both S and R are correct, but R is not the correct explanation for S
(c) S is correct and R is the correct explanation for S
(d*) S is correct and R is wrong

10. Let $f(x) = x\, e^{x(1-x)}$, then f(x) is-
(a*) Increasing on [–1/2, 1] (b) Decreasing on R
(c) Increasing on R (d) Decreasing on [–1/2, 1]

11. The length of a longest interval in which the function $3 \sin x - 4 \sin^3 x$ is increasing, is-
(a*) $\pi/3$ (b) $\pi/2$ (c) $3\pi/2$ (d) π

12. $f(x) = x^2 - 2bx + 3c^2$ & $g(x) = -x^2 - 2cx + b^2$ if the minimum value of f(x) is always greater than maximum value of g(x) then.
(a*) $|c| > \sqrt{2}\,|b|$ (b) $c > \sqrt{2b}$ (c) $c < -\sqrt{2b}$ (d) $|c| < \sqrt{2}\,|b|$

13. Let $f(x) = \int_{x^2}^{x^2+1} e^{-t^2}$, $x \in (-\infty, \infty)$ then the interval for which f(x) is increasing is
(a*) $(-\infty, 0]$ (b) $[0, \infty)$ (c) $[-2, 2]$ (d) no where

14. Let $f(x) = x^3 + bx^2 + cx + d;\ 0 < b^2 < c$ then f(x)-
(a*) is strictly increasing (b) has local maxima

(c) has local minima (d) is bounded curve

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ans.	d	d	b	c	a	d	b	c	d	a	a	A	a	a

22. MAXIMA & MINIMA

1. If A > 0, B > 0 and A + B = π/3, then the maximum value of tanA tan B is……..
(a*)1/3 (b) 2/3 (c) 1/2 (d) None of these

2. The function f(x) = |px – q| + r|x|, x ∈ (–∞, ∞) where p > 0, q > 0, r > 0, assumes its minimum value only at one point if
(a) p ≠ q (b) r ≠ q (c*) r ≠ p (d) p = q = r

3. On the interval [0, 1], the function $x^{25}(1 - x^{75})$ takes its maximum value of the point-
(a) 0 (b*) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) $\frac{1}{3}$

4. The number of values of x where the function f(x) = cosx + cos $(\sqrt{2x})$ attains its maximu is
(a) 0 (b*) 1 (c) 2 (d) infinte

5. The function f(x) = $\int_{-1}^{x} t(e^t - 1)\ (t-1)\ (t-2)^3\ (t-3)^5\, dt$ has a local minimum at x =
(a) 0, 4 (b*) 1, 3 (c) 0, 2 (d) 2, 4

6. Let f(x) = $\begin{cases} |x| & \text{for } 0 < |x| \le 2 \\ 1 & \text{for } x = 0 \end{cases}$, then at x = 0, f has-
(a*) a local maximum (b) no local maximum
(c) a local minimum (d) no extremum

7. Let f(x) = $(1 + b^2)x^2 + 2bx + 1$ and m (b) is minimum value of f(x). As b varies, the range of m(b) is-
(a) [0, 1] (b) [0, 1/2] (c) [1/2, 1] (d*) (0, 1]

8. The value of 'θ'; θ ∈ [0, π] for which the sum of intercepts on coordinate axes cut by tangent at point ($3\sqrt{3}$ cos θ, sin θ) to ellipse $\frac{x^2}{27} + y^2 = 1$ is minimum is:
(a*) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{8}$

9. If f(x) = $\sqrt{x^2 + x} + \frac{\tan^2\alpha}{\sqrt{x^2 + x}}$, α ∈ (0, π/2) , x > 0 then value of f(x) is greater than or equal to:
(a) 2 (b*) 2 tan α (c) $\frac{5}{2}$ (d) sec α

ANSWER KEY

pankaj.baluja@mathematicsonline.co.in

Q.No.	1	2	3	4	5	6	7	8	9
Ans.	a	c	b	b	b	a	d	a	b

23. INDEFINITE INTEGRATION

1. $\int \frac{(3x+1)}{(x-1)^3\ (x+1)} dx$ equal to-I

(a*) $\frac{1}{4}$ log |x + 1| – $\frac{1}{4}$ log |x – 1| – $\frac{1}{2(x-1)} - \frac{1}{(x-1)} + c$

(b) $\frac{1}{4}$ log |x – 1| – $\frac{1}{4}$ log |x + 1| – $\frac{1}{2(x-1)} - \frac{1}{(x-1)^2} + c$

(c) $\frac{1}{4}$ log |x + 1| + $\frac{1}{4}$ log |x – 1| – $\frac{1}{2(x-1)} - \frac{1}{(x-1)}$ + c

(d) None of these

2. The value of the integral $\int \frac{\cos^3 x + \cos^5 x}{\sin^2 x + \sin^4 x} dx$ is-

(a) sin x – 6 $\tan^{-1}$ (sin x) + c
(b) sin x – 2 $(\sin x)^{-1}$ + c
(c*) sin x – 2 $(\sin x)^{-1}$ – 6 $\tan^{-1}$ (sin x) + c
(d) sin x – 2 $(\sin x)^{-1}$ + 5 $\tan^{-1}$ (sin x) + c

3. $\int \frac{dx}{(x-p)\ \sqrt{(x-p)\ (x-q)}}$ is equal to-

(a) $\frac{2}{p-q}\sqrt{\frac{x-p}{x-q}} + c$
(b*) $-\frac{2}{p-q}\sqrt{\frac{x-q}{x-p}} + c$
(c) $\frac{1}{\sqrt{(x-p)\ (x-q)}}$ + c
(d) None of these

4. $\int \frac{(x+1)}{x(1+xe^x)^2} dx$ is equal-

(a*) log $\left(\frac{x\ e^x}{1+x\ e^x}\right) + \frac{1}{1+x\ e^x} + c$
(b) log $\left(\frac{x}{1+x\ e^x}\right) + \frac{1}{1+x\ e^x} + c$
(c) log $\left(\frac{1+x\ e^x}{x\ e^x}\right) + \frac{1}{1+x\ e^x} + c$
(d) None of these

5. $\int \frac{dx}{(\sin x + 4)\ (\sin x - 1)} = \frac{A}{\tan\frac{x}{2} - 1}$ + B $\tan^{-1}$ (f(x)) + c, then-

(a) A = $\frac{1}{5}$, B = – $\frac{2}{5\sqrt{15}}$, f(x) = $\frac{4\tan x + 3}{\sqrt{15}}$

(b) $A = -\frac{1}{5}$, $B = \frac{1}{\sqrt{15}}$, $f(x) = \frac{4\tan\left(\frac{x}{2}\right)+1}{\sqrt{15}}$

(c) $A = \frac{2}{5}$, $B = -\frac{2}{5\sqrt{5}}$, $f(x) = \frac{4\tan x+1}{\sqrt{5}}$

(d*) $A = \frac{2}{5}$, $B = -\frac{2}{\sqrt{15}}$, $f(x) = \frac{4\tan\left(\frac{x}{2}\right)+1}{\sqrt{5}}$

6. $\int \frac{\cos x - \sin x}{\cos x + \sin x}(2 + 2\sin 2x)\,dx$ is equal to

(a*) $\sin 2x + c$ (b) $\cos 2x + c$ (c) $\tan 2x + c$ (d) None of these

7. $\int \frac{dx}{(2x-7)\sqrt{x^2-7x+12}}$ is equal to-

(a) $2\sec^{-1}(2x-7) + c$ (b*) $\sec^{-1}(2x-7) + c$

(c) $\frac{1}{2}\sec^{-1}(2x-7) + 2$ (d) None of these

8. $\int \left(\frac{1-\sqrt{x}}{1+\sqrt{x}}\right)^{1/2} \frac{dx}{x}$ is equal to-

(a) $\left[\log\left|\frac{1+\sqrt{1-x}}{\sqrt{x}}\right| + \cos^{-1}\sqrt{x}\right] + c$ (b*) $-2\left[\log\left|\frac{1+\sqrt{1-x}}{\sqrt{x}}\right| - \cos^{-1}\sqrt{x}\right] + c$

(c) $-2\left[\log\left|\frac{\sqrt{x}}{1+\sqrt{1-x}}\right| - \cos^{-1}\sqrt{x}\right] + c$ (d) None of thse

9. $\int \cos x \log\left(\tan\frac{x}{2}\right)dx$ is equal to-

(a) $\sin x \log\left(\tan\frac{x}{2}\right) + c$ (b*) $\sin x \log \tan\frac{x}{2} - x + c$

(c) $\sin x \log\left(\tan\frac{x}{2}\right) + x + c$ (d) None of these

10. $\int \frac{x^3+3x+2}{(x^2+1)^2(x+1)}\,dx$ is equal to-

(a) $\frac{1}{4}\log\left|\frac{x^2+1}{(x+1)^2}\right| + \frac{3}{2}\tan^{-1}x - \frac{x}{x^2+1} + c$ (b) $\frac{1}{4}\log\left|\frac{(x+1)^2}{x^2+1}\right| + \frac{3}{2}\tan^{-1}x + \frac{x}{x^2+1} + c$

(c*) $\frac{1}{4}\log\left|\frac{x^2+1}{(x+1)^2}\right| + \frac{3}{2}\tan^{-1}x + \frac{x}{x^2+1} + c$ (d) None of these

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans.	a	c	b	a	d	a	b	b	b	c

24. DEFINITE INTEGRATION

1. $\int_{-\pi}^{\pi} (\cos ax - \sin bx)^2\, dx$ where a and b are integers is equal to-

(a) –π (b) 0 (c) π (d*) 2 π

2. The value of $\int_{-\pi}^{\pi} (1 - x^2)\, \sin x \cos^2 x\, dx$ is-

(a*) 0 (b) $\pi - \pi^3/3$ (c) $2\pi - \pi^3$ (d) $\frac{7}{2} - 2\pi^2$

3. Integral $\int_0^1 |\sin 2\pi x|\, dx$ is equal to-

(a) 0 (b) $-\frac{1}{\pi}$ (c) $\frac{1}{\pi}$ (d*) $\frac{2}{\pi}$

4. If $\int_0^{\pi/3} \frac{\cos x}{3 + 4\sin x}\, dx = k \log \left(\frac{3 + 2\sqrt{3}}{3}\right)$ then k is-

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c*) $\frac{1}{4}$ (d) $\frac{1}{8}$

5. The value of $\int_0^{3\pi/2} \frac{dx}{1 + \tan^3}$ is

(a) 0 (b) 1 (c) π/2 (d*) π/4

6. The value of $\int_{\pi/4}^{3\pi/4} \frac{\phi}{1 + \sin\phi}\, d\phi$ is.......

(a*) $\pi(\sqrt{2} - 1)$ (b) $\pi(\sqrt{2} + 1)$ (c) $\pi(\sqrt{2} - 2)$ (d) None

7. $\int_2^3 \frac{\sqrt{x}}{\sqrt{(5 - x)} + \sqrt{x}}\, dx =$

(a*) 1/2 (b) 1/3 (c) 1/5 (d) None

8. If f(x) = A sin (πx/2) + B, $f'\left(\frac{1}{2}\right) = \sqrt{2}$ and $\int_0^1 f(x)dx = \frac{2A}{\pi}$, then the constants A and B are-

(a) π/2 and π/2 (b) 2/π and 3π (c) 0 and –4/π (d*) 4/π and 0

9. The value of $\int_{\pi}^{2\pi} [2\sin x]dx$, where [] represents the greatest integer function is:

(a*) $-\frac{5\pi}{3}$ (b) – π (c) $\frac{5\pi}{3}$ (d) – 2π

10. The function $L(x) = \int_1^x \frac{dt}{t}$ satisfied the equation

(a) L (x + y) = L (x) + L(y) (b) $L\left(\frac{x}{y}\right)$ = L(x) = L(y)

(c*) L(xy) = L(x) + L(y)(d) None of these

11. If for a non-zero x, a f(x) + b $f\left(\frac{1}{x}\right) = \frac{1}{x} - 5$, where a ≠ b, then $\int_1^2 f(x)\ dx$ =

(a) $\frac{1}{a^2+b^2}\left(a\log 2 + 5a + \frac{7b}{2}\right)$ (b*) $\frac{1}{a^2-b^2}\left(a\log 2 - 5a + \frac{7b}{2}\right)$

(c) $-\frac{1}{a^2+b^2}\left(a\log 2 + 5a - \frac{7b}{2}\right)$ (d) None of these

12. The value of $\int_{-\pi}^{\pi} \frac{\cos^2 x}{1+a^x}$ dx, a > 0 is-

(a) π (b) a π (c*) $\frac{\pi}{2}$ (d) 2π

13. Let $\frac{d}{dx}$ F(x) = $\frac{e^{\sin x}}{x}$, x > 0. If $\int_1^4 \frac{2e^{\sin x^2}}{x}$ dx = F(K) – F(1), then one of the possible values of K is-

(a) 2 (b) 4 (c) 8 (d*) 16

14. If g (x) = $\int_a^x \cos^4 t\ dt$, then g(x + π) equals-

(a*) g(x) + g(π) (b) g(x) – g(π) (c) g(x) g(π) (d) g(x)/g(π)

15. Let f be a positive function, let $I_1 = \int_{1-k}^{k}$ x. f[x (1 – x)] dx & $I_2 = \int_{1-k}^{k}$ f[x (1 – x)] dx, where (2k – 1) > 0, then $\frac{I_1}{I_2}$ is

(a) 2 (b) k (c*) 1/2 (d) 1

16. If $\int_0^x f(t)dt = x + \int_x^1 tf(t)dt$, then the value of f(1) is-

(a*) 1/2 (b) 0 (c) 1 (d) –1/2

17. $\int_0^1 \tan^{-1}(1 - x + x^2)dx =$

(a*) log 2 (b) $\log\frac{1}{2}$ (c) π log 2 (d) $\frac{\pi}{2}\log\frac{1}{2}$

18. For n > 0 $\int_0^{2\pi} \frac{x\sin^{2n} x}{\sin^{2n} x + \cos^{2n} x}dx =$

(a*) π (b) π (c) 2π (d) 3π

19. Let f(x) = x – [x], for every real number x, where [x] is the integral part of x. Then $\int_{-1}^{1} f(x)dx$ is-

(a*) 1 (b) 2 (c) 0 (d) $\frac{1}{2}$

20. $\int_{\pi/4}^{3\pi/4} \frac{dx}{1+\cos x}$ is equal to-

(a*) 2 (b) – 2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

21. If for a real number y, [y] is the greatest integer less than or equal to y, then the value of the integral $\int_{\pi/2}^{3\pi/2} [2\sin x]\ dx$ is

(a) – π (b) 0 (c*) – π/2 (d) π/2

22. $\int_{-\pi}^{\pi} \frac{\cos^2 x}{1+a^x} dx$, a > 0

(a) π (b) πa (c*) π/2 (d) 2π

23. The value of the integral $\int_{e^{-1}}^{e^2} \left|\frac{\log_e x}{x}\right| dx$ is

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

24. If f(x) = $\begin{cases} e^{\cos x}\sin; & |x|<2 \\ 2; & \text{otherwise} \end{cases}$ Then $\int_{-2}^{3} f(x)dx =$

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

25. Let g(x) = $\int_0^x f(t)dt$ where $\frac{1}{2} \le f(t) \le 1$, t ∈ [0, 1] and $0 \le f(t) \le \frac{1}{2}$ for t ∈ [1, 2]. Then

(a) $-\frac{3}{2} \le g(2) < \frac{1}{2}$ (b*) 0 ≤ g(2) < 2 (c) $\frac{3}{2} < g(2) \le \frac{5}{2}$ (d) 2 < g(2) < 4

26. Let f: (0, ∞) → R and F(x^2) = $\int_0^{x^2} f(t)dt$ If F(x^2) = x^2(1 + x), then f(4) equals-

(a) $\frac{5}{4}$ (b) 7 (c*) 4 (d) 2

27. The integral $\int_{-\frac{1}{2}}^{\frac{1}{2}} \left([x]+\ell n\left(\frac{1+x}{1-x}\right)\right) dx$ equals-

(a*) –1/2 (b) 0 (c) 1 (d) $2\ell n(1/2)$

28. Let T > 0 be a fixed real number. Suppose f is a continuous function such that for al $x \in R$, f(x + T) = f(x). If I = $\int_0^T f(x)dx$ then the value of $\int_3^{3+3T} f(2x)dx$ is-

(a) –3/2 I (b) $\pm 1/\sqrt{2}$ (c*) $\pm \frac{1}{2}$ (d) 0 and 1

29. Let f(x) = $\int_1^x \sqrt{2-t^2}\,dt$. Then the real roots of the equation $x^2 - f'(x) = 0$ are-

(a*) ± 1 (b) $\pm 1/\sqrt{2}$ (c) $\pm \frac{1}{2}$ (d) 0 and 1

30. $I_{(m,n)} = \int_0^1 t^m (1+t)^n dt$, then $I_{m,n}$ = ?

(a) $I_{(m,n)} = \frac{n}{m+1} \cdot \frac{I_{(m+1,\, n-1)}}{m+1}$ (b) $I_{(m,n)} = \frac{1}{m+1} \cdot \frac{I_{(m+1,\, n-1)}}{m+1}$

(c*) $I_{(m,n)} = \frac{2^n}{1+m} - \frac{n.I_{(m+1,\, n-1)}}{m+1}$ (d) $I_{(m,n)} = \frac{2^n}{1+m} + \frac{n.I_{(m+1,\, n-1)}}{m+1}$

31. If $\int_0^{t^2} xf(x)dx = \frac{2}{5}t^5$ for t > 0, then f(4/25) is-

(a) $-\frac{2}{5}$ (b) 0 (c*) $\frac{2}{5}$ (d) 1

32. $\int_0^1 \sqrt{\frac{1-x}{1+x}}\,dx$ equals to-

(a) $\frac{\pi}{2}+1$ (b*) $\frac{\pi}{2}-1$ (c) 1 (d) π

33. $\int_{-2}^{0} [x^3 + 3x^2 + 3x + 3 + (x+1)\cos(x+1)]dx =$

(a*) 4 (b) 0 (c) –1 (d) 1

34. $\int_{\sin x}^{1} t^2 f(t)dt = 1 - \sin x;\ 0 \le x \le \frac{\pi}{2}$, then $f\left(\frac{1}{\sqrt{3}}\right)$ is-

(a*) 3 (b) $\frac{1}{3}$ (c) 1 (d) $\sqrt{3}$

ANSWER KEY

Q.No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Ans.	d	a	d	c	d	a	a	d	a	c	b	c	d	a	c	a	a
Q.No.	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**

Ans.	a	a	a	c	c	b	c	b	c	a	c	a	c	c	b	a	a

25. AREA UNDER THE CURVE

1. The area between the curves $y = x^2$ and $y = \frac{2}{1+x^2}$ is-

(a) $\pi - \frac{1}{3}$ (b) $\pi - 2$ (c*) $\pi - \frac{2}{3}$ (d) $\pi + \frac{2}{3}$

2. The area of the region bounded by $y = |x - 1|$ and $y = 1$ is

(a*) 1 (b) 2 (c) 1/2 (d) None of these

3. The slope of the tangent to the curve $y = f(x)$ at a point (x, y) is $2x + 1$ and the curve passes through (1, 2). The area of the region bounded by the curve, the x-axis and the line $x = 1$ is-

(a) 5/3 units (b*) 5/6 units (c) 6/5 units (d) 6 units

4. Let A_n be the area bounded by the curve $y = (\tan x)^n$ and the lines $x = 0$, $y = 0$, $x = \pi/4$. If $n \geq 2$, then $A_n + A_{n+2}$ is equal to-

(a*) $\frac{1}{n+1}$ (b) $\frac{1}{n}$ (c) $\frac{1}{n-1}$ (d) None of these

5. If the area bounded by the curves $y = x - bx^2$ and $y = \frac{1}{b}x^2$, where $b > 0$ is maximum, then b =

(a) 0 (b*) 1 (c) 2 (d) None of these

6. Let $f(x) = \text{Maximum } [x^2, (1 - x)^2, 2x(1 - x)]$ where $0 \leq x \leq 1$. The area of the region bounded by the curves $y = f(x)$, x-axis $x = 0$ and $x = 1$ is-

(a*) $\frac{17}{27}$ (b) $\frac{14}{27}$ (c) $\frac{19}{27}$ (d) None of these

7. For which of the following values of m, is the area of the region bounded by the curve $y = x - x^2$ and the line $y = mx$ equals 9/2

(a) –4 (b) –2 (c) 2, –4 (d*) 4, – 2

8. The triangle formed by the tangent to the curve $f(x) = x^2 + bx - b$ at the point (1, 1) and the coordinates axes, lies in the first quadrant. If its area is 2, then the value of b is-

(a) –1 (b) 3 (c) – 3 (d) 1

9. The area bounded by the curves $y = |x| - 1$ and $y = -|x| + 1$ is-

(a) 1 (b) 2 (c*) $2\sqrt{2}$ (d) 4

10. Area of the region bounded by $y = \sqrt{x}$, $x = 2y + 3$ & x-axis lying in 1st quadrant is-

(a) $2\sqrt{3}$ (b) 18 (c*) 9 (d) 34/3

11. The are a of quadrilateral formed by tangents at the ends of latus rectum of ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$ is-

(a) 9 (b*) 27 (c) $\frac{27}{4}$ (d) $\frac{27}{2}$

12. If area bounded by the curves $x = ay^2$ and $y = ax^2$ is 1, then a equals-

(a*) $\frac{1}{\sqrt{3}}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{1}{6}$

13. Find the area between the curves $y = (x - 1)^2$, $y = (x + 1)^2$ and $y = \frac{1}{4}$

(a*) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{4}{3}$ (d) $\frac{1}{6}$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Ans.	c	a	b	a	b	a	d	c	c	c	b	a	a

26. DIFFERENTIAL EQUATION

1. The differential equation whose solution is $(x - h)^2 + (y - k)^2 = a^2$ is (where a is a constant)-

(a) $\left[1+\left(\frac{dx}{dx}\right)^2\right]^3 = a^2\frac{d^2y}{dx^2}$ (b*) $\left[1+\left(\frac{dy}{dx}\right)^2\right]^3 = a^2\left(\frac{d^2y}{dx^2}\right)^2$

(c) $\left[1+\left(\frac{dy}{dx}\right)\right]^3 = a^2\left(\frac{d^2y}{dx^2}\right)^2$ (d) None of these

2. The solution of the differential equation $(2x - 10y^3)\frac{dy}{dx} + y = 0$ is-

(a) $x + y = ce^{2x}$ (b) $y^2 = 2x^3 + c$ (c*) $xy^2 = 2y^5 + c$ (d) $x(y^2 + xy) = 0$

3. A curve y = f(x) passes thro' the point P(1, 1). The normal to the curve at P is a (y – 1) = 0. If the slope of the tangent at any point on the curve is proportional to the ordinate of the point, then the equation of the curve is-

(a*) $y = e^{K(x-1)}$ (b) $y = e^{Kx}$ (c) $y = e^{K(x-2)}$ (d) None of these

4. The equation of the curve passing through origin and satisfying the differential equation $\frac{dy}{dx} = \sin(10x + 6y)$ is-

(a*) $y = \frac{1}{3}\tan^{-1}\left(\frac{5\tan 4x}{4-3\tan 4x}\right) - \frac{5x}{3}$ (b) $y = \frac{1}{3}\tan^{-1}\left(\frac{5\tan 4x}{4+3\tan 4x}\right) - \frac{5x}{3}$

(c) $y = \frac{1}{3}\tan^{-1}\left(\frac{3+\tan 4x}{4-3\tan 4x}\right) - \frac{5x}{3}$ (d) None of these

5. A curve C has the property that if the tangent drawn at any point P on C meets the coordinate axis at A and B, then P is the midpoint of AB. If the curve passes through the point (1, 1) then the equation of the curve is-

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

6. The order of the differential equation whose general solution is given by

$y = (c_1 + c_2)\cos(x + c_3) - c_4 e^{x + c_5}$, where c_1, c_2, c_3, c_4, c_5 are arbitrary constant is-

(a) 5 (b) 4 (c*) 3 (d) 2

7. The differential equation representing the family of curve $y^2 = 2x(x + \sqrt{c})$, where c is a positive parameter, is of-

(a*) Order 1, degree 3 (b) Order 2, degree 2

(c) Degree 3, order 3 (d) Degree 4, order 4

8. The solution of the differential equation $\left(\frac{dy}{dx}\right)^2 - x\frac{dy}{dx} + y = 0$ is-

(a) y = 2 (b) y = 2x (c*) y = 2x – 4 (d) $y = 2x^2 - 4$

9. Let $(1 + t)\frac{dy}{dt} - ty = 1$, y (0) = – 1. find y(t) t = 1 ?

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

10. If y = y(x) satisties $\frac{2+\sin x}{1+y}\left(\frac{dy}{dx}\right)$ = – cos x such that y(0) = 1 then y (π/2) is equal to-

(a) 3/2 (b) 5/2 (c*) 1/3 (d) 1

11. $(x^2 + y^2)\,dy = xy\,dx$ (initial value problem), y > 0, x > 0, y (1) = 1, $y(x_0)$ then find x_0 = ?

(a) $\sqrt{\frac{e^2-1}{2}}$ (b) $\sqrt{2e^2-1}$ (c) $\sqrt{e^2-2}$ (d*) $\sqrt{3}\,e$

12. $x\,dy - y\,dx = y^2dy$, y > 0 & y(1) = 1 then find y (–3) = ?

(a*) 3 (b) 2 (c) 4 (d) 5

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12
Ans.	b	c	a	a	c	c	a	c	a	c	d	a

27. VECTOR

1. A unit vector coplanar with **i + j + 2k** and **i + 2j + k** and perpendicular to **i + j + k** is

(a*) $\pm\frac{j-k}{\sqrt{2}}$ (b) $\frac{j-k}{\sqrt{2}}$ (c) $-\frac{j+k}{\sqrt{2}}$ (d) None of these

2. A unit vector in xy-plane that makes an angle of 45º with the vector **i + j** and an angle of 60º with the vector **3i – 4j** is

(a) i (b) $\frac{(i+j)}{\sqrt{2}}$ (c) $\frac{(i-j)}{\sqrt{2}}$ (d*) None of these

3. If **x** and **y** are two unit vectors and ϕ is the angle between them, then $\frac{1}{2}$ |**x – y**| is equal to

(a) 0 (b) π/2 (c) $\left|\sin\frac{1}{2}\phi\right|$ (d*) $\left|\cos\frac{1}{2}\phi\right|$

4. Let a, b, c be distinct non-negative numbers. If the vectors ai + aj + ck, I + k and ci + cj + bk lie in a plane, then c is-

(a) The Arithmetic Mean of a and b (b*) The Geometric mean of an and b

(c) The Harmonic mean of and b (d) Equal to zero+

5. If the non-zero vectors $\vec{a}$ and $\vec{b}$ are perpendicular to each other, then the solution of the equation $\vec{r}\times\vec{a}=\vec{b}$ is -

(a*) $\vec{r}=x\vec{a}+\frac{1}{\vec{a}.\vec{a}}(\vec{a}\times\vec{b})$ (b) $\vec{r}=x\vec{b}+\frac{1}{\vec{b}.\vec{b}}(\vec{a}\times\vec{b})$

(c) $\vec{r}=x\vec{a}\times\vec{b}$ (d) $\vec{r}=x\vec{b}\times\vec{a}$

6. Let α, β, γ be distinct real numbers. The points with position vectors $\alpha i + \beta j + \gamma k$, $\beta i + \gamma j + \alpha k$, $\gamma i + \alpha j + \beta k$-

(a) Are collinear (b*) Form an equilateral triangle

(c) Form an isosceles triangle (d) Form a right angled triangle

7. The vector $\frac{1}{3}$ (2i – 2j + k) is

(a*) A unit vector

(b) Makes an angle $\pi/3$ with the vector 2i –4j + 3k

(c) Parallel to the vector 3i + 2j – 2k

(d) None of these

8. Let a = i – j, b = j – k, c = k – i. If d is a unit vector such that a. d = 0 = [b, c, d], then d equals

(a*) $\pm\frac{i+j-2k}{\sqrt{6}}$ (b) $\pm\frac{i+j-k}{\sqrt{3}}$ (c) $\frac{i+j+k}{\sqrt{3}}$ (d) ± k

9. Let u, v, w be vectors such that u + v + w = 0. If |u| = 3, |v| = 4, |w| = 5. Then the value of the u.v. + v. w + w. u is-

(a*) 47 (b) – 25 (c) 0 (d) 25

10. A, B and C are three non coplanar vectors, then (A + B + C). ((A + B) × (A + C)) equals

(a) 0 (b) [A, B, C] (c) 2[A, B, C] (d*) – [A, B, C]

11. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar unit vectors such that $\vec{a}\times(\vec{b}\times\vec{c})=\frac{\vec{b}+\vec{c}}{\sqrt{2}}$ then the angle between $\vec{a}$ and $\vec{b}$ is-

(a*) $\frac{3\pi}{4}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) π

12. A vector $\vec{a}$ has components 2p and 1 with respect to a rectangular Cartesian system. The sytem is rotated thro'a certain angle about the origin in the counterclockwise sense. If, with respect to new system, $\vec{a}$ has components p + 1 and 1, then

(a) p = 0 (b*) p = 1 or p = $-\frac{1}{3}$ (c) p = – 1 or p = $\frac{1}{3}$ (d) p = 1 or p = – 1

13. If $\vec{b}$ and $\vec{c}$ are any two perpendicular unit vectors and $\vec{a}$ is any vector, then $(\vec{a}.\vec{b})\vec{c}+(\vec{a}.\vec{c})\vec{b}+\frac{\vec{a}.(\vec{b}\times\vec{c})}{|\vec{b}\times\vec{c}|^2}(\vec{b}\times\vec{c})$ is equal to-

(a) $\vec{b}$ (b*) $\vec{a}$ (c) $\vec{c}$ (d) None of these

14. Let $\overline{OA} = \vec{a}, \overline{OB} = 10\vec{a}$ and $\overline{OC} = \vec{b}$ where O, A, c are non-collinear. Let p denote the are of the quadrilateral OABC and q denote the area of the parallelogram with OA and OC as adjacent sides. The $\frac{p}{q}$ is equal to-

(a) 4 (b*) 6 (c) $\frac{1}{2}\frac{|\vec{a}-\vec{b}|}{|\vec{a}|}$ (d) None of these

15. Let $\vec{p}, \vec{q}, \vec{r}$ be three mutually perpendicular vectors of the same magnitude. If a vector $\vec{x}$ satisfies the equation. $\vec{p}\times[(\vec{x}-\vec{q})\times\vec{p}]+\vec{q}\times[(\vec{x}-\vec{r})\times\vec{q}+\vec{r}\times[(\vec{x}-\vec{p})\times\vec{r}]=\vec{0}$, then $\vec{x}$ is given by

(a) $\frac{1}{2}(\vec{p}+\vec{q}-2\vec{r})$ (b*) $\frac{1}{2}(\vec{p}+\vec{q}+\vec{r})$ (c) $\frac{1}{3}(\vec{p}+\vec{q}+\vec{r})$ (d) $\frac{1}{3}(2\vec{p}+\vec{q}-\vec{r})$

16. If $\vec{a}, \vec{b}$ and $\vec{c}$ are vectors such that $|\vec{b}| = |\vec{c}|$, then $[(\vec{a}+\vec{b})\times(\vec{a}+\vec{c})]\times(\vec{b}\times \vec{c}).(\vec{b}+ \vec{c})$ =

(a) 1 (b) –1 (c*) 0 (d) None of these

17. If $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors having magnitudes 1, 1 and 2 respectively. If $\vec{a}\times(\vec{a}\times \vec{c})-\vec{b}=\vec{0}$, then the acute angle between $\vec{a}$ and $\vec{c}$ is-

(a) $\frac{\pi}{4}$ (b*) $\frac{\pi}{6}$ (c) $\frac{\pi}{3}$ (d) None of these

18. If a = i + j + k, b = 4i + 3j + 4k and c = I + αj + βk are linearly dependent vectors and $|c| = \sqrt{3}$, then

(a) α = 1, β = – 1 (b) α = 1, β = ± 1 (c) α = – 1, β = ± 1 (d*) α = ± 1, β = 1

19. For three vectors u, v, w which of the following expressions is not equal to any of remaining three ?

(a) u. (v × w) (b) (v × w). u (c*) v. (u × w) (d) (u × v). w

20. Which of the following expression of meaningful ?

(a*) u. (v × w) (b) (u. v). w (c) (u . v)w (d) None of these

21. Let a = 2i + j – 2k and b = I + j. if c is vector such that a . c = |c|, |c – a| = $2\sqrt{2}$ and the angle between (a × b) and c is 30º. Then |(a × b) × c| =

(a) $\frac{2}{3}$ (b*) $\frac{3}{2}$ (c) 2 (d) 3

22. Let a = 2i + j + k, b = I + 2j – k and a unit vector c be coplanar. If c perpendicular to a, the c =

(a) $\frac{1}{\sqrt{2}}$(–j + k) (b) $\frac{1}{\sqrt{3}}$ (–i – j –k) (c*) $\frac{1}{\sqrt{5}}$(i – 2j) (d) $\frac{1}{\sqrt{3}}$(i – j – k)

23. Let a and b be two non-collinear unit vectors. If u = a – (a . b) b and v = a × b, then |v| is

(a) |u| + |u + a| (b*) |u| + |u . a| (c) |u| + |u . b| (d) |u| + u . (a + b)

24. Let $\vec{u}$ and $\vec{v}$ be unit vectors. If $\vec{w}$ is a vector such that $\vec{w}$ + $(\vec{w}+\vec{u})=\vec{v}$, then $|(\vec{u}\times\vec{v}).\vec{w}|$

(a) ≤ 1/3 (b*) ≤ 1/2 (c) >1/3 (d) ≥ 1/2

25. If the vector a,b and c form the sider BC, CA and AB respectively of a triangle ABC, the-

(a*) a . b + b . c + c . a = 0 (b) a × b = b × c = c × a

(c) a . b = b . c = c . a(d) a × b + c × c + c × a = 0

26. Let the vector a, b, c and d be such that (a × b) × (c × d) = 0. Let P_1 and P_2 be planes determined by the pairs of vectors a, b, c and d respectively. Then the angle between P_1 and P_2 is-
(a*) 0 (b) π/4 (c) π/3 (d) π /2

27. Let $\vec a, \vec b, \vec c$ be the position vectors of three vertices. A, B, C of a triangle respectively. Then the area of this triangle is given by-
(a) $\vec a \times \vec b + \vec b \times \vec c + \vec c \times \vec a$ (b) $\frac{1}{2}(\vec a \times \vec b).\vec c$
(c*) $\frac{1}{c}|\vec a \times \vec b + \vec b \times \vec c + \vec a \times \vec a|$ (d) None of these

28. Let a = i – k, b = xi + j + (1 – x)k and c = yi + xj + (1 + x – y)k. Then [a b c] depends on-
(a) only x (b) only y (c*) neither x nor y (d) both x and y

29. If $\vec a, \vec b, \vec c$ are unit vectors , then $|\vec a - \vec b|^2 + |\vec b - \vec c|^2 + |\vec c - \vec a|^2$ does not exceed-
(a) 4 (b*) 9 (c) 8 (d) 6

30. If $\vec a$ and $\vec b$ are two unit vectors such that $\vec a + 2\vec b$ and $5\vec a - 4\vec b$ are perpendicular to each other then the angle between $\vec a$ and $\vec b$ is-
(a) 45° (b*) 60° (c) $\cos^{-1}\left(\frac{1}{3}\right)$ (d) $\cos^{-1}\left(\frac{2}{7}\right)$

31. Let $\vec V = 2\vec i + \vec j - \vec k$ and $\vec W = \vec i + 3\vec k$. If $\vec U$ is a unit vector; then the maximum value of the scalar triple product $[\vec U \vec V \vec W]$ is-
(a) –1 (b) $\sqrt{10} + \sqrt{6}$ (c*) $\sqrt{59}$ (d) $\sqrt{60}$

32. If $\vec a$ = I + aj + k; $\vec b$ = j + ak; $\vec c$ = ai + k, then find the value of 'a' for which volume of parallelepiped formed by these three vectors as coterminous edges, is minimum.
(a) $\sqrt{3}$ (b) 3 (c*) $\frac{1}{\sqrt{3}}$ (d) $\frac{1}{3}$

33. If $\vec a = i + j + k$ and $\vec a.\vec b = 1$ $\vec a \times \vec b = j - k$ then $\vec b$ is equal to-
(a) 2i (b) I – j + k (c*) i (d) 2j – k

34. A unit vector is orthogonal to 5i – 2j + 6k and is coplanar to 2i – 5j + 3k and I – j + k then the vector, is-
(a*) $\frac{3j-k}{\sqrt{10}}$ (b) $\frac{2j+5k}{\sqrt{29}}$ (c) $\frac{6j-5k}{\sqrt{61}}$ (d) $\frac{2i+2j-k}{3}$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ans.	a	d	c	b	a	b	a	a	b	d	a	b	b	b	b	c	B
Q.No.	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34

Ans.	d	c	a	b	a	c	b	b	a	c	c	b	b	c	c	c	a

28. PROBABILITY

1. India plays two matches each with West-indies and Australia. In any match the probability of India getting points 0, 1 and 2 are 0.45, 0.05 and 0.50 respectively. Assuming that the out comes are independent, the probability of Indies getting at least 7 points is-
(a) 0.8750 (b*) 0.0875 (c) 0.0626 (d) 0.0250

2. An unbiased die with faces marked 1,2,3,4,5 and 6 is rolled four times. Out of four face values obtained, the probability that the minimum face value is not less than 2 and the maximum face value is not greater than 5 is then-
(a*) 16/81 (b) 1/81 (c) 80/81 (d) 15/81

3. Let E and F be two independent events. The probability that both E and F happen is 1/12 and the probability that neither E nor F happens is 1/2. Then-
(a*) p(E) = 1/3, p(F) = 1/4 (b) p(E) = 1/2, p(E) = 1/6
(c) p(E) = 1/6, p(F) = 1/2 (d) None of these

4. You are given a box with 20 cards in it. 10 of these cards have letter I printed on them. The other ten have the letter T printed on the. If you pick up 3 cards at random and keep them in same order, the probability of making the word I.I.T. is-
(a) $\frac{9}{80}$ (b*) $\frac{1}{8}$ (c) $\frac{4}{27}$ (d) $\frac{5}{38}$

5. Three identical dice are rolled. The probability that the same number will appear on each of them is-
(a) $\frac{1}{6}$ (b*) $\frac{1}{36}$ (c) $\frac{1}{18}$ (d) $\frac{3}{28}$

6. The probability of India winning a test match against West Indies is ½. Assuming independence from match to match the probability that in a 5 match series. India's second with occurs at the third test is-
(a*) 1/8 (b) 1/4 (c) 1/2 (d) 1/3

7. Three of the six vertices of a regular hexagon are chosen at random. The probability that the triangle with these vertices is equilateral, equals-
(a) 1/2 (b) 1/5 (c*) 1/10 (d) 1/20

8. Three numbers are chosen at random without replacement from {1, 2, 3,…10}. The probability that the minimum of the chosen numbering is 3 or their maximum is 5,
(a*) 7/40 (b) 5/40 (c) 11/40 (d) None of these

9. Seven white balls and three black balls are randomly placed in a row. The probability that no two black balls are placed adjacently equals-
(a) 1/2 (b*) 7/15 (c) 2/15 (d) 1/3

10. If from each of the three boxes containing 3 2hite and 1 black, 2 2hite and 2 black, white and 3 black balls, one ball is drawn at random, then the probability that 2 white and 1 black ball will be drawn is-
(a*) 13/32 (b) 1/4 (c) 1/32 (d) 3/16

11. There are four machines and it is known that exactly two of them are faulty. They are tested, one by one, in a random order till both the faulty machines are identified. Then the probability that only two tests are needed is-
(a) 1/3 (b*) 1/6 (c) 1/2 (d) 1/4

12. A fair coin is tossed repeatedly. If tail appears on first four tosses, then the probability of head appearing on fifth toss equals-
(a*)1/2 (b) 1/32 (c) 31/32 (d) 1/5

13. If the integers m and n are chosen at random between 1 and 100, then the probability that a number of the form $7^m + 7^n$ is divisible by 5 equals-
(a) 1/4 (b) 1/7 (c*) 1/8 (d) 1/49

14. The probabilities that a student passes in Mathematics, Physics and Chemistry are m, p and c, respectively. Of these subjects the student have a 75% chance of passing in atleast one, a 50% change of passing in atleast two, and a 40% chance of passing in exactly two. Which of the following relations are true ?
(a) p + m + c = 19/20(b*) p + m + c = 27/20
(c) pmc = 1/4 (d) None of these

15. A coin has probability p of showing head when tossed. It is tossed in times. Let p_n denote the probability that no two (or more) consecutive heads occurs, then
(a) $p_1 = 1$
(b) $p_2 = 1 - p^2$
(c) $p_n = (1 - p)p_{n-1} + p(1 - p)p_{n-2}$ for all $n \geq 3$
(d*) All of these

16. Given that P(B) = ¾, $P(A \cap B \cap \bar{C}) = 1/3$, $P(\bar{A} \cap B \cap \bar{C}) = 1/3$ then find probability of $B \cap C$, when $\bar{A}, \bar{B}, \bar{C}$ are negotiations of A,B,C respectively, is
(a) 2/3 (b*) 1/12 (c) 1/15 (d) 1/4

17. Two numbers are chosen, one by one (with out replacement) from the set of numbers A = {1, 2, 3, 4, 5, 6} The probability that minimum value of chosen number is less than 4 is
(a) 1/15 (b) 14/15 (c) 1/5 (d*) 4/4

18. Three distinct numbers are chosen randomly from first 100 natural number, then probability that all are divisible by 2 and 3 both is
(a) 4/33 (b) 4/35 (c) 4/25 (d*) 4/115

19. While throwing a dice getting one an even no. of throws has probability P, then P is equal to
(a) 1/6 (b) 5/36 (c) 6/11 (d*) 5/11

ANSWER KEY

Q.No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Ans.	b	a	a	d	b	a	c	a	b	a	b	a	c	b	D

Q.No.	**16**	**17**	**18**	**19**
Ans.	b	d	d	d

29. MATRICES & DETERMINANTS

1. If $D_r = \begin{vmatrix} 2^{r-1} & 2.3^{r-1} & 4.5^{r-1} \\ \alpha & \beta & \gamma \\ 2^n - 1 & 3^n - 1 & 5^n - 1 \end{vmatrix}$, then the value of $\sum_{r=1}^{n} D_r$
(a*) 0 (b) $\alpha\,\beta\,\gamma$ (c) $\alpha + \beta + \gamma$ (d) $\alpha.2^n + \beta.3^n + \gamma.4^n$

2. If a, b,c are in G.P., then the value of determinant $\Delta = \begin{vmatrix} a & b & ax+b \\ b & c & bx+c \\ ax+b & bx+c & 0 \end{vmatrix}$ is-
(a) 1 (b*) 0 (c) –1 (d) None of thees

3. If a_1, a_2……..form a G.P. and $a_i > 0$ for all $i \geq 1$, then $\Delta = \begin{vmatrix} \log a_m & \log a_{m+1} & \log a_{m+2} \\ \log a_{m+3} & \log a_{m+4} & \log a_{m+5} \\ \log a_{m+6} & \log a_{m+7} & \log a_{m+8} \end{vmatrix}$ is equal to-

(a) $\log(a_{m+8}) - \log(a_m)$ (b) $\log(a_{m+8}) + \log a_m$
(c*) zero (d) $\log_2 a_{m+4}$

4. If the system of equations $x + ay + az = 0$; $bx + y + bz = 0$; $cx + cy + z = 0$ where a, b and c are non-zero and non-unity, has a non-trivial solution, then the value of $\frac{a}{1-a} + \frac{b}{1-b} + \frac{c}{1-c}$ is

(a) zero (b) 1 (c*) –1 (d) $\frac{abc}{a^2+b^2+c^2}$

5. If $\omega(\neq 1)$ is a cube root of unity, then $\begin{vmatrix} 1 & 1+i+\omega^2 & \omega^2 \\ 1-i & -1 & \omega^2-1 \\ -i & -i+\omega-1 & -1 \end{vmatrix}$ equals

(a) 0 (b) 1 (c*) i (d) ω

6. The determinant $\begin{vmatrix} xp+y & x & y \\ yp+z & y & z \\ 0 & xp+y & yp+z \end{vmatrix} = 0$ if-

(a) x, y, z are in A.P. (b*) x, y, z are in G.P.
(c) x, y, z are in H.P. (d) xy, yz, zx are in A.P.

7. Let $f(x) = \begin{vmatrix} x^3 & \sin x & \cos x \\ 6 & -1 & 0 \\ p & p^2 & p^3 \end{vmatrix}$ where p is a constant. Then $\frac{d^3}{dx^3}$ [f(x)] at x = 0 is-

(a) p (b) $p + p^2$ (c) $p + p^3$ (d*) independent of p

8. The parameter on which the value of the determinant $\begin{vmatrix} 1 & a & a^2 \\ \cos(p-d)x & \cos px & \cos(p+d)x \\ \sin(p-d)x & \sin px & \sin(p+d)x \end{vmatrix}$ does not depend upon is-

(a) a (b*) p (c) d (d) x

9. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix} = x + iy$, then-

(a) x = 3, y = 1 (b) x = 1, y = 3 (c) x = 0, y = 3 (d*) x = 0, y = 0

10. If $f(x) = \begin{vmatrix} 1 & x & x+1 \\ 2x & x(x-1) & (x+1)x \\ 3x(x-1) & x(x-1)(x-2) & (x+1)x(x-1) \end{vmatrix}$ then f(100) is equal to-

(a*) –1, 2 (b) 1, 2 (c) 0, 1 (d) –1, 1

11. If the system of equations $x - Ky - z = 0$, $Kx - y - z = 0$, $x + y - z = 0$ has a non-zero solution, then the possible values of K are-

(a) –1, 2 (b) 1, 2 (c) 0, 1 (d*) –1, 1

12. The number of distinct real roots of $\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$ in the interval $-\frac{\pi}{4} \le x \le \frac{\pi}{4}$ is-

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

13. The number of values of K for which the system of equations, $(K + 1)x + 8y = 4K$ and $Kx + (K + 3)y = 3K - 1$ has infinitely many solutions, is

(a) 0 (b*) 1 (c) 2 (d) Infinite

14. Let $\omega = -\frac{1}{2} + i\frac{\sqrt{3}}{2}$. Then the value of the determinant $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ 1 & -1-\omega^2 & \omega^2 \\ 1 & \omega^2 & \omega^4 \end{vmatrix}$ is

(a) 3ω (b*) $3\omega(\omega - 1)$ (c) $3\omega^2$ (d) $3\omega(1 - \omega)$

15. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$ and $A^2 = B$, then

(a*) Statement is not true for any real value of α

(b) $\alpha = 1$

(c) $\alpha = -1$

(d) $\alpha = 4$

16. If $x + ay = 0$; $y + az = 0$; $z + ax = 0$, then value of 'a' for which system of equations will have infinite number of solution is

(a) a = 1 (b) a = 0 (c*) a = – 1 (d) no value of a

17. $\begin{bmatrix} \alpha & 2 \\ 2 & \alpha \end{bmatrix} = A$ & $|A^3| = 125$, then α is-

(a) 0 (b) ±2 (c*) ± 3 (d) ± 5

18. If the system of equations $2x - y - 2z = 2$; $x - 2y + z = -4$; $x + y + \lambda z = 4$ has no solutions then λ is equal to

(a) –2 (b) 3 (c) 0 (d*) –3

19. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 2 \end{bmatrix}$ & $I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $A^{-1} = \frac{1}{6}[A^2 + cA + dI]$, find ordered pair (c, d) ?

(a) (6, 11) (b) (–6, –11) (c*) (–6, 11) (d) (6, –11)

20. Let a matrix $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ & $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$ $Q = PAP^T$ where P^T is transpose of matrix P. Find

$P^T Q^{2005} P$ is

(a*) $\begin{bmatrix} 1 & 2005 \\ 0 & 1 \end{bmatrix}$ (b) $\frac{1}{4}\begin{bmatrix} 1+2005\sqrt{3} & 6015 \\ 2005 & 1-2005\sqrt{3} \end{bmatrix}$

(c) $\frac{1}{4}\begin{bmatrix} 1+2005\sqrt{3} & 2005 \\ 2005 & 1-2005\sqrt{3} \end{bmatrix}$ (d) $\begin{bmatrix} 2005 & 2005 \\ 0 & 1 \end{bmatrix}$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	a	b	c	c	c	b	d	b	d	a	d	c	b	b	a	c	c	d	c	a

30. ELLIPSE

1. Let P be a variable point on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ with foci F_1 and F_2. If A is the area of the triangle PF_1F_2, then the maximum value of A is-

(a) 2abe (b*) abe (c) $\frac{1}{2}$ abc (d) None of these

2. Let E be the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ and C be the circle $x^2 + y^2 = 9$. Let P and Q be the points (1, 2) and (2, 1) respectively. Then

(a) Q lies inside C but outside E (b) Q lies outside both C and E

(c) P lies inside both C and E (d*) P lies inside C but outside E

3. The radius of the circle passing thro' the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ and having its centre (0, 3) is-

(a*) 4 (b) 3 (c) $\sqrt{12}$ (d) $\frac{7}{2}$

4. If P (x, y), F_1 = (3, 0), F_2 (–3, 0) and $16x^2 + 25y^2 = 400$, then $PF_1 + PF_2$ equals-

(a) 8 (b) 6 (c*) 10 (d) 12

5. On the ellipse $4x^2 + 9y^2 = 1$, then points at which the tangents are parallel to 8x = 9y are-

(a) $\left(\frac{2}{5},\frac{1}{5}\right)$ (b*) $\left(-\frac{2}{5},\frac{1}{5}\right)$ or $\left(\frac{2}{5},-\frac{1}{5}\right)$

(c) $\left(-\frac{2}{5},-\frac{1}{5}\right)$ (d) $\left(\frac{-3}{5},-\frac{2}{5}\right)$

6. An ellipse has OB as semi-minor axis. F and F' are its foci and the angle FBF' is a right angle. Then the eccentricity of the ellipse is-

(a) $\frac{1}{2}$ (b*) $\frac{1}{\sqrt{2}}$ (c) $\frac{2}{3}$ (d) $\frac{1}{3}$

7. A tangent to the ellipse $x^2 + 4y^2 = 4$ meets the ellipse $x^2 + 2y^2 = 6$ at P and Q. The angle between the tangents at P and Q of the ellipse $x^2 + 2y^2 = 6$ is-

(a*) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

8. The number of values of c such that the straight line y = 4x + c touches the curve $\frac{x^2}{4}+y^2=1$ is

(a) 0 (b) 1 (c*) 2 (d) infinite

9. Locus of middle point of segment of tangent to ellipse $x^2 + 2y^2 = 2$ which is intercepted between the coordinate axes, is-

(a*) $\frac{1}{2x^2}+\frac{1}{4y^2}=1$ (b) $\frac{1}{4x^2}+\frac{1}{2y^2}=1$ (c) $\frac{x^2}{2}+\frac{y^2}{4}=1$ (d) $\frac{x^2}{4}+\frac{y^2}{2}=1$

10. A tangent is drawn at some point P of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is intersecting to the coordinate axes at points A & B then minimum area of the ΔPAB is-

(a*) ab (b) $\frac{a^2+b^2}{2}$ (c) $\frac{a^2+b^2}{4}$ (d) $\frac{a^2+b^2-ab}{3}$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans.	b	d	a	c	b	b	a	c	a	a

31. HYPERBOLA

1. A variable straight line of slope 4 intersects the hyperbola xy = 1 at two point. The locus of the point which divides the line segment between these two points in the ratio 1 : 2 is

(a*) $16x^2 + 1= xy + y^2 = 2$ (b) $16x^2 – 10 xy + y^2 = 2$

(c) $16x^2 + 10 xy + y^2 = 4$ (d) None of these

2. If the circle $x^2 + y^2 = a^2$ intersects the hyperbola $xy = c^2$ in four points $P(x_1, y_1)$, $Q (x_2, y_2)$, $R(x_3, y_3)$, $S(x_4, y_4)$, then

(a*) $x_1 + x_2 + x_3 + x_4 = 0$ (b) $y_1 + y_2 + y_3 + y_4 = 2$

(c) $x_1x_2x_3x_4 = 2c^4$ (d) $y_1y_2y_3y_4 = 2c^4$

3. If a circle cuts the rectangular hyperbola xy = 1 in the points (x_1, y_r) whre r = 1, 2, 3, 4, then

(a) $x_1x_2x_3x_4 = 2$ (b*) $x_1x_2x_3x_4 = 1$ (c) $x_1+x_2+x_3+x_4 = 0$ (d) $y_1 + y_2 + y_3 + y_4 = 0$

4. If x = 9 is the chord of contact of the hyperbola $x^2 – y^2 = 9$, then the equation of the corresponding pair of tangents is-

(a) $9x^2 – 8y^2 + 18 x –9 = 0$ (b*) $9x^2 – 8y^2 – 18x + 9 = 0$

(c) $9x^2 – 8y^2 – 18x – 9 = 0$ (d) $9x^2 – 8y^2 + 18x + 9 = 0$

5. Let P (a sec θ, b tan) and Q (a sec ϕ, b tan ϕ) where θ + ϕ = $\frac{\pi}{2}$, be two points on the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$. If (h, k) is the point of intersection of the normals at P and Q, then K is equal to-

(a) $\frac{a^2+b^2}{a}$ (b) $-\frac{a^2+b^2}{a}$ (c) $\frac{a^2+b^2}{b}$ (d*) $-\frac{a^2+b^2}{b}$

6. $\frac{x^2}{\cos^2\alpha} - \frac{y^2}{\sin^2\alpha} = 1$ represents family of hyperbolas, where α varies then

(a) e remains constant
(b*) Abscissas of foci remain constant
(c) equation of directrices remain constant
(d) Abscissas of vertices remains constant

7. The point at which the line $2x + \sqrt{6}\,y = 2$ touches the curve $x^2 - 2y^2 = 4$, is-

(a*) $(4, -\sqrt{6})$
(b) $(\sqrt{6}, 1)$
(c) $\left(\frac{1}{2}, \frac{1}{\sqrt{6}}\right)$
(d) $\left(\frac{\pi}{6}, \pi\right)$

ANSWER KEY

Q.No.	1	2	3	4	5	6	7
Ans.	a	a	b	b	d	b	a

32. 3-DIMENSIONAL GEOMETRY

1. If line $\frac{x-4}{1} = \frac{y-2}{1} = \frac{2-k}{2}$ lies in the plane $2x - 4y + z = 7$ then the value of k = ?

(a) k = – 7
(b*) k = 7
(c) k = – 7
(d) no value of k

2. Two lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$ intersect at a point then k is-

(a) 3/2
(b*) 9/2
(c) 2/9
(d) 2

3. A plane at a unit distance from origins cuts at three axes at P, Q, R points. ΔPQR has centroid at (x, y, z) point and satisfies to $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = k$, then k =

(a*) 9
(b) 1
(c) 3
(d) 4

ANSWER KEY

Q.No.	1	2	3
Ans.	b	b	a