PROFILE
MODEL PAPER - I

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P-partial

HIGHER SECONDARY SECOND YEAR

MATHEMATICS

MODEL QUESTION PAPER – 1

Time Allowed: 15 Min + 3.00 Hours] **[Maximum Marks:90**

Instructions: (a) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(b) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

Note: (i) **All** questions are **compulsory.** $20\times1=20$

(ii) Choose the correct or most suitable answer from the given **four** alternatives. Write the option code and the corresponding answer.

1. If A is a 3×3 non-singular matrix such that $AA^T=A^TA$ and $B=A^{-1}A^T$, then $BB^T=$
(1) A (2) B (3) I (4) B^T

2. The rank of the matrix $\begin{bmatrix}1&2&3&4\\2&4&6&8\\-1&-2&-3&-4\end{bmatrix}$ is
(1) 1 (2) 2 (3) 4 (4) 3

3. Which of the following are correct statements?
(i) $e^{-i\theta}=\cos\theta-i\sin\theta$ (ii) $e^{i\frac{\pi}{2}}=i$
(iii) $e^{i(x+iy)}=e^{-y}(\cos x+i\sin x)$ (iv) $e^{-i(y-ix)}=e^{-x}(\cos y-i\sin y)$
(1) (i) and (iv) only (2) (iii) only (3) (i), (ii) and (iii) (4) all

4. The value of $\sum_{i=1}^{13}\left(i^n+i^{n-1}\right)$ is
(1) $1+i$ (2) i (3) 1 (4) 0

5. If α,β, and γ are the roots of $x^3+px^2+qx+r=0$, then $\sum\frac{1}{\alpha}$ is
(1) $-\frac{q}{r}$ (2) $-\frac{p}{r}$ (3) $\frac{q}{r}$ (4) $-\frac{q}{p}$

6. e^{ix} is a periodic function with period
(1) 0 (2) π (3) 2π (4) 4π

7. The radius of the circle $3x^2+by^2+4bx-6by+b^2=0$ is
(1) 1 (2) 3 (3) $\sqrt{10}$ (4) $\sqrt{11}$

8. The length of latus rectum of the parabola $x^2=25y$ is
(1) 25 (2) $\frac{25}{4}$ (3) 100 (4) $\frac{25}{2}$

9. The volume of the parallelepiped with its edges represented by the vectors $\hat{i}+\hat{j},\ \hat{i}+2\hat{j},\ \hat{i}+\hat{j}+\pi\hat{k}$ is
(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{3}$ (3) π (4) $\frac{\pi}{4}$

10. The Cartesian form of the plane $\vec{r}.(2\hat{i}+2\hat{j}+5\hat{k})=1$ is
(1) $2x+2y+5z+1=0$ (2) $2x+2y+5z=1$ (3) $x+y+5z=1$ (4) $2x+2y+5z=-1$

11. The position of a particle moving along a horizontal line of any time t is given by $s(t)=3t^2-2t-8$. The time at which the particle is at rest is
(1) $t=0$ (2) $t=\frac{1}{3}$ (3) $t=1$ (4) $t=3$

12. The minimum value of the function $|3-x|+9$ is
(1) 0 (2) 3 (3) 6 (4) 9

13. The differential df of $f(x)=x+\tan x$ is
(1) $1+\sec^2 x$ (2) $(1+\sec^2 x)dx$ (3) $1+\tan x$ (4) $\sec^2 x\,dx$

14. If $f(2a-x)=f(x)$ then $\int_0^{2a}f(x)dx=$
(1) $2\int_0^a f(x)dx$ (2) $\int_{-a}^a f(x)dx$ (3) 0 (4) $\int_0^a f(x)dx$

15. $\int_0^{\frac{\pi}{2}}(\sec^2 x-\tan^2 x)dx=$
(1) $\frac{\pi}{4}$ (2) 0 (3) π (4) $\frac{\pi}{2}$

16. The order and degree of the differential equation $\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^{1/3}+x^{1/4}=0$ are respectively
(1) 2, 3 (2) 3, 3 (3) 2, 6 (4) 2, 4

17. The differential equation of the family of curves $y=Ae^x+Be^{-x}$, where A and B are arbitrary constants, is
(1) $\frac{d^2y}{dx^2}+y=0$ (2) $\frac{d^2y}{dx^2}-y=0$ (3) $\frac{dy}{dx}+y=0$ (4) $\frac{dy}{dx}-y=0$

18. Which of the following are true in the case of $c.d.f$ $F(x)$? (X is a discrete random variable)

(i) $0 \le F(x) \le 1$ (ii) $\lim_{x \to -\infty} F(x) = 0$ and $\lim_{x \to \infty} F(x) = 1$

(iii) $P[x_1 < X \le x_2] = F(x_2) - F(x_1)$ (iv) $P[X > x] = 1 - P[X \le x] = 1 - F(x)$

(1) (i) and (iv) only (2) (ii),(iii),(iv) only

(3) (i), (ii), (iii) only (4) all

19. If X is the random variable with distribution function $F(x)$ given by,

$$F(x) = \begin{cases} 0, & x < 0 \\ x, & 0 \le x < 1 \\ 1, & 1 \le x \end{cases}$$ then the p.d.f. $f(x)$ is

(1) $\begin{cases} 1 & 0 \le x < 1 \\ 0 & \text{otherwise} \end{cases}$ (2) $\begin{cases} 1 & 0 \le x < 1 \\ x & \text{otherwise} \end{cases}$ (3) $\begin{cases} x & 0 \le x < 1 \\ 1 & \text{otherwise} \end{cases}$ (4) 0 for all x

20. In the set $\mathbb{Q}$ define $a \odot b = a + b + ab$. Then the value of y in $3 \odot (y \odot 5) = 7$ is

(1) $\frac{2}{3}$ (2) $\frac{-2}{3}$ (3) $\frac{-3}{2}$ (4) 4

PART – II

Note: (i) Answer any **SEVEN** questions. $7 \times 2 = 14$

(ii) Question number **30 is compulsory.**

21. If $z_1 = 3 - 2i$ and $z_2 = 6 + 4i$, show that $\frac{z_1}{z_2} = \frac{5}{26} - \frac{6}{13}i$.

22. If α and β are the roots of the quadratic equation $2x^2 - 7x + 13 = 0$, find $\alpha^2 + \beta^2 + 3\alpha\beta$.

23. Find the principal value of $\sin^{-1}\left(-\frac{1}{2}\right)$.

24. Show that the vectors $\hat{i} + 2\hat{j} - 3\hat{k}, 2\hat{i} - \hat{j} + 2\hat{k}$ and $3\hat{i} + \hat{j} - \hat{k}$ are coplanar.

25. Find the tangent to the curve $y = x^4 + 2e^x$ at $(0, 2)$.

26. Find df if $f(x) = x^2 + 3x$, $x = 3$ and $dx = 0.02$.

27. If $\sin x$ is the integrating factor of the linear differential equation $\frac{dy}{dx} + Py = Q$, then show that P is $\cot x$.

28. Suppose the amount of milk sold daily at a milk booth is distributed with a minimum of 200 litres and a maximum of 600 litres with probability density function $f(x) = \begin{cases} k & 200 \le x \le 600 \\ 0 & \text{otherwise} \end{cases}$. Find the value of k.

29. The p.m.f of a random variable X is

x	2	4	6	8	10
$f(x)$	$\frac{1}{36}$	$\frac{4}{36}$	$\frac{10}{36}$	$\frac{12}{36}$	$\frac{9}{36}$

Write the c.d.f in horizontal form.

30. Show that the solution of the differential equation $\frac{dy}{dx} = 2xy$ is $\log y = x^2 + c$.

PART– III

Note: (i) Answer any **SEVEN** questions. $7 \times 3 = 21$

(ii) Question number **40 is compulsory.**

31. If A is nonsingular, then prove that A^{-1} is also nonsingular and $(A^{-1})^{-1} = A$.

32. Find the matrix A for which $A\begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix} = \begin{bmatrix} 14 & 7 \\ 7 & 7 \end{bmatrix}$.

33. Show that the equation $z^3 + 2\bar{z} = 0$ has five solutions.

34. Find the exact number of real zeros and imaginary zeros of the polynomial $x^9 + 9x^7 + 7x^5 + 5x^3 + 3x$.

35. A circle of area 9π square units has two of its diameters along the lines $x + y = 5$ and $x - y = 1$. Find the equation of the circle.

36. Evaluate : $\lim_{x \to 0} \frac{1 - \cos x}{x^2}$.

37. A circular plate expands uniformly under the influence of heat. If it's radius increases from 10.5cm to 10.75cm, then find an approximate change in the area.

38. Show that $\int_{\frac{\pi}{8}}^{\frac{3\pi}{8}} \frac{1}{1 + \sqrt{\tan x}} dx = \frac{\pi}{8}$.

39. Show that the cube roots of unity under usual multiplication satisfies the closure axiom.

40. A force given by $3\hat{i} + 2\hat{j} - 4\hat{k}$ is applied at the point $(1, -1, 2)$. Find the moment of the force about the point $(2, -1, 3)$.

PART – IV

Note: Answer **all** the questions. $7 \times 5 = 35$

41. (a) Solve the system of linear equations $2x + 3y - z = 9$, $x + y + z = 9$, $3x - y - z = -1$ by matrix inversion method.

(OR)

(b) Find the centre, foci, vertices of the ellipse $\frac{(x-1)^2}{25} + \frac{(y+2)^2}{16} = 1$.

42. (a) Solve : $\sin^{-1}\frac{5}{x}+\sin^{-1}\frac{12}{x}=\frac{\pi}{2}$.

(OR)

(b) Find the fourth roots of $\sqrt{3}+i$.

43. (a) Prove that $\cos(\alpha-\beta)=\cos\alpha\cos\beta+\sin\alpha\sin\beta$ by vector method.

(OR)

(b) Verify whether $((p\vee q)\wedge\neg p)\to q$ is tautology or contradiction or contingency.

44. (a) Find the area of the region bounded between the parabola $y^2=4ax$ and its latus rectum.

(OR)

(b) Salt is poured from a conveyer belt at a rate of 30 cubic metre per minute forming a conical pile with a circular base whose height and diameter of base are always equal. How fast is the height of the pile increasing when the pile is 10 metre high?

45. (a) Write any five points to trace the curve $y=x\sqrt{4-x}$.

(OR)

(b) Find the volume of the solid generated by revolving the region enclosed by $x^2=1+y$ and $y=3$ about y-axis, using integration.

46. (a) An engineer designs a satellite dish with a parabolic cross section. The dish is 5m wide at the opening, and the focus is placed 1.2m from the vertex. Find the depth of the satellite dish at the vertex.

(OR)

(b) Solve the differential equation $xdy-ydx=\sqrt{x^2+y^2}dx$.

47. (a) The cumulative distribution function of a discrete random variable is given by

$$F(x)=\begin{cases}0 & -\infty<x<-1\\ 0.15 & -1\le x<0\\ 0.35 & 0\le x<1\\ 0.60 & 1\le x<2\\ 0.85 & 2\le x<3\\ 1 & 3\le x<\infty\end{cases}$$

Find (i) the probability mass function (ii) $P(X<1)$ and (iii) $P(X\ge 2)$.

(OR)

47. (b) Find the vector (parametric, non parametric) and Cartesian equations of the plane passing through the points $(-1,2,0)$, $(2,2-1)$ and parallel to the straight line $\frac{x-1}{1}=\frac{2y+1}{2}=\frac{z+1}{-1}$.

MODEL QUESTION PAPER – 1

ANSWERS

PART – I

Qn. No.	Option	Answer	Qn. No.	Option	Answer
1.	(3)	I	11.	(2)	$t=\frac{1}{3}$
2.	(1)	1	12.	(4)	9
3.	(4)	all	13.	(2)	$(1+\sec^2 x)dx$
4.	(1)	$1+i$	14.	(1)	$2\int_0^a f(x)dx$
5.	(1)	$-\frac{q}{r}$	15.	(4)	$\frac{\pi}{2}$
6.	(3)	2π	16.	(1)	2, 3
7.	(3)	$\sqrt{10}$	17.	(2)	$\frac{d^2y}{dx^2}-y=0$
8.	(1)	25	18.	(4)	all
9.	(3)	π	19.	(1)	$\begin{cases}1 & 0\le x<1\\ 0 & \text{otherwise}\end{cases}$
10.	(2)	$2x+2y+5z=1$	20.	(2)	$-\frac{2}{3}$

For writing the correct option and the answer – one mark.

PROFILE

MODEL PAPER - II

Part I		Part II		Part III		Part IV	
1	Exercise 1.8 (16)	21	Chapter – 2 Created	31	Example 1.18	41 a	Chapter – 1 Created
2	Chapter – 1 Created (3)	22	Example 3.3	32	Example 1.12 (modified)	41 b	Example 5.40
3	Chapter – 2 Created	23	Example 4.9 (i)	33	Example 2.4	42 a	Exercise 4.2 (6 – i)
4	Exercise 2.9 (12)	24	Exercise 6.2 (8)	34	Exercise 3.2 (4)	42 b	Exercise 2.6 (2)
5	Exercise 3.7 (1)	25	Example 7.47	35	Exercise 5.2 (1 – iv)	43 a	Example 11.22
6	Chapter – 4 Created	26	Exercise 7.3 (3 – ii)	36	Exercise 7.2 (4)	43 b	Exercise 6.7 (4)
7	Exercise 5.6 (9)	27	Example 10.3	37	Exercise 7.4 (1 – iv)	44 a	Exercise 5.2 (4 – v)
8	Chapter – 5 Created	28	Example 11.6 (modified)	38	Exercise 9.3 (2 – iii)	44 b	Exercise 7.1 (9 - i)
9	Exercise 6.10 (4)	29	Exercise 11.3 (4 – i)	39	Exercise 12.1 (10) P	45 a	Exercise 7.8 (6)
10	Chapter – 6 Created (1)	30	Chapter – 10 Created	40	Chapter – 6 Created	45 b	Exercise 9.9 (4)
11	Chapter – 7 Created (1)					46 a	Exercise 9.8 (10)
12	Chapter – 7 Created					46 b	Exercise 10.5 (3)
13	Exercise 8.8 (11)					47 a	Exercise 6.1 (10)
14	Exercise 9.10 (4)					47 b	Exercise 12.2 (15)
15	Chapter – 9 Created						
16	Exercise 10.9 (3)						
17	Exercise 10.9 (2)						
18	Chapter – 11 Created						
19	Chapter – 11 Created						
20	Exercise 12.3 (7)						

HIGHER SECONDARY SECOND YEAR

MATHEMATICS

MODEL QUESTION PAPER – 2

Time Allowed: 15 Min + 3.00 Hours] **[Maximum Marks:90**

Instructions: (a) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(b) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

$20\times1=20$

Note: (i) **All** questions are **compulsory.**

(ii) Choose the correct or most suitable answer from the given **four** alternatives. Write the option code and the corresponding answer.

1. If $A=\begin{bmatrix}2 & 3\\5 & -2\end{bmatrix}$ be such that $\lambda A^{-1}=A$, then λ is

(1) 17 (2) 14 (3) 19 (4) 21

2. Which of the following is incorrect?

(1) $adj(adj\,A)=|A|^{n-2}A$ (2) $|adjA|=A^{n-1}$

(3) $|adj(adjA)|=|A|^{(n-1)^2}$ (4) $(adjA)^T=adj(A^T)$

3. The conjugate of $i^{16}+i^{17}+i^{18}+i^{19}$ is

(1) 0 (2) $-i$ (3) i (4) 1

4. If z is a complex number such that $z\in\mathbb{C}\setminus\mathbb{R}$ and $z+\frac{1}{z}\in\mathbb{R}$, then $|z|$ is

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

5. A zero of x^3+64 is

(1) 0 (2) 4 (3) $4i$ (4) -4

6. The principal value of $\sin^{-1}\left(\frac{1}{2}\right)$ is

(1) $\frac{\pi}{4}$ (2) $-\frac{\pi}{6}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{3}$

7. The radius of the circle passing through the point $(6,2)$ two of whose diameters are $x+y=6$ and $x+2y=4$ is

(1) 10 (2) $2\sqrt{5}$ (3) 6 (4) 4

8. The length of the conjugate axis of the hyperbola $\frac{x^2}{9}-\frac{y^2}{25}=1$ is

(1) 10 (2) 6 (3) 5 (4) 3

9. If $\vec{a},\vec{b},\vec{c}$ are three unit vectors such that $\vec{a}$ is perpendicular to $\vec{b}$, and is parallel to $\vec{c}$ then $\vec{a}\times(\vec{b}\times\vec{c})$ is equal to

(1) $\vec{a}$ (2) $\vec{b}$ (3) $\vec{c}$ (4) $\vec{0}$

10. Which one is meaningful?

(1) $(\vec{a}\times\vec{b})\times(\vec{b}\cdot\vec{c})$ (2) $\vec{a}\times(5+\vec{b})$ (3) $(\vec{a}\cdot\vec{b})\times(\vec{c}\cdot\vec{d})$ (4) $(\vec{a}\times\vec{b})\cdot(\vec{c}\times\vec{d})$

11. If $ax^2+by^2=1$ and $a_1x^2+b_1y^2=1$ intersect each other orthogonally then which one is incorrect?

(1) $\frac{1}{a}-\frac{1}{b}=\frac{1}{a_1}-\frac{1}{b_1}$ (2) $\frac{1}{a}-\frac{1}{a_1}=\frac{1}{b}-\frac{1}{b_1}$ (3) $\frac{1}{a}+\frac{1}{b_1}=\frac{1}{b}+\frac{1}{a_1}$ (4) $\frac{1}{a}-\frac{1}{b_1}=\frac{1}{b}-\frac{1}{a_1}$

12. The minimum value of $f(x)=x^2+x$ in $\mathbb{N}$ is

(1) ∞ (2) 3 (3) 2 (4) 1

13. If $f(x)=\frac{x}{x+1}$, then its differential is

(1) $\frac{-1}{(x+1)^2}dx$ (2) $\frac{1}{(x+1)^2}dx$ (3) $\frac{1}{x+1}dx$ (4) $\frac{-1}{x+1}dx$

14. The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\sin^2 x\cos x\,dx$ is

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

15. $\int_0^{\pi} x\cos x\,dx=$

(1) $x\sin x$ (2) 2π (3) 0 (4) -2

16. The order and degree of the differential equation $\sqrt{\sin x}\,(dx+dy)=\sqrt{\cos x}\,(dx-dy)$ is

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

17. The differential equation representing the family of curves $y=A\cos(x+B)$, where A and B are parameters, is

(1) $\frac{d^2y}{dx^2}-y=0$ (2) $\frac{d^2y}{dx^2}+y=0$ (3) $\frac{d^2y}{dx^2}=0$ (4) $\frac{d^2x}{dy^2}=0$

18. If the probability mass function $f(x)$ of a random variable X is

x	1	2	3	4
$f(x)$	$\frac{1}{12}$	$\frac{5}{12}$	$\frac{5}{12}$	$\frac{1}{12}$

Then $F(3)$ is

(1) $\frac{11}{12}$ (2) $\frac{5}{12}$ (3) 1 (4) 0

19. The probability density function of X is given by $f(x)=\begin{cases}k & 1\le x\le 5\\ 0 & \text{otherwise}\end{cases}$

Then the value of k is

(1) 4 (2) $\frac{1}{4}$ (3) $\frac{3}{4}$ (4) 5

20. If $a*b=\sqrt{a^2+b^2}$ on the real numbers then $*$ is

(1) commutative but not associative (2) associative but not commutative

(3) both commutative and associative (4)neither commutative nor associative

PART – II

$7\times2=14$

Note: (i) Answer any **SEVEN** questions.

(ii) Question number **30 is compulsory.**

21. Show that the points representing complex numbers $7+9i,-3+7i,3+3i$ form a right angled triangle in the Argand plane.

22. If α, β, γ are the roots of the equation $x^3+px^2+qx+r=0$, show that $\sum\frac{1}{\beta\gamma}=\frac{p}{r}$.

23. Find the principal value of $\tan^{-1}(-\sqrt{3})$.

24. $\vec{a}=\hat{i}-\hat{k},\vec{b}=x\hat{i}+\hat{j}+(1-x)\hat{k},\ \vec{c}=y\hat{i}+x\hat{j}+(1+x-y)\hat{k}$, show that $[\vec{a},\vec{b},\vec{c}]$ is independent of x and y.

25. Prove that the function $f(x)=x^2-2x-3$ is strictly increasing in $(2,\infty)$.

26. Explain why Lagrange's mean value theorem is not applicable to $f(x)=|3x+1|, x\in[-1,3]$

27. Form the differential equation by eliminating the arbitrary constants A and B from $y=A\cos x+B\sin x$.

28. A pair of fair dice is rolled once. Find the probability to get two 4's.

29. The probability density function of X is given by $f(x)=\begin{cases} ke^{-\frac{x}{3}} & \text{for } x>0 \\ 0 & \text{for } x\le 0 \end{cases}$

show that the value of k is $\frac{1}{3}$.

30. Show that the integrating factor of the differential equation $\frac{dy}{dx}=\frac{x+y+1}{x+1}$ is $\frac{1}{x+1}$.

PART– III

Note: (i) Answer any **SEVEN** questions. $7\times 3=21$

(ii) Question number **40 is compulsory.**

31. Find the rank of the matrix $\begin{bmatrix} 2 & -2 & 4 & 3 \\ -3 & 4 & -2 & -1 \\ 6 & 2 & -1 & 7 \end{bmatrix}$.

32. Show that $A=\frac{1}{7}\begin{bmatrix} 6 & -3 & 2 \\ -3 & -2 & 6 \\ 2 & 6 & 3 \end{bmatrix}$ is orthogonal and hence find A^{-1}.

33. Show that $\left(\frac{1+i}{1-i}\right)^3-\left(\frac{1-i}{1+i}\right)^3=-2i$.

34. Find a polynomial equation of minimum degree with rational coefficients, having $\sqrt{5}-\sqrt{3}$ as a root.

35. Show that the equation of the parabola whose end points of latus rectum are $(4,-8)$ and $(4,8)$; open rightward and the vertex is (0, 0), is $y^2=16x$.

36. Find the points on the curve $y^2-4xy=x^2+5$ for which the tangent is horizontal.

37. Write the Maclaurin's series expansion of the function $\log(1-x); -1\le x<1$

38. Evaluate : $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \sin^2 x\,dx$

39. Let A be $Q-\{1\}$. Define $*$ on A by $x*y=x+y-xy$. Is $*$ a binary on A?

40. Find the direction cosines and torque of the force $2\hat{i}+\hat{j}-\hat{k}$ if it acts about the point $(2,0,-1)$ and through the origin.

PART – IV

Note: Answer all the questions. $7\times 5=35$

41. (a) Can you solve the following system by using Cramers method. If yes, solve the system.
$x+y+z-2=0,\ 6x-4y+5z-31=0,\ 5x+2y+2z=13$

(OR)

(b) Two coast guard stations are located 600 km apart at points $A(0,0)$ and $B(0,600)$. A distress signal from a ship at P is received at slightly different times by two stations. It is determined that the ship is 200 km farther from station A than it is from station B. Determine the equation of hyperbola that passes through the location of the ship.

42. (a) Find the domain of $f(x)=\sin^{-1}\left(\frac{|x|-2}{3}\right)+\cos^{-1}\left(\frac{1-|x|}{4}\right)$

(OR)

(b) If $z=x+iy$ is a complex number such that $Im\left(\frac{2z+1}{iz+1}\right)=0$, show that $2x^2+2y^2+x-2y=0$.

43. (a) On the average, 20% of the products manufactured by ABC Company are found to be defective. If we select 6 of these products at random, find (i) two products are defective (ii) at most one product is defective (iii) at least two products are defective.

(OR)

(b) Find the vector and Cartesian equations of the plane passing through the point $(1,-2,4)$ and perpendicular to the plane $x+2y-3z=11$ and parallel to the line $\frac{x+7}{3}=\frac{y+3}{-1}=\frac{z}{1}$.

44. (a) Find the vertex, focus, equation of directrix and length of the latus rectum of the parabola $y^2-4y-8x+12=0$.

(OR)

(b) A ladder 17 metre long is leaning against the wall. The base of the ladder is pulled away from the wall at a rate of 5 m/s. When the base of the ladder is 8 metres from the wall, how fast is the top of the ladder moving down the wall?

45. (a) A farmer plans to fence a rectangular pasture adjacent to a river. The pasture must contain 1,80,000 sq.mtrs in order to provide enough grass for herds. No fencing is needed along the river. What is the length of the minimum needed fencing material?

(OR)

(b) The region enclosed between the graphs of $y=x$ and $y=x^2$ is denoted by R, find the volume generated by R when R is rotated through 360° about x-axis, using integration.

46. (a) Find the area of the region common to the circle $x^2+y^2=16$ and the parabola $y^2=6x$.

(OR)

(b) Find the equation of the curve whose slope is $\frac{y-1}{x^2+x}$ and which passes through the point $(1,0)$.

47. (a) Prove that $\sin(\alpha+\beta)=\sin\alpha\cos\beta+\cos\alpha\sin\beta$ by using vectors.

(OR)

(b) Prove that $p\to(\neg q\vee r)\equiv\neg p\vee(\neg q\vee r)$.

MODEL QUESTION PAPER – II

ANSWERS

PART – I

Qn. No.	Option	Answer	Qn. No.	Option	Answer
1.	(3)	19	11.	(4)	$\frac{1}{a}-\frac{1}{b_1}=\frac{1}{b}-\frac{1}{a_1}$
2.	(2)	$\|adjA\|=A^{n-1}$	12.	(3)	2
3.	(1)	0	13.	(2)	$\frac{1}{(x+1)^2}dx$
4.	(2)	1	14.	(4)	$\frac{2}{3}$
5.	(4)	–4	15.	(4)	–2
6.	(3)	$\frac{\pi}{6}$	16.	(3)	1, 1
7.	(2)	$2\sqrt{5}$	17.	(2)	$\frac{d^2y}{dx^2}+y=0$
8.	(1)	10	18.	(1)	$\frac{11}{12}$
9.	(2)	$\vec{b}$	19.	(2)	$\frac{1}{4}$
10.	(4)	$(\vec{a}\times\vec{b})\cdot(\vec{c}\times\vec{d})$	20.	(3)	both commutative and associative

For writing the correct option and the answer – one mark.

HIGHER SECONDARY SECOND YEAR

MATHEMATICS

MODEL QUESTION PAPER – 3

Time Allowed: 15 Min + 3.00 Hours] **[Maximum Marks: 90**

Instructions: (a) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(b) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

Note: (i) All questions are **compulsory.** $20\times1=20$

(ii) Choose the correct or most suitable answer from the given **four** alternatives. Write the option code and the corresponding answer.

1. If $A=\begin{bmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{bmatrix}$ and $A(\text{adj}\,A)=\begin{bmatrix}k & 0\\ 0 & k\end{bmatrix}$, then $k=$

(1) 0 (2) $\sin\theta$ (3) $\cos\theta$ (4) 1

2. If ρ represents the rank and, A and B are $n\times n$ matrices, then

(1) $\rho(A+B)=\rho(A)+\rho(B)$ (2) $\rho(AB)=\rho(A)\rho(B)$

(3) $\rho(A-B)=\rho(A)-\rho(B)$ (4) $\rho(A+B)\le n$

3. The conjugate of a complex number is $\frac{1}{i-2}$. Then the complex number is

(1) $\frac{1}{i+2}$ (2) $\frac{-1}{i+2}$ (3) $\frac{-1}{i-2}$ (4) $\frac{1}{i-2}$

4. Which of the following are incorrect?

(i) $(\cos\theta+i\sin\theta)^m=\cos m\theta+i\sin m\theta$ if m is a negative integer

(ii) $(\sin\theta+i\cos\theta)^n=\cos n\left(\frac{\pi}{2}-\theta\right)+i\sin n\left(\frac{\pi}{2}-\theta\right)$

(iii) $(\cos\theta-i\sin\theta)^{-m}=\cos m\theta+i\sin m\theta$ if m is a negative integer

(iv) $(\cos\theta-i\sin\theta)^n=\cos n\theta-i\sin n\theta$

(1) none (2) (i) and (iv) (3) (i) and (ii) (4) (iii) and (iv)

5. If $\frac{p}{q}$ (where p and q are co-primes), is a root of a polynomial equation $a_nx^n+a_{n-1}x^{n-1}+\cdots+a_0=0$, then identify the correct option.

Statement A : p is a factor of a_0 and q is a factor of a_n.

Statement B : q is a factor of a_0 and p is a factor of a_n.

(1) both are not true (2) both are true

(3) A is correct but B is false (4) A is incorrect but B is correct

6. The domain of the function which is defined by $f(x)=\sin^{-1}\sqrt{x-1}$, is

(1) $[1,2]$ (2) $[-1,1]$ (3) $[0,1]$ (4) $[-1,0]$

7. The equation of the circle passing through the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ and having centre at (0,3) is

(1) $x^2+y^2-6y-7=0$ (2) $x^2+y^2-6y+7=0$

(3) $x^2+y^2-6y-5=0$ (4) $x^2+y^2-6y+5=0$

8. The locus of a point whose distance from (−2,0) is $\frac{2}{3}$ times its distance from the line $x=-\frac{9}{2}$ is

(1) a parabola (2) a hyperbola (3) an ellipse (4) a circle

9. If $\vec{a}\times(\vec{b}\times\vec{c})=(\vec{a}\times\vec{b})\times\vec{c}$, where $\vec{a},\vec{b},\vec{c}$ are any three vectors such that $\vec{b}\cdot\vec{c}\ne0$ and $\vec{a}\cdot\vec{b}\ne0$, then $\vec{a}$ and $\vec{c}$ are

(1) perpendicular (2) parallel

(3) inclinded at an angle $\frac{\pi}{3}$ (4) inclined at an angle $\frac{\pi}{6}$

10. The shortest distance between the two skew lines $\vec{r}=\vec{a}+t\vec{u}$ and $\vec{r}=\vec{b}+t\vec{v}$ is

(1) $\frac{|(\vec{b}-\vec{a})\cdot(\vec{u}\times\vec{v})|}{|\vec{u}\times\vec{v}|}$ (2) $\frac{|(\vec{b}-\vec{a})\cdot(\vec{u}\times\vec{v})|}{\vec{u}\times\vec{v}}$

(3) $\frac{|(\vec{b}-\vec{a})\cdot(\vec{u}\times\vec{v})|}{|\vec{a}\times\vec{b}|}$ (4) $\frac{|(\vec{b}-\vec{a})\cdot(\vec{u}\times\vec{v})|}{|\vec{a}|}$

11. The number given by the Mean value theorem for the function $\frac{1}{x}, x\in[1,9]$ is

(1) 2 (2) 2.5 (3) 3 (4) 3.5

12. "If $f(x)$ is continuous on $[a,b]$ then f has both absolute maximum and absolute minimum in $[a\ b]$". This statement is

(1) Extreme value theorem (2) Intermediate value theorem

(3) Lagrange mean value theorem (4) Taylors theorem

13. The approximate change in the volume V of a cube of side x metres caused by increasing the side by 1% is

(1) $0.3xdxm^3$ (2) $0.03xm^3$ (3) $0.03x^2m^3$ (4) $0.03x^3m^3$

14. The volume of solid of revolution of the region bounded by $y^2 = x(a-x)$ about x-axis is

(1) πa^3 (2) $\frac{\pi a^3}{4}$ (3) $\frac{\pi a^3}{5}$ (4) $\frac{\pi a^3}{6}$

15. If $f(2a-x) = -f(x)$ then $\int_0^{2a} f(x)dx =$

(1) $2\int_0^a f(x)dx$ (2) $\int_{-a}^a f(x)dx$ (3) 0 (4) $\int_0^a f(x)dx$

16. If p and q are the order and degree of the differential equation $y\frac{dy}{dx}+x^3\left(\frac{d^2y}{dx^2}\right)+xy=\cos x$, then

(1) $p<q$ (2) $p=q$ (3) $p>q$ (4) none of these

17. The general solution of the differential equation $\frac{dy}{dx}=\frac{y}{x}$ is

(1) $xy=k$ (2) $y=k\log x$ (3) $y=kx$ (4) $\log y=kx$

18. A random variable X has binomial distribution with $n=25$ and $p=0.8$ then standard deviation of X is

(1) 6 (2) 4 (3) 3 (4) 2

19. The probability function of a random variable is defined as :

x	-2	-1	0	1	2
$f(x)$	k	$2k$	$3k$	$4k$	$5k$

Then $E(X)$ is equal to :

(1) $\frac{1}{15}$ (2) $\frac{1}{10}$ (3) $\frac{1}{3}$ (4) $\frac{2}{3}$

20. The operation $*$ is defined by $a*b=\frac{ab}{7}$. It is not a binary operation on

(1) $\mathbb{Q}^+$ (2) $\mathbb{Z}$ (3) $\mathbb{R}$ (4) $\mathbb{C}$

PART – II

Note: (i) Answer any **SEVEN** questions. $7\times2=14$

(ii) Question number **30 is compulsory.**

21. If A is a nonsingular matrix of odd order, prove that $|\text{adj}\,A|$ is positive.

22. If $\frac{z+3}{z-5i}=\frac{1+4i}{2}$, find the complex number z in the rectangular form.

23. State Fermat's theorem.

24. Examine the position of the point $(2,3)$ with respect to the circle $x^2+y^2-6x-8y+12=0$.

25. Find the differential dy if $y=e^{x^2-5x+7}\cos(x^2-1)$.

26. Evaluate $\int_0^{\frac{\pi}{2}}\left(\sin^2 x+\cos^4 x\right)dx$

27. Solve $\frac{dy}{dx}+2y=e^{-x}$.

28. If $E(X)=2$ then find $E(5X+7)$.

29. Let $A=\left\{x-\sqrt{3}y : x,y\in\mathbb{Z}\right\}$. Check whether the usual addition is a binary operation on A.

30. Find the value of $\sin^{-1}\left(-\frac{1}{2}\right)+\sec^{-1}(2)$.

PART– III

Note: (i) Answer any **SEVEN** questions. $7\times3=21$

(ii) Question number **40 is compulsory.**

31. If $A=\frac{1}{9}\begin{bmatrix}-8 & 1 & 4\\ 4 & 4 & 7\\ 1 & -8 & 4\end{bmatrix}$, prove that $A^{-1}=A^T$.

32. If $\frac{1+z}{1-z}=\cos2\theta+i\sin2\theta$, show that $z=i\tan\theta$.

33. Show that the equation $x^9-5x^5+4x^4+2x^2+1=0$ has atleast 6 imaginary solutions.

34. Solve : $\tan^{-1}2x+\tan^{-1}3x=\frac{\pi}{4}$. Here $6x^2<1$.

35. Find the of vector (parametric) and Cartesian equations of the straight line passing through the point $(-2,3,4)$ and parallel to the straight line $\frac{x-1}{-4}=\frac{y+3}{5}=\frac{8-z}{6}$.

36. Find the equation of a circle whose centre is $(3,2)$ and the radius is the radius of $x^2+y^2+2x+4y-4=0$.

37. Find the volume of the solid generated by revolving the region bounded by the parabola $x=y^2+1$, the y-axis, and the lines $y=1$ and $y=-1$, about y-axis.

38. If α, β and γ are the roots of the cubic equation $x^3+2x^2+3x+4=0$, form a cubic equation whose roots are $-\alpha, -\beta, -\gamma$

39. If X is the random variable with distribution function $F(x)$ given by,

$$F(x)=\begin{cases}0, & x<0\\ \frac{1}{2}\left(x^2+x\right) & 0\le x<1\\ 1, & x\ge 1\end{cases}$$

then find $P[0.3\le x\le 0.6]$.

40. Evaluate $\int_2^3 \frac{\sqrt{x}}{\sqrt{5-x}+\sqrt{x}}dx$.

PART – IV

Note: Answer all the questions. $7\times 5=35$

41. (a) Investigate the values of λ and μ for the system of linear equations $2x+3y+5z=9$, $7x+3y-5z=8$, $2x+3y+\lambda z=\mu$, to have
(i) no solution (ii) a unique solution (iii) infinite number of solutions.

(OR)

(b) Find the area of the region bounded between the curves $y=\sin x$, $y=\cos x$ and $x=0$ and the lines $x=0$ and $x=\pi$.

42. (a) Solve the equation $z^5+z^3-z^2-1=0$.

(OR)

(b) Write any five points to sketch the function $y=-\frac{1}{3}(x^3-3x+2)$.

43. (a) Find the centre, foci, vertices of the hyperbola $\frac{(x+3)^2}{225}-\frac{(y-4)^2}{64}=1$

(OR)

(b) Prove that $\cos(\alpha-\beta)=\cos\alpha\cos\beta+\sin\alpha\sin\beta$, by using vectors.

44. (a) Draw the curves $\sin x$ and $\sin^{-1}x$ in the respective principal domain.

(OR)

(b) The equation of electromotive force for an electric circuit containing resistance and self-inductance is $E=Ri+L\frac{di}{dt}$, where E is the electromotive force given to the circuit, R the resistance and L, the coefficient of induction. Find the current i at time t when E = 0.

45. (a) Show that $\neg(p\leftrightarrow q)\equiv p\leftrightarrow\neg q$.

(OR)

(b) Let $z(x,y)=x^3-3x^2y^3$, where $x=se^t, y=se^{-t}, s,t\in\mathbb{R}$. Find $\frac{\partial z}{\partial s}$ and $\frac{\partial z}{\partial t}$.

46. (a) On lighting a rocket cracker it gets projected in a parabolic path and reaches a maximum height of 4m when it is 6m away from the point of projection. Find the angle of projection at the starting point.

(OR)

(b) Find the intervals of increasing, decreasing, concavity and the point of inflection of the curve $y=x^3-3x$.

47. (a) Find the non-parametric form of vector equation, and Cartesian equation of the plane $\vec{r}=\left(6\hat{i}-\hat{j}+\hat{k}\right)+s\left(-\hat{i}+2\hat{j}+\hat{k}\right)+t\left(-5\hat{i}-4\hat{j}-5\hat{k}\right)$.

(OR)

(b) The mean and variance of a binomial variate X are respectively 2 and 1.5. Find
(i) $P(X=0)$ (ii) $P(X=1)$ (iii) $P(X\ge 1)$

MODEL QUESTION PAPER – III

ANSWERS

PART – I

Qn. No.	Option	Answer	Qn. No.	Option	Answer
1.	(4)	1	11.	(3)	3
2.	(4)	$\rho(A+B)\leq n$	12.	(1)	Extreme value theorem
3.	(2)	$\frac{-1}{i+2}$	13.	(4)	$0.03x^3\ m^3$
4.	(1)	none	14.	(4)	$\frac{\pi a^3}{6}$
5.	(3)	A is correct but B is false	15.	(3)	0
6.	(1)	$[1,2]$	16.	(3)	$p>q$
7.	(1)	$x^2+y^2-6y-7=0$	17.	(3)	$y=kx$
8.	(3)	an ellipse	18.	(4)	2
9.	(2)	Parallel	19.	(4)	$\frac{2}{3}$
10.	(1)	$\frac{\left\|(\vec{b}-\vec{a})\cdot(\vec{u}\times\vec{v})\right\|}{\|\vec{u}\times\vec{v}\|}$	20.	(2)	$\mathbb{Z}$

For writing the correct option and the answer – one mark.

PROFILE
MODEL PAPER - IV

Part I		Part II		Part III		Part IV	
1	Exercise 1.8 (17)	21	Example 1.11	31	Exercise 1.1 (4)	41 a	Exercise 1.5 (4)
2	Chapter – 1 Created (2)	22	Example 3.12	32	Exercise 2.5 (5)	41 b	Exercise 2.8 (3)
3	Exercise 2.9 (21)	23	Exercise 4.2 (3)	33	Chapter – 3 Created	42 a	Chapter – 5 Created
4	Chapter – 3 Created	24	Example 6.47	34	Example 6.36	42 b	Chapter – 4 Created
5	Exercise 4.6 (14)	25	Exercise 7.1 (6)	35	Exercise 7.3 (2 – iii)	43 a	Exercise 5.5 (2)
6	Exercise 5.6 (14)	26	Chapter – 8 Created	36	Chapter – 8 Created	43 b	Example 6.2 (i)
7	Exercise 6.10 (2)	27	Chapter – 10 Created	37	Exercise 9.5 (1 - ii)	44 a	Example 7.62
8	Chapter – 6 Created (5)	28	Exercise 11.3 (2 – iii)	38	Example 11.16	44 b	Example 10.25
9	Chapter – 7 Created (15)	29	Example 12.8	39	Exercise 12.2 (9)	45 a	Example 9.56
10	Exercise 7.10 (7)	30	Chapter – 2 Created	40	Chapter – 4 Created	45 b	Chapter – 9 Created
11	Exercise 8.8 (3)					46 a	Example 10.27
12	Chapter – 8 Created (1)					46 b	Exercise 11.5 (7)
13	Exercise 9.10 (14)					47 a	Example 7.45
14	Exercise 9.10 (1)					47 b	Exercise 6.8 (2)
15	Chapter – 10 Created -						
16	Exercise 10.9 (13)						
17	Chapter – 11 Created (1)						
18	Chapter – 11 Created (8)						
19	Exercise 12.3 (3)						
20	Chapter – 12 Created (8)						

HIGHER SECONDARY SECOND YEAR
MATHEMATICS
MODEL QUESTION PAPER – 4

Time Allowed: 15 Min + 3.00 Hours] **[Maximum Marks:90**

Instructions: (a) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(b) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

Note: (i) All questions are **compulsory.** $20\times1=20$

(ii) Choose the correct or most suitable answer from the given **four** alternatives. Write the option code and the corresponding answer.

1. If $adjA=\begin{bmatrix}2 & 3\\4 & -1\end{bmatrix}$ and $adjB=\begin{bmatrix}1 & -2\\-3 & 1\end{bmatrix}$ then $adj(AB)$ is

(1) $\begin{bmatrix}-7 & -1\\7 & -9\end{bmatrix}$ (2) $\begin{bmatrix}-6 & 5\\-2 & -10\end{bmatrix}$ (3) $\begin{bmatrix}-7 & 7\\-1 & -9\end{bmatrix}$ (4) $\begin{bmatrix}-6 & -2\\5 & -10\end{bmatrix}$

2. Which of the following are incorrect?

(i) A is non singular and $AB=AC\Rightarrow B=C$

(ii) A is non singular and $BA=CA\Rightarrow B=C$

(iii) A and B are non singular of same order then $(AB)^{-1}=B^{-1}A^{-1}$

(iv) A is non singular then $A=\left(A^{-1}\right)^{-1}$

(1) none (2) (i) and (ii) (3) (ii) and (iii) (4) (iii) and (iv)

3. If α and β are the roots of $x^2+x+1=0$, then $\alpha^{2020}+\beta^{2020}$ is

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

4. If $p+\sqrt{q}$ and $-i\sqrt{q}$ are the roots of a polynomial equation with rational coefficients then the least possible degree of the equation is

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

5. $\sin^{-1}(2\cos^2 x-1)+\cos^{-1}(1-2\sin^2 x)=$

(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{3}$ (3) $\frac{\pi}{4}$ (4) $\frac{\pi}{6}$

6. Tangents are drawn to the hyperbola $\frac{x^2}{9}-\frac{y^2}{4}=1$ parallel to the straight line $2x-y=1$. One of the points of contact of tangents on the hyperbola is

(1) $\left(\frac{9}{2\sqrt{2}},\frac{-1}{\sqrt{2}}\right)$ (2) $\left(\frac{-9}{2\sqrt{2}},\frac{1}{\sqrt{2}}\right)$ (3) $\left(\frac{9}{2\sqrt{2}},\frac{1}{\sqrt{2}}\right)$ (4) $\left(3\sqrt{3},-2\sqrt{2}\right)$

7. If a vector $\vec{\alpha}$ lies in the plane which contains $\vec{\beta}$ and $\vec{\gamma}$, then

(1) $\left[\vec{\alpha},\vec{\beta},\vec{\gamma}\right]=1$ (2) $\left[\vec{\alpha},\vec{\beta},\vec{\gamma}\right]=-1$ (3) $\left[\vec{\alpha},\vec{\beta},\vec{\gamma}\right]=0$ (4) $\left[\vec{\alpha},\vec{\beta},\vec{\gamma}\right]=2$

8. Which one of the following is insufficient to find the equation of a straight line?

(1) two points on the line
(2) one point on the line and direction ratios of one parallel line
(3) one point on the line and direction ratios of its perpendicular line
(4) a perpendicular line and a parallel line in Cartesian form.

9. The slant asymptote of $f(x)=\frac{x^2-6x+7}{x+5}$ is

(1) $x+y+11=0$ (2) $x+y-11=0$ (3) $x=-5$ (4) $y=x-11$

10. The slope of the normal to the curve $f(x)=2\cos 4x$ at $x=\frac{\pi}{12}$ is

(1) $-4\sqrt{3}$ (2) -4 (3) $\frac{\sqrt{3}}{12}$ (4) $4\sqrt{3}$

11. If $u(x,y)=e^{x^2+y^2}$, then $\frac{\partial u}{\partial x}$ is equal to

(1) $e^{x^2+y^2}$ (2) $2xu$ (3) x^2u (4) y^2u

12. Identify the incorrect statements

(i) absolute error = | Actual value − app. value |
(ii) relative error = $\frac{\text{absolute error}}{\text{actual value}}$
(iii) percentage error = relative error ×100
(iv) absolute error has unit of measurement but relative error and percentage errors are units free

(1) all (2) (i) and (ii) only (3) (i), (ii), (iii) only (4) none

13. The value of $\int_0^\infty e^{-3x}x^2\,dx$ is

(1) $\frac{7}{27}$ (2) $\frac{5}{27}$ (3) $\frac{4}{27}$ (4) $\frac{2}{27}$

14. The value of $\int_0^{\frac{2}{3}}\frac{dx}{\sqrt{4-9x^2}}$ is

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{2}$ (3) $\frac{\pi}{4}$ (4) π

15. The order and degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^{\frac{2}{3}}-3\frac{d^2y}{dx^2}+5\frac{dy}{dx}+4=0$ are

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

16. The solution of the differential equation $\frac{dy}{dx}+\frac{1}{\sqrt{1-x^2}}=0$ is

(1) $y+\sin^{-1}x=c$ (2) $x+\sin^{-1}y=0$
(3) $y^2+2\sin^{-1}x=c$ (4) $x^2+2\sin^{-1}y=0$

17. A random variable X is a function from

(1) $S\to\mathbb{R}$ (2) $\mathbb{R}\to S$ (3) $S\to\mathbb{N}$ (4) $\mathbb{N}\to S$

18. With usual notations, which of the following are correct?

(i) $Var(X)=E(X^2)-\left[E(X)\right]^2$
(ii) $Var(aX+b)=a^2Var(X)$
(iii) $E(aX+b)=aE(X)+b$
(iv) $E(X)=\int_{-\infty}^{\infty}f(x)dx$ if X is continuous

(1) all (2) (i), (ii), (iii) only (3) (i), (ii), (iv) only (4) (ii), (iii), (iv) only

19. Which one of the following is a binary operation on $\mathbb{N}$?

(1) Subtraction (2) Multiplication (3) Division (4) All the above

20. The fourth roots of unity under multiplication satisfies the properties

(1) closure only (2) closure and associative only
(3) closure, associative and identity (4) closure, associative identity and inverse

PART – II

$7\times2=14$

Note: (i) Answer any **SEVEN** questions.
(ii) Question number **30 is compulsory.**

21. Prove that $\begin{bmatrix}\cos\theta & -\sin\theta\\ \sin\theta & \cos\theta\end{bmatrix}$ is orthogonal.

22. If $x^2+2(k+2)x+9k=0$ has equal roots, find k.

23. Is $\cos^{-1}(-x)=\pi-\cos^{-1}(x)$ true? Justify your answer.

24. Find the acute angle between the planes $\vec{r}\cdot\left(2\hat{i}+2\hat{j}+2\hat{k}\right)=11$ and $4x-2y+2z=15$.

25. A stone is dropped into a pond causing ripples in the form of concentric circles. The radius r of the outer ripple is increasing at a constant rate at 2 cm per second. When the radius is 5 cm find the rate of changing of the total area of the disturbed water?

26. If $y=10^x$, find dy.

27. Obtain the differential equation for $y=mx+c$ where m is the arbitrary constant and c is an ordinary constant.

28. The probability density function of X is $f(x)=\begin{cases} x & 0<x<1 \\ 2-x & 1\le x<2 \\ 0 & \text{otherwise} \end{cases}$

Find $P(0.5\le X<1.5)$

29. Let $A=\begin{bmatrix}0&1\\1&1\end{bmatrix}$, $B=\begin{bmatrix}1&1\\0&1\end{bmatrix}$ be any two boolean matrices of the same type. Find $A\vee B$ and $A\wedge B$.

30. Prove that $\sum_{n=1}^{204}\left(i^{n+1}-i^{n+2}\right)=0$.

PART – III

Note: (i) Answer any **SEVEN** questions.
(ii) Question number **40 is compulsory.** $7\times3=21$

31. If $A=\begin{bmatrix}5&3\\-1&-2\end{bmatrix}$, show that $A^2-3A-7I_2=0$. Hence find A^{-1}.

32. If $|z|=1$, show that $2\le|z^2-3|\le4$.

33. Discuss the real and imaginary roots of $x^5+x^3+x^2+1=0$.

34. Find the shortest distance between the given straight lines $\vec{r}=(2\hat{i}+3\hat{j}+4\hat{k})+t(-2\hat{i}+\hat{j}-2\hat{k})$ and $\frac{x-3}{2}=\frac{y}{-1}=\frac{z+2}{2}$.

35. Using the Rolle's theorem, determine the values of x at which the tangent is parallel to the x-axis for the function $f(x)=\sqrt{x}-\frac{x}{3}$, $x\in[0,9]$.

36. The edge of a cube was found to be $30cm$ with a possible error in measurement of $0.1cm$. Use differentials to estimate the maximum possible error in computing
(i) Volume of the cube (ii) Surface area of the cube

37. Evaluate the following: $\int_0^{\frac{\pi}{2}}\frac{dx}{5+4\sin^2 x}$

38. Suppose that $f(x)$ given below represents a probability mass function,

x	1	2	3	4	5	6
$f(x)$	c^2	$2c^2$	$3c^2$	$4c^2$	c	$2c$

Find (i) the value of c (ii) Mean and variance.

39. Prove that $q\to p\equiv\neg p\to\neg q$.

40. Find the equation of the parabola with focus $(-1,-2)$ and the directrix is $x-2y+3=0$.

PART – IV

Note: Answer **all** the questions. $7\times5=35$

41. (a) A boy is walking along the path $y=ax^2+bx+c$ $(-6,8),(-2,-12)$ and $(3,8)$. He wants to meet his friend at $P(7,60)$. Will he meet his friend?

(OR)

(b) Find the value of $\left(\dfrac{1+\sin\frac{\pi}{10}+i\cos\frac{\pi}{10}}{1+\sin\frac{\pi}{10}-i\cos\frac{\pi}{10}}\right)^{10}$.

42. (a) Find the equation of the circle passing through the points $(1,8),(7,2)$ and $(1,-4)$.

(OR)

(b) Find the domain of the function $f(x)=\sin^{-1}\frac{x}{2}+\cos^{-1}\frac{x}{3}$.

43. (a) A tunnel through a mountain for a four lane highway is to have a elliptical opening. The total width of the highway (not the opening) is to be 16m, and the height at the edge of the road must be sufficient for a truck 4m high to clear if the highest point of the opening is to be 5m approximately. How wide must the opening be?

(OR)

(b) With usual notations, in any triangle ABC, prove $a=b\cos C+c\cos B$.

44. (a) A 12 unit square piece of thin material is to be made an open box by cutting small squares from the four corners and folding the sides up. Find the length of the side of the square to be removed, when the volume is maximum and also find the maximum volume.

(OR)

(b) Solve : $\left(1+x^3\right)\frac{dy}{dx}+6x^2y=1+x^2$.

45. (a) Find the area of the region bounded by $y = \cos x, y = \sin x$, the lines $x = \frac{\pi}{4}$ and $x = \frac{5\pi}{4}$.

(OR)

(b) Find the volume of the solid generated when the region enclosed by $y = \sqrt{x}$, $y = 2$ and $x = 0$ revolved about the y-axis.

46. (a) The growth of a population is proportional to the number present. If the population of a colony doubles in 50 years, in how many years will the population become triple?

(OR)

(b) The mean and standard deviation of a binomial variate X are respectively 6 and 2. Find (i) the probability mass function (ii) $P(X = 3)$ (iii) $P(X \geq 2)$.

47. (a) Evaluate : $\lim_{x \to 1^+} x^{\frac{1}{1-x}}$.

(OR)

(b) Show that the lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{3}$ and $\frac{x-1}{-3} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar. Also, find the cartesian equation of the plane which contains these two lines.

MODEL QUESTION PAPER – IV
ANSWERS
PART – I

Qn. No.	Option	Answer	Qn. No.	Option	Answer
1.	(2)	$\begin{bmatrix} -6 & 5 \\ -2 & -10 \end{bmatrix}$	11.	(2)	$2xu$
2.	(1)	none	12.	(4)	none
3.	(2)	-1	13.	(4)	$\frac{2}{27}$
4.	(4)	4	14.	(1)	$\frac{\pi}{6}$
5.	(1)	$\frac{\pi}{2}$	15.	(3)	3, 2
6.	(3)	$\left(\frac{9}{2\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$	16.	(1)	$y + \sin^{-1} x = c$
7.	(3)	$[\vec{\alpha}, \vec{\beta}, \vec{\gamma}] = 0$	17.	(1)	$S \to \mathbb{R}$
8.	(4)	a perpendicular line and a parallel line in Cartesian form.	18.	(2)	(i), (ii), (iii) only
9.	(4)	$y = x - 11$	19.	(2)	Multiplication
10.	(3)	$\frac{\sqrt{3}}{12}$	20.	(4)	Closure, associative, identity and inverse

For writing the correct option and the answer – one mark.

PROFILE

MODEL PAPER - V

Part I		Part II		Part III		Part IV	
1	Exercise 1.8 (7)	21	Chapter – 1 Created	31	Exercise 1.1 (8)	41 a	Example 1.29
2	Chapter – 1 Created (6)	22	Exercise 2.4 (2 – iii)	32	Exercise 2.8 (1)	41 b	Exercise 10.5 (2)
3	Exercise 2.9 (16)	23	Exercise 4.1 (2 – i)	33	Example 3.9	42 a	Exercise 5.5 (7)
4	Chapter – 2 Created (4)	24	Chapter – 3 Created	34	Chapter – 4 Created	42 b	Exercise 4.5 (5)
5	Chapter – 3 Created (1)	25	Exercise 6.3 (2)	35	Example 7.59	43 a	Exercise 5.2 (8 – iv)
6	Exercise 5.6 (4)	26	Chapter – 7 Created	36	Example 9.62	43 b	Exercise 7.2 (10)
7	Exercise 5.6 (12)	27	Example 9.25	37	Exercise 10.7 (1)	44 a	Example 8.20
8	Exercise 6.10 (19)	28	Chapter – 11 Created	38	Example 11.11 (ii)	44 b	Exercise 9.8 (7)
9	Exercise 6.10 (15)	29	Example 12.1	39	Exercise 12.2 (6 - iii)	45 a	Example 2.18
10	Exercise 7.10 (8)	30	Chapter – 10 Created	40	Chapter – 8 Created	45 b	Exercise 10.8 (1)
11	Exercise 7.10 (10)					46 a	Exercise 11.4 (2)
12	Chapter – 8 Created					46 b	Chapter – 9 Created
13	Exercise 9.10 (6) Created					47 a	Exercise 6.7 (6)
14	Exercise 9.10 (12)					47 b	Exercise 7.8 (7)
15	Exercise 10.1 (1-vi)						
16	Chapter - 10 Created (30)						
17	Chapter – 11 Created (7)						
18	Exercise 11.6 (5)						
19	Chapter – 12 Created (4)						
20	Exercise 12.3 (10)						

HIGHER SECONDARY SECOND YEAR
MATHEMATICS
MODEL QUESTION PAPER – 5

Time Allowed: 15 Min + 3.00 Hours] **[Maximum Marks:90**

Instructions: (a) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(b) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

Note: (i) All questions are **compulsory.** $20\times1=20$

(ii) Choose the correct or most suitable answer from the given **four** alternatives. Write the option code and the corresponding answer.

1. If $P=\begin{bmatrix}1 & x & 0\\ 1 & 3 & 0\\ 2 & 4 & -2\end{bmatrix}$ is the adjoint of 3×3 matrix A and $|A|=4$, then x is

(1) 15 (2) 12 (3) 14 (4) 11

2. Consider the statements :

A : A is symmetric $\Rightarrow$ $adjA$ is symmetric

B : $adj(AB)=adj(A)\cdot adj(B)$

Choose the correct option

(1) Both statements are correct (2) Neither statements are correct

(3) A is correct, B is incorrect (4) A is incorrect, B is correct

3. The principal argument of $\frac{3}{-1+i}$ is

(1) $-\frac{5\pi}{6}$ (2) $-\frac{2\pi}{3}$ (3) $-\frac{3\pi}{4}$ (4) $-\frac{\pi}{2}$

4. Identify the incorrect statement.

(1) $|z|^2=1 \Rightarrow \frac{1}{z}=\bar{z}$ (2) $\text{Re}(z)\le|z|$

(3) $\|z_1|-|z_2\|\ge|z_1+z_2|$ (4) $|z^n|=|z|^n$

5. The statement "A polynomial equation of degree n has exactly n roots which are either real or complex" is

(1) Fundamental theorem of Algebra (2) Rational root theorem

(3) Descartes rule (4) Complex conjugate root theorem

6. The length of the diameter of the circle which touches the x-axis at the point $(1,0)$ and passes through the point $(2,3)$ is

(1) $\frac{6}{5}$ (2) $\frac{5}{3}$ (3) $\frac{10}{3}$ (4) $\frac{3}{5}$

7. If $x+y=k$ is a normal to the parabola $y^2=12x$, then the value of k is

(1) 3 (2) -1 (3) 1 (4) 9

8. The distance from the origin to the plane $3x-6y+2z+7=0$ is

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

9. The angle between the lines $\frac{x-2}{3}=\frac{y+1}{-2}$, $z=2$ and $\frac{x-1}{1}=\frac{2y+3}{3}=\frac{z+5}{2}$ is

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{4}$ (3) $\frac{\pi}{3}$ (4) $\frac{\pi}{2}$

10. The tangent to the curve $y^2-xy+9=0$ is vertical when

(1) $y=0$ (2) $y=\pm\sqrt{3}$ (3) $y=\frac{1}{2}$ (4) $y=\pm3$

11. $\lim_{x\to0}\left(\cot x-\frac{1}{x}\right)$ is

(1) 0 (2) 1 (3) 2 (4) ∞

12. The approximate change in the volume V of a cube of side 10 metres caused by increasing the side by 1% is

(1) $0.3m^3$ (2) $300m^3$ (3) $3m^3$ (4) $30m^3$

13. The value of $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}}\left(\frac{2x^7-3x^5+7x^3-x}{\cos^2x}\right)dx$ is

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

14. The value of $\int_0^{\frac{\pi}{6}}\cos^3 3x\,dx$ is

(1) $\frac{2}{3}$ (2) $\frac{2}{9}$ (3) $\frac{1}{9}$ (4) $\frac{1}{3}$

15. The order and the degree of the differential equation $x^2\frac{d^2y}{dx^2}+\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{1}{2}}=0$ are

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

16. Assume that a spherical rain drop evaporates at a rate proportional to its surface area. The rate of change of the radius (r) of the rain drop, then $\frac{dr}{dt}$ (k is the constant of proportionality and $k<0$) is

(1) kr (2) k (3) $-k$ (4) $-kr$

17. For a continuous random variable X, which of the following is/are incorrect?

(i) $P[X=x]=0$ and $P[a<X<b]=F(b)-F(a)$

(ii) $P[X=x]=1$ and $P[a<X<b]=F(b)-F(a)$

(iii) $P[X=x]=0$ and $P[a\le X\le b]=P[a<X<b]$

(iv) $P[a<X<b]=P[a\le X<b]=P[a<X\le b]$ and $P[X=x]=0$

(1) (ii) and (iii) only (2) (ii) only (3) (i) and (ii) only (4) (iv) only

18. A random variable X has binomial distribution with $n=25$ and $p=0.8$ then standard deviation of X is

(1) 6 (2) 4 (3) 3 (4) 2

19. The additive inverses do not exist for some elements in the set

(1) $\mathbb{R}$ (2) $-1\le x\le 2$ (3) $\mathbb{Z}$ (4) Q

20. If a compound statement involves 3 simple statements, then the number of rows in the truth table is

(1) 9 (2) 8 (3) 6 (4) 3

PART – II

Note: (i) Answer any **SEVEN** questions. $7\times2=14$

(ii) Question number **30 is compulsory.**

21. Find the rank of the matrix $\begin{bmatrix}-2 & 2 & -1\\ 0 & 5 & 1\\ 2 & 0 & 0\end{bmatrix}$

22. If $z=x+iy$, find $\text{Im}(3z+4\bar{z}-4i)$.

23. Find the period and amplitude of $y=\sin 7x$

24. If α, β are the roots of $17x^2+43x-73=0$, find the equation whose roots are $-\alpha$ and $-\beta$.

25. For any vector $\vec{a}$, prove that $\hat{i}\times(\hat{a}\times\hat{i})+\hat{j}\times(\vec{a}\times\hat{j})+\hat{k}\times(\vec{a}\times\hat{k})=2\vec{a}$.

26. State Rolle's theorem.

27. Evaluate : $\int_{-\log 2}^{\log 2} e^{-|x|}\,dx$.

28. If $E(X+5)=6$ then show that $E(X)=1$.

29. Examine the closure property of the operation $a*b=a+3ab-5b^2;\forall a,b\in\mathbb{Z}$

30. Show that the differential equation for the function $y^2=4ax$, where a is arbitrary, is $y=2y'x$.

PART– III

$7\times3=21$

Note: (i) Answer any **SEVEN** questions.

(ii) Question number **40 is compulsory.**

31. If $\text{adj}(A)=\begin{bmatrix}2 & -4 & 2\\ -3 & 12 & -7\\ -2 & 0 & 2\end{bmatrix}$, find A.

32. If $\omega\ne1$ is a cube root of unity, show that $\frac{a+b\omega+c\omega^2}{b+c\omega+a\omega^2}+\frac{a+b\omega+c\omega^2}{c+a\omega+b\omega^2}=-1$.

33. Find a polynomial equation of minimum degree with rational coefficients, having $2-\sqrt{3}$ as a root.

34. Find the domain of $\sin^{-1}\left(\frac{2+\sin x}{3}\right)$.

35. Find the local extremum of the function $f(x)=x^4+32x$.

36. Find the volume of a sphere of radius a through integration.

37. Solve the differential equation $\cos x\frac{dy}{dx}+y\sin x=1$.

38. Find the constant C such that the function $f(x)=\begin{cases}Cx^2 & 1<x<4\\ 0 & \text{Otherwise}\end{cases}$

is a density function, and compute $P(X\le2)$.

39. Construct the truth table for $(p\vee q)\vee\neg q$

40. If $f(x,y)=\frac{x^2+y^2+xy}{x^2-y^2}$ then show that $x\frac{\partial f}{\partial x}+y\frac{\partial f}{\partial y}=0$.

PART – IV

$7\times5=35$

Note: Answer **all** the questions.

41. (a) Test for consistency of the following system of linear equations and if possible solve: $x+2y-z=3,\ 3x-y+2z=1,\ x-2y+3z=3,\ x-y+z+1=0$.

(OR)

(b) The velocity v, of a parachute falling vertically satisfies the equation $v\frac{dv}{dx} = g\left(1-\frac{v^2}{k^2}\right)$, where g and k are constants. If v and x are both initially zero, find v in terms of x.

42. (a) A rod of length 1.2m moves with its ends always touching the coordinate axes. The locus of a point P on the rod, which is 0.3m from the end in contact with x-axis. Prove that the locus is an ellipse and hence find the eccentricity.

(OR)

(b) Prove that $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \tan^{-1}\left[\frac{x+y+z-xyz}{1-xy-yz-zx}\right]$.

43. (a) Identify the type of conic $\frac{(y-2)^2}{25} - \frac{(x+1)^2}{16} = 1$. Find the centre, foci and vertices.

(OR)

(b) Show that the two curves $x^2 - y^2 = r^2$ and $xy = c^2$, where c, r are constants, cut orthogonally.

44. (a) Let $g(x,y) = 2y + x^2, x = 2r - s, y = r^2 + 2s, r, s \in \mathbb{R}$. Find $\frac{\partial g}{\partial r}, \frac{\partial g}{\partial s}$.

(OR)

(b) Find the area of the region bounded by the parabola $y^2 = x$ and the line $y = x - 2$.

45. (a) For the complex number $z = 3 + 2i$, plot z, iz, and $z + iz$ in the Argand plane. Show that these complex numbers form the vertices of an isosceles right angled triangle.

(OR)

(b) The rate of increase in the number of bacteria in a certain bacteria culture is proportional to the number present. Given that the number triples in 5 hours, find how many bacteria will be present after 10 hours?

46. (a) Two balls are drawn in succession without replacement from an urn containing four red balls and three black balls. Let X be the possible outcomes of drawing red balls. Find the probability mass function and mean for X.

(OR)

(b) Show that $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{\cot x}} = \frac{\pi}{12}$.

47. (a) Find the vector and Cartesian equations of the plane passing through the points $(3,6,-2), (-1,-2,6)$, and $(6,4,-2)$.

(OR)

(b) Find the dimensions of the rectangle with maximum area that can be inscribed in a circle of radius 10 cm.

MODEL QUESTION PAPER – V

ANSWERS

PART – I

Qn. No.	Option	Answer	Qn. No.	Option	Answer
1.	(4)	11	11.	(1)	0
2.	(3)	A is correct, B is incorrect	12.	(4)	$30m^3$
3.	(3)	$\frac{-3\pi}{4}$	13.	(4)	0
4.	(3)	$\lvert\lvert z_1\rvert - \lvert z_2\rvert\rvert \geq \lvert z_1 + z_2\rvert$	14.	(2)	$\frac{2}{9}$
5.	(1)	Fundamental theorem of Algebra	15.	(1)	2, 2
6.	(3)	$\frac{10}{3}$	16.	(2)	k
7.	(4)	9	17.	(2)	(ii) only
8.	(2)	1	18.	(4)	2
9.	(4)	$\frac{\pi}{2}$	19.	(2)	$-1 \leq x \leq 2$
10.	(4)	$y = \pm 3$	20.	(2)	8

For writing the correct option and the answer – one mark..

PROFILE

MODEL PAPER - VI

Part I		Part II		Part III		Part IV	
1	Exercise 1.8 (19)	21	Exercise 1.1 (9)	31	Exercise 1.6 (1 – iii)	41 a	Example 1.24
2	Chapter – 1 Created (9)	22	Example 2.7	32	Example 2.16	41 b	Example 11.12
3	Exercise 2.9 (15)	23	Example 3.2	33	Exercise 3.5 (1 - i)	42 a	Exercise 5.5 (1)
4	Chapter – 2 Created	24	Exercise 5.3 (5)	34	Exercise 5.2 (2 – iii)	42 b	Example 4.20
5	Exercise 3.7 (5)	25	Chapter – 7 Created	35	Exercise 6.1 (12)	43 a	Example 5.10
6	Exercise 4.6 (15)	26	Exercise 8.2 (9)	36	Example 5.16	43 b	Example 6.3
7	Chapter – 5 Created	27	Example 10.2	37	Exercise 8.1 (6)	44 a	Exercise 7.1 (8)
8	Exercise 5.6 (14)	28	Exercise 11.5 (4)	38	Example 9.26	44 b	Example 12.18
9	Exercise 6.10 (17)	29	Exercise 12.1 (2)	39	Chapter – 10 Created	45 a	Example 9.68
10	Chapter – 6 Created (6)	30	Chapter – 9 Created	40	Chapter – 4 Created	45 b	Exercise 10.6 (8)
11	Exercise 7.10 (13)					46 a	Chapter – 2 Created
12	Chapter – 7 Created					46 b	Example 8.22
13	Chapter – 9 Created (3)					47 a	Chapter – 6 Created
14	Exercise 9.10 (9)					47 b	Chapter – 7 Created
15	Chapter – 10 Created (23)						
16	Chaper – 10 Created (28)						
17	Exercise 11.6 (7)						
18	Exercise 11.6 (16)						
19	Exercise 12.3 (1)						
20	Chapter – 12 Created (9)						

HIGHER SECONDARY SECOND YEAR

MATHEMATICS

MODEL QUESTION PAPER – 6

Time Allowed: 15 Min + 3.00 Hours] **[Maximum Marks:90**

Instructions: (a) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(b) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

$20\times1=20$

Note: (i) All questions are **compulsory.**

(ii) Choose the correct or most suitable answer from the given **four** alternatives. Write the option code and the corresponding answer.

1. If $x^a y^b = e^m, x^c y^d = e^n, \Delta_1 = \begin{vmatrix} m & b \\ n & d \end{vmatrix}, \Delta_2 = \begin{vmatrix} a & m \\ c & n \end{vmatrix}, \Delta_3 = \begin{vmatrix} a & b \\ c & d \end{vmatrix}$, then the values of x and y are respectively,
   (1) $e^{(\Delta_2/\Delta_1)}, e^{(\Delta_3/\Delta_1)}$ (2) $\log(\Delta_1/\Delta_3), \log(\Delta_2/\Delta_3)$
   (3) $\log(\Delta_2/\Delta_1), \log(\Delta_3/\Delta_1)$ (4) $e^{(\Delta_1/\Delta_3)}, e^{(\Delta_2/\Delta_3)}$
2. In the case of Cramer's rule which of the following are correct?
   (i) $\Delta = 0$ (ii) $\Delta \neq 0$
   (iii) the system has unique solution (iv) the system has infinitely many solutions
   (1) (i) and (iv) (2) (ii) and (iii) (3) all (4) none
3. If $z = x + iy$ is a complex number such that $|z+2| = |z-2|$, then the locus of z is
   (1) real axis (2) imaginary axis (3) ellipse (4) circle
4. $\arg\left(\frac{3}{-1-i}\right) =$
   (1) $-\frac{5\pi}{6}$ (2) $-\frac{2\pi}{3}$ (3) $\frac{3\pi}{4}$ (4) $-\frac{\pi}{2}$
5. Which number is not possible rational root of $4x^7 + 2x^4 - 10x^3 - 5 = 0$ (According to Rational Root Theorem) ?
   (1) -1 (2) $\frac{5}{4}$ (3) $\frac{4}{5}$ (4) 5
6. $\cot^{-1}\left(\sqrt{\sin\alpha}\right) + \tan^{-1}\left(\sqrt{\sin\alpha}\right) = u$, then $\cos 2u$ is equal to
   (1) $\tan^2\alpha$ (2) 0 (3) -1 (4) $\tan 2\alpha$
7. For the parabola $(x-h)^2 = -4a(y-k)$, the equation of the directrix is
   (1) $y = k$ (2) $y = a$ (3) $x = k + a$ (4) $y = k + a$

8. Two tangents are drawn to the hyperbola $\frac{x^2}{9}-\frac{y^2}{4}=1$ parallel to the straight line $2x-y=1$. One of the points of contact of tangents on the hyperbola is

(1) $\left(\frac{9}{2\sqrt{2}},\frac{-1}{\sqrt{2}}\right)$ (2) $\left(\frac{-9}{2\sqrt{2}},\frac{1}{\sqrt{2}}\right)$ (3) $\left(\frac{9}{2\sqrt{2}},\frac{1}{\sqrt{2}}\right)$ (4) $\left(3\sqrt{3},-2\sqrt{2}\right)$

9. The angle between the line $\vec{r}=\left(\hat{i}+2\hat{j}-3\hat{k}\right)+t\left(2\hat{i}+\hat{j}-2\hat{k}\right)$ and the plane $\vec{r}\cdot\left(\hat{i}+\hat{j}\right)+4=0$ is

(1) 0° (2) 30° (3) 45° (4) 90°

10. Which of the following statement is incorrect?

(1) if two lines are coplanar then their direction ratios must be same

(2) two coplanar lines must lie in a plane

(3) skew lines are neither parallel nor intersecting

(4) if two lines are parallel or intersecting then they are coplanar

11. The number given by the Mean value theorem for the function $\frac{1}{x}, x\in[1,9]$ is

(1) 2 (2) 2.5 (3) 3 (4) 3.5

12. The slope of the tangent to the curve $f(x)=2\cos 4x$ at $x=\frac{\pi}{12}$ is

(1) $-4\sqrt{3}$ (2) -4 (3) $\frac{\sqrt{3}}{12}$ (4) $4\sqrt{3}$

13. $\int_a^b f(a+b-x)dx=$

(1) $f(a)-f(b)$ (2) $\int_b^a f(x)dx$ (3) 0 (4) $\int_a^b f(x)dx$

14. The value of $\int_0^1 x(1-x)^{99}dx$ is

(1) $\frac{1}{11000}$ (2) $\frac{1}{10100}$ (3) $\frac{1}{10010}$ (4) $\frac{1}{10001}$

15. The order and degree of $\frac{d^2y}{dx^2}=xy+\cos\left(\frac{dy}{dx}\right)$ are

(1) 2, does not exist (2) 2,1 (3) 1,2 (4) 2,2

16. For a certain substance, the rate of change of vapor pressure P with respect to temperature T is proportional to the vapor pressure and inversely proportional to the square of the temperature. The corresponding differential equation is (k is constant of proportionality)

(1) $\frac{dP}{dT}=k\cdot\frac{T^2}{P}$ (2) $\frac{dT}{dP}=k\cdot T^2$ (3) $\frac{dP}{dT}=k\cdot\frac{P}{T^2}$ (4) $\frac{dP}{dT}=k\cdot P$

17. If the function $f(x)=\frac{1}{12}$ for $a<x<b$, represents a probability density function of a continuous random variable X, then which of the following cannot be the value of a and b?

(1) 0 and 12 (2) 5 and 17 (3) 7 and 19 (4) 16 and 24

18. If $f(x)=\begin{cases}2x & 0\le x\le a\\ 0 & \text{otherwise}\end{cases}$ is a probability density function of a random variable, then the value of a is

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

19. A binary operation on a set S is a function from

(1) $S\to S$ (2) $(S\times S)\to S$ (3) $S\to(S\times S)$ (4) $(S\times S)\to(S\times S)$

20. Which one of the following is correct?

(1) $[3]+_4[2]=[5]$ (2) $[0]+_{10}[12]=[0]$

(3) $[4]\times_5[3]=[12]$ (4) $[5]\times_6[4]=[2]$

PART – II

$7\times2=14$

Note: (i) Answer any **SEVEN** questions.

(ii) Question number **30 is compulsory.**

21. If $\text{adj}(A)=\begin{bmatrix}0 & -2 & 0\\ 6 & 2 & -6\\ -3 & 0 & 6\end{bmatrix}$, find A^{-1}.

22. Find z^{-1}, if $z=(2+3i)(1-i)$.

23. If α and β are the roots of the quadratic equation $2x^2-7x+13=0$, construct a quadratic equation whose roots are α^2 and β^2.

24. Identify the type of conic $11x^2-25y^2-44x+50y-256=0$

25. Evaluate the limit $\lim_{x\to0}\left(\frac{\sin mx}{\sin nx}\right)$.

26. The relation between number of words y a person learns in x hours is given by $y=52\sqrt{x}, 0\le x\le9$. What is the approximate number of words learned when x changes from 1 to 1.1 hour?

27. Find the differential equation for the family of all straight lines passing through the origin.

28. The probability that a certain kind of component will survive a electrical test is $\frac{3}{4}$. Find the probability that exactly 3 of the 5 components tested survive.

29. On $\mathbb{Z}$, define $\otimes$ by $(m \otimes n) = m^n + n^m : \forall m, n \in \mathbb{Z}$. Is $\otimes$ binary on $\mathbb{Z}$?

30. Show that the area of the region bounded by $y = \sin x, x = 0$ and $x = \pi$ is 2.

PART– III

Note: (i) Answer any **SEVEN** questions. $7 \times 3 = 21$

(ii) Question number **40 is compulsory.**

31. Test for consistency and if possible, solve the system of equations $2x + 2y + z = 5$, $x - y + z = 1$, $3x + y + 2z = 4$, by rank method.

32. Show that the equation $z^2 = \bar{z}$ has four solutions.

33. Solve the equation $\sin^2 x - 5\sin x + 4 = 0$

34. Find the equation of the ellipse whose length of latus rectum is 8, eccentricity is $\frac{3}{5}$, the centre is $(0,0)$ and the major axis is on x-axis.

35. Forces of magnitudes $5\sqrt{2}$ and $10\sqrt{2}$ units acting in the directions $3\hat{i} + 4\hat{j} + 5\hat{k}$ and $10\hat{i} + 6\hat{j} - 8\hat{k}$, respectively, act on a particle which is displaced from the point with position vector $4\hat{i} - 3\hat{j} - 2\hat{k}$ to the point with position vector $6\hat{i} + \hat{j} - 3\hat{k}$. Find the work done by the forces.

36. Find the equation of the parabola with focus $(-\sqrt{2}, 0)$ and directrix $x = \sqrt{2}$.

37. The time T, taken for a complete oscillation of a single pendulum with length l, is given by the equation $T = 2\pi\sqrt{\frac{l}{g}}$, where g is a constant. Find the approximate percentage error in the calculated value of T corresponding to an error of 2 percent in the value of l.

38. Evaluate : $\int_0^a \frac{f(x)}{f(x) + f(a-x)} dx$.

39. Solve the following differential equation : $\frac{dy}{dx} = xy\, e^x$

40. Find the value of $\tan^{-1}(-1) + \cos^{-1}\left(\frac{1}{2}\right) + \sec^{-1}(-2)$.

PART – IV

Note: Answer **all** the questions. $7 \times 5 = 35$

41. (a) If $A = \begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$, find the products AB and BA and hence solve the system of equations $x - y + z = 4, x - 2y - 2z = 9, 2x + y + 3z = 1$.

(OR)

(b) If X is the random variable with probability density function

$$f(x) = \begin{cases} x - 1, & 1 \le x < 2 \\ -x + 3, & 2 \le x < 3 \\ 0 & \text{otherwise} \end{cases},$$

find the distribution function $F(x)$.

42. (a) A bridge has a parabolic arch that is 10m height in the centre and 30m wide at the bottom. Find the height of the arch 6m from the centre, on any one side.

(OR)

(b) Evaluate $\sin\left[\sin^{-1}\left(\frac{3}{5}\right) + \sec^{-1}\left(\frac{5}{4}\right)\right]$.

43. (a) Find the equation of the circle passing through the points $(1,1)$, $(2,-1)$, and $(3,2)$.

(OR)

(b) Prove that $\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$, by using vectors.

44. (a) A conical water tank with vertex down of 12 metres height has a radius of 5 metres at the top. If water flows into the tank at a rate 10 cubic m/min, how fast is the depth of the water increases when the water is 8 metres deep?

(OR)

(b) Show that $p \leftrightarrow q \equiv (p \to q) \wedge (q \to p)$.

45. (a) Find the volume of the solid generated by revolving the region bounded by the curve $y = \frac{3}{4}\sqrt{x^2 - 16}$, $x \ge 4$, the y-axis, and the lines $y = 1$ and $y = 6$, about y-axis.

(OR)

(b) Solve $(x^2 + y^2)dy = xy\,dx$. Find the value of x_0 when $y(1) = 1$ and $y(x_0) = e$.

46 (a) Find all the values of $(-\sqrt{3} - i)^{\frac{2}{3}}$.

(OR)

(b) If $u = \sin^{-1}\left(\frac{x + y}{\sqrt{x} + \sqrt{y}}\right)$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{1}{2}\tan u$.

47. (a) Find the vector and Cartesian equations of the plane passing through the point $(-2,-2,4)$ and perpendicular to the planes $6x + 4y - 6z = 5$ and $10x - 8y + 2z = 1$.

(OR)

(b) Examine the local extrema and points of inflexion for the curve $f(x) = \frac{4}{3}x^3 - 8x^2 + 16x + 5$. If so, find them.

MODEL QUESTION PAPER – VI

ANSWERS

PART – II

Qn. No.	Option	Answer	Qn. No.	Option	Answer
1.	(4)	$e^{(\Delta_1/\Delta_3)}, e^{(\Delta_2/\Delta_3)}$	11.	(3)	3
2.	(2)	(ii) and (iii)	12.	(1)	$-4\sqrt{3}$
3.	(2)	Imaginary axis	13.	(4)	$\int_a^b f(x)dx$
4.	(3)	$\frac{3\pi}{4}$	14.	(2)	$\frac{1}{10100}$
5.	(3)	$\frac{4}{5}$	15.	(1)	2, does not exist
6.	(3)	-1	16.	(3)	$\frac{dP}{dT} = k\frac{P}{T^2}$
7.	(4)	$y = k + a$	17.	(4)	16 and 24
8.	(3)	$\left(\frac{9}{2\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$	18.	(1)	1
9.	(3)	$45°$	19.	(2)	$(S \times S) \to S$
10.	(1)	if two lines are coplanar then their direction ratios must be same	20.	(4)	$[5] \times_6 [4] = [2]$

For writing the correct option and the answer – one mark.