SUN TUITION CENTER

12th MATHEMATICS

QUESTION BANK

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PTA MODEL QUESTION PAPER -6

PUBLIC MODEL QUESTION PAPER-12

'Life is a Good Circle, You Choose the Best Radius'

10th

ALL SUBJECT

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Life is a Good Circle, ypu Choose the Best Radius

CHAPTER - XII

1. 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) $(S \times S) \to (S \times S)$

2. Subtraction is not a binary operation in

   (1) $\mathbb{R}$ (2) $\mathbb{Z}$ (3) $\mathbb{N}$ (4) $\mathbb{Q}$

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

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

4. In the set $\mathbb{R}$ of real numbers ' * ' is defined as follows. Which one of the following is not a binary operation on $\mathbb{R}$?

   (1) $a*b$=min (a.b) (2) $a*b$=max (a,b) (3) $a*b = a$ (4) $a*b = a^b$

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

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

6. In the set $\mathbb{Q}$ define $a \odot b = a + b + ab$. For what value of y, $3 \odot (y \odot 5) = 7$?

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

7. 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

8. Which one of the following statements has the truth value T ?

   (1) sin$x$ is an even function.

   (2) Every square matrix is non-singular

   (3) The product of complex number and its conjugate is purely imaginary

   (4) $\sqrt{5}$ is an irrational number

9. Which one of the following statements has truth value F ?

   (1) Chennai is in India or $\sqrt{2}$ is an integer

   (2) Chennai is in India or $\sqrt{2}$ is an irrational number

   (3) Chennai is in China or $\sqrt{2}$ is an integer

   (4) Chennai is in China or $\sqrt{2}$ is an irrational number

10. 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

11. Which one is the inverse of the statement $(p \vee q) \rightarrow (p \wedge q)$?

(1) $(p \wedge q) \rightarrow (p \vee q)$ (2) $\sim (p \vee q) \rightarrow (p \wedge q)$

(3) $(\sim p \vee \sim q) \rightarrow (\sim p \wedge \sim q)$ (4) $(\sim p \wedge \sim q) \rightarrow (\sim p \vee \sim q)$

12. Which one is the contrapositive of the statement $(p \vee q) \rightarrow r$?

(1) $\sim r \rightarrow (\sim p \wedge \sim q)$ (2) $\sim r \rightarrow (p \vee q)$

(3) $r \rightarrow (p \wedge q)$ (4) $p \rightarrow (q \vee r)$

13. The truth table for $(p \wedge q) \vee (\sim q)$ is given below

p	q	$(p \wedge q) \vee (\sim q)$
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is true?

	(a)	(b)	(c)	(d)
(1)	T	T	T	T
(2)	T	F	T	T
(3)	T	T	F	T
(4)	T	F	F	F

14. In the last column of the truth table for $\sim (p \vee \sim q)$ the number of final outcomes of the truth value "F are

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

15. Which one of the following is incorrect? For any two propositions p and q , we have

(1) $\vee \sim (p \vee q) \equiv \sim p \wedge \sim q$ (2) $\sim (p \wedge q) \equiv \sim p \vee \sim q$

(3) $\sim (p \vee q) \equiv \sim p \vee \sim q$ (4) $\sim (\sim p) \equiv p$

16. Which one of the following is not true?

(1) Negation of a negation of a statement is the statement i t self.

(2) If the last column of the Truth table contains only T then it is a tautology.

(3) If the last column of its truth table contains only F then it is a Contradiction

(4) If p and q are any two statements then $p \leftrightarrow q$ is a tautology.

17.

p	q	$(p \wedge q) \rightarrow (\sim p)$
T	T	(a)
T	F	(b)
F	T	(c)
F	F	(d)

Which one of the following is correct for the truth value of $(p \wedge q) \rightarrow (\sim p)$?

	(a)	(b)	(c)	(d)
(1)	T	T	T	T
(2)	F	T	T	T
(3)	F	F	T	T
(4)	T	T	T	F

18. The dual of $\sim (p \vee q) \vee [p \vee (p \wedge \sim r)]$ is

(1) $\sim (p \wedge q) \wedge [p \vee (p \wedge \sim r)]$ (2) $(p \wedge q) \wedge [p \wedge (p \vee \sim r)]$

(3) $\sim (p \wedge q) \wedge [p \wedge (p \wedge r)]$ (4) $\sim (p \wedge q) \wedge [p \wedge (p \vee \sim r)]$

19. The proposition is $p \wedge (\sim p \vee q)$ is

(1) a tautology (2) a contradiction

(3) logically equivalent to $p \wedge q$ (4) logically equivalent to $p \vee q$

20. Determine the truth value of each of the following statements:

(a) 4 + 2 = 5 and 6 + 3 = 9 (b) 3 + 2 = 5 and 6 + 1 = 7

© 4 + 5 = 9 and 1 + 2 = 4 (d) 3 + 2 = 5 and 4+7 = 11

	(a)	(b)	(c)	(d)
(1)	F	T	F	T
(2)	T	F	T	F
(3)	T	T	F	F
(4)	F	F	T	T

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HIGHER SECONDARY SECOND YEAR

MATHEMATICS

PTA- 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 and B are orthogonal, then $(AB)^T(AB)$ is

(a) A (b) B (c) I (d) A^T

2. If A is a non-singular matrix such that $A^{-1}=\begin{bmatrix}5 & 3\\ -2 & -1\end{bmatrix}$, then $(A^T)^{-1}=$

(a) $\begin{bmatrix}-5 & 3\\ 2 & 1\end{bmatrix}$ (b) $\begin{bmatrix}5 & 3\\ -2 & -1\end{bmatrix}$ (c) $\begin{bmatrix}-1 & -3\\ 2 & 5\end{bmatrix}$ (d) $\begin{bmatrix}5 & -2\\ 3 & -1\end{bmatrix}$

3. $i^n+i^{n+1}+i^{n+2}+i^{n+3}$ is

(a) 0 (b) 1 (c) -1 (d) i

4. The product of all four values of $\left(\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}\right)^{\frac{3}{4}}$ is

(a) -2 (b) -1 (c) 1 (d) 2

5. A polynomial equation in x of degree n always has

(a) n distinct roots (b) n real roots
(c) n imaginary roots (d) at most one root.

6. If $\sin^{-1}x+\sin^{-1}y=\frac{2\pi}{3}$, then $\cos^{-1}x+\cos^{-1}y$ is equal to

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

7. The equation of the directrix of the parabola $y^2=x+4$ is

(a) $x=\frac{15}{4}$ (b) $x=-\frac{15}{4}$ (c) $x=-\frac{17}{4}$ (d) $x=\frac{17}{4}$

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HIGHER SECONDARY SECOND YEAR

MATHEMATICS

PTA- 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

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

1. If $A=\begin{bmatrix}7 & 3\\ 4 & 2\end{bmatrix}$, then $9I-A=$

(a) A^{-1} (b) $\frac{A^{-1}}{2}$ (c) $3A^{-1}$ (d) $2A^{-1}$

2. If $A=\begin{bmatrix}3 & -3 & 4\\ 2 & -3 & 4\\ 0 & -1 & 1\end{bmatrix}$, then adj(adj A) is

(a) $\begin{bmatrix}3 & -3 & 4\\ 2 & -3 & 4\\ 0 & -1 & 1\end{bmatrix}$ (b) $\begin{bmatrix}6 & -6 & 8\\ 4 & -6 & 8\\ 0 & -2 & 2\end{bmatrix}$ (c) $\begin{bmatrix}-3 & 3 & -4\\ -2 & 3 & -4\\ 0 & 1 & -1\end{bmatrix}$ (d) $\begin{bmatrix}3 & -3 & 4\\ 0 & -1 & 1\\ 2 & -3 & 4\end{bmatrix}$

3. The area of the triangle formed by the complex numbers z, iz and $z+iz$ in the Argand's diagram is

(a) $\frac{1}{2}|z|^2$ (b) $|z|^2$ (c) $\frac{3}{2}|z|^2$ (d) $2|z|^2$

4. All complex numbers z which satisfy the equation $\left|\frac{z-6i}{z+6i}\right|=1$ lie on the

(a) real axis (b) imginary axis (c) circle (d) ellipse

5. If $\cot^{-1}2$ and $\cot^{-1}3$ are two angles of a triangle, then the third angle is

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

6. The range of $\sec^{-1}x$ is

(a) $[0,\pi]\setminus\left\{\frac{\pi}{2}\right\}$ (b) $[0,\pi]$ (c) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ (d) $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$

7. $P(x, y)$ be any point on $16x^2 + 25y^2 = 400$ with foci $F_1(3, 0)$ and $F_2(-3, 0)$ then $PF_1 + PF_2$ is

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

HIGHER SECONDARY SECOND YEAR

MATHEMATICS

PTA- 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 $A=\begin{bmatrix} 1 & \tan\frac{\theta}{2} \\ -\tan\frac{\theta}{2} & 1 \end{bmatrix}$ and $AB=I$, then $B=$

(a) $\left(\cos^2\frac{\theta}{2}\right)A$ (b) $\left(\cos^2\frac{\theta}{2}\right)A^T$ (c) $(\cos^2\theta)I$ (d) $\left(\sin^2\frac{\theta}{2}\right)A$

2. 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,

(a) $e^{(\Delta_2/\Delta_1)}, e^{(\Delta_3/\Delta_1)}$ (b) $\log(\Delta_1/\Delta_3), \log(\Delta_2/\Delta_3)$

(c) $\log(\Delta_2/\Delta_1), \log(\Delta_3/\Delta_1)$ (d)) $e^{(\Delta_1/\Delta_3)}, e^{(\Delta_2/\Delta_3)}$

3. If $z=x+iy$ is a complex number such that $|z+2|=|z-2|$ then the locus of z is

(a) real axis (b) imaginary axis (c) ellipse (d) circle

4. The principal argument of the complex number $\frac{\left(1+i\sqrt{3}\right)^2}{4i\left(1-i\sqrt{3}\right)}$ is

(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{5\pi}{6}$ (d) $\frac{\pi}{2}$

5. The polynomial equation $x^3+2x+3=0$ has

(a) one negative and two real roots (b) one positive and two imaginary roots
(c) three real roots (d) no solution

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

7. An ellipse has OB as semi minor axes, F and F' its foci and the angle FBF' is a right angle. Then the eccentricity of the ellipse is

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

8. If $\vec{a},\vec{b},\vec{c}$ are three 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) $\frac{\pi}{2}$ (b) $\frac{3\pi}{4}$ (c) $\frac{\pi}{4}$ (d) π

9. The equation of the plane passing through (3,4,5) and parallel to the plane $x+2y-2z-9=0$ is

(a) $x+2y-2z=4$ (b) $x+2y-2z=3$ (c) $x+2y-2z=1$ (d) $x+2y-2z=5$

10. If $[\vec{a},\vec{b},\vec{c}]=1$, then the value of $\frac{\vec{a}\cdot(\vec{b}\times\vec{c})}{(\vec{c}\times\vec{a})\cdot\vec{b}}+\frac{\vec{b}\cdot(\vec{c}\times\vec{a})}{(\vec{a}\times\vec{b})\cdot\vec{c}}+\frac{\vec{c}\cdot(\vec{a}\times\vec{b})}{(\vec{c}\times\vec{b})\cdot\vec{a}}$ is

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

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

(i) $-4\sqrt{3}$ (ii) -4 (iii) $\frac{\sqrt{3}}{12}$ (iv) $4\sqrt{3}$

12. The number given by the Rolle's theorem for the function $x^3-3x^2, x\in[0,3]$ is

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

13. If $f(x,y,z)=xy+yz+zx$, then f_x-f_z is equal to

(a) $z-x$ (b) $y-z$ (c) $x-z$ (d) $y-x$

14. If $f(x)=\int_0^x t\cos t\,dt$, then $\frac{df}{dx}=$

(a) $\cos x-x\sin x$ (b) $\sin x+x\cos x$ (c) $x\cos x$ (d) $x\sin x$

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

(a) 0 (b) 2 (c) $\log 2$ (d) $\log 4$

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HIGHER SECONDARY SECOND YEAR

MATHEMATICS

PTA- 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. The adjoint of 3×3 matrix P is $\begin{bmatrix}-1 & 2 & 2\\ 1 & 1 & 2\\ 2 & 2 & 1\end{bmatrix}$, then the possible value(s) of the determinant P is (are)

(a) 3 (b) -3 (c) ±3 (d) $\pm\sqrt{3}$

2. If $x=\dfrac{-1+i\sqrt{3}}{2}$ then the value of x^2+x+1

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

3. The value of $\left(\dfrac{1+\sqrt{3}i}{1-\sqrt{3}i}\right)^{10}$ is

(a) $cis\dfrac{2\pi}{3}$ (b) $cis\dfrac{4\pi}{3}$ (c) $-cis\dfrac{2\pi}{3}$ (d) $-cis\dfrac{4\pi}{3}$

4. A polynomial equation in x of degree n always has

(a) n distinct roots (b) n real roots (c) n imaginary roots (d) atmost one root

5. $\sin^{-1}(\cos x)=\dfrac{\pi}{2}-x$ is valid for

(a) $-\pi\le x\le0$ (b) $0\le x\le\pi$ (c) $-\dfrac{\pi}{2}\le x\le\dfrac{\pi}{2}$ (d) $-\dfrac{\pi}{4}\le x\le\dfrac{3\pi}{4}$

6. If $\cot^{-1}\left(\sqrt{\sin\alpha}\right)+\tan^{-1}\left(\sqrt{\sin\alpha}\right)=u$, then $\cos2u$ is equal to

(a) $\tan^2\alpha$ (b) 0 (c) -1 (d) $\tan2\alpha$

HIGHER SECONDARY SECOND YEAR

MATHEMATICS

PTA- MODEL QUESTION PAPER – 5

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

Instructions:
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(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.

PART – I

1. If A is a 3×3 matrix such that $|3adjA|=3$ then $|A|$ is equal to

(a) $\frac{1}{3}$ (b) $-\frac{1}{3}$ (c) $\pm\frac{1}{3}$ (d) ±3

2. If $A=\begin{bmatrix}3 & 1 & -1\\ 2 & -2 & 0\\ 1 & 2 & -1\end{bmatrix}$ and $A^{-1}=\begin{bmatrix}a_{11} & a_{12} & a_{13}\\ a_{21} & a_{22} & a_{23}\\ a_{31} & a_{32} & a_{33}\end{bmatrix}$ then the value of a_{23} is

(a) 0 (b) -2 (c) –3 (d) –1

3. z_1, z_2 and z_3 be complex numbers such that $z_1+z_2+z_3=0$ and $|z_1|=|z_2|=|z_3|=1$ then $z_1^2+z_2^2+z_3^2$ is

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

4. The value of $i^{201}+i^{202}+i^{203}$ is

(a) 1 (b) i (c) $-i$ (d) –1

5. If $\frac{z-1}{z+1}$ is purely imaginary, then $|z|$ is

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

6. If f and g are polynomials of degrees m and n respectively, and if $h(x)=(f\circ g)(x)$, then the degree of h is

(a) mn (b) $m+n$ (c) m^n (d) n^m

HIGHER SECONDARY SECOND YEAR

MATHEMATICS

PTA- 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

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 $\rho(A)=\rho([A\,|\,B])$, then the system of linear equations $AX=B$ is

(a) consistent and has a unique solution (b) consistent

(c) consistent and has infinitely many solution (d) inconsistent

2. Let A be a non-singular matrix then which one of the following is false

(a) $(\text{adj}A)^{-1}=\dfrac{A}{|A|}$ (b) I is an orthogonal matrix

(c) $adj\,(adjA)=|A|^{n}A$ (d) If A is symmetric then adj$A$ is symmetric

3. If $z=\dfrac{\left(\sqrt{3}+i\right)^{3}(3i+4)^{2}}{(8+6i)^{2}}$, then $|z|$ is

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

4. The continued product of the four values of $\left(\cos\dfrac{\pi}{3}+i\sin\dfrac{\pi}{3}\right)^{\frac{3}{4}}$ is

(a) 1 (b) -1 (c) 2 (d) -2

5. The value of $\sin^{-1}\left(2\cos^{2}x-1\right)+\cos^{-1}\left(1-2\sin^{2}x\right)$ is

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

6. The area of quadrilateral formed with foci of the hyperbolas $\dfrac{x^{2}}{a^{2}}-\dfrac{y^{2}}{b^{2}}=1$ and $\dfrac{x^{2}}{a^{2}}-\dfrac{y^{2}}{b^{2}}=-1$ is

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PUBLIC MODEL QUESTION PAPER-18

STD-XII

TIME -3 HOURS **MATHEMATICS** MAX.MARKS:90

Instructions: **1)** *Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.*

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

PART-A $20 \times 1 = 20$

Note: **i)** *Answer all the questions.*

ii) *Choose the most appropriate answer from the given four alternatives and 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 $BB^T =$

$(a)\ A$ $(b)\ B$ $(c)\ I_3$ $(d)\ B^T$

2) If A is a non-singular matrix, such that $A^{-1} = \begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$, then $(A^T)^{-1} =$

$(a)\begin{bmatrix} -5 & 3 \\ 2 & 1 \end{bmatrix}$ $(b)\begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$ $(c)\begin{bmatrix} -1 & -3 \\ 2 & 5 \end{bmatrix}$ $(d)\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$

3) If $|z - 2 + i| \leq 2$, then the greatest value of $|z|$ is

$(a)\ \sqrt{3} - 2$ $(b)\ \sqrt{3} + 2$ $(c)\ \sqrt{5} - 2$ $(d)\ \sqrt{5} + 2$

4) If $|z_1| = 1, |z_2| = 2, |z_3| = 3$ and $|9z_1\, z_2 + 4z_1z_3 + z_2z_3| = 12$, then the value of $|z_1 + z_2 + z_3|$ is

$(a)\ 1$ $(b)\ 2$ $(c)\ 3$ $(d)\ 4$

5) A polynomial equation in x of degree n always has

$(a)\ n$ distinct roots $(b)\ n$ real roots $(c)\ n$ complex roots (d) at most one root.

6) If $sin^{-1}\frac{x}{5} + cosec^{-1}\frac{5}{4} = \frac{\pi}{2}$, then the value of x is

$(a)\ 4$ $(b)\ 5$ $(c)\ 2$ $(d)\ 3$

7) The equation of the circle passing through $(1,5)$ and $(4,1)$ and touching $y-$axis is $x^2 + y^2 - 5x - 6y + 9 + \lambda(4x + 3y - 19) = 0$ where λ is equal to

(a) $0, -\frac{40}{9}$ (b) 0 (c) $\frac{40}{9}$ (d) $\frac{-40}{9}$

8) The radius of the circle $3x^2 + by^2 + 4bx - 6by + b^2 = 0$ is

(a) 1 (b) 3 (c) $\sqrt{10}$ (d) $\sqrt{11}$

9) If $\vec{a}$ and $\vec{b}$ are unit vectors such that $[\vec{a}, \vec{b}, \vec{a} \times \vec{b}] = \frac{1}{4}$, then the angle between $\vec{a}$ and $\vec{b}$ is

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

10) 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

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

11) A balloon rises straight up at $10\ m/s$. An observer is $40\ m$ away from the spot where the balloon left the ground. The rate of change of the balloon's angle of elevation in radian per second when the balloon is 30 meters above the ground.

(a) $\frac{3}{25} rad/sec$ (b) $\frac{4}{25} rad/sec$ (c) $\frac{1}{5}\ rad/\ sec$ (d) $\frac{1}{3}\ rad/sec$

12) The abscissa of the point on the curve $f(x) = \sqrt{8 - 2x}$ at which the slope of the tangent is -0.25 ?

(a) -8 (b) -4 (c) -2 (d) 0

13) If we measure the side of a cube to be $4\ cm$ with an error of $0.1\ cm$, then the error in our calculation of the volume is

(a) $0.4\ cu.cm$ (b) $0.45\ cu.cm$ (c) $2\ cu.cm$ (d) $4.8\ cu.cm$

14) For any value of $n \in \mathbb{Z}$, $\int_0^{\pi} e^{cos^2 x}\ cos^3[(2n+1)x]dx$ is

(a) $\frac{\pi}{2}$ (b) π (c) 0 (d) 2

15) The degree of the differential equation $y(x) = 1 + \frac{dy}{dx} + \frac{1}{1.2}\left(\frac{dy}{dx}\right)^2 + \frac{1}{1.2.3}\left(\frac{dy}{dx}\right)^3 + \cdots$ is

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

16) Let X represent the difference between the number of heads and the number of tails obtained when a coin is tossed n times. Then the possible values of X are

(a) $i + 2n, i = 0,1,2, \ldots n$ (b) $2i - n, i = 0,1,2, \ldots n$

(c) $n - i, i = 0,1,2, \ldots n$ (d) $2i + 2n, i = 0,1,2, \ldots n$

17) Subtraction is not a binary operation in

$(a)\ \mathbb{R}$ $(b)\ \mathbb{Z}$ $(c)\ \mathbb{N}$ $(d)\ \mathbb{Q}$

18) The value of $\cos^{-1}(cos12) - \sin^{-1}(sin12)$ is

$(a)\ 0$ $(b)\ \pi$ $(c)\ 8\pi - 24$ $(d)\ 9\pi + 24$

19) The radius of the auxiliary circle of the conic $9x^2 + 16y^2 = 144$ is

$(a)\ \sqrt{7}$ $(b)\ 4$ $(c)\ 3$ $(d)\ 5$

20) A six sided die is marked '1' on one face, '2' on two of its faces, and '3' on remaining three faces.

The die is rolled twice. If X denotes the total score in two throws. Find $P\ (3 \leq X < 6)$

$(a)\ \frac{9}{36}$ $(b)\ \frac{26}{36}$ $(c)\ \frac{23}{36}$ $(d)\ \frac{18}{36}$

PART-B $7 \times 2 = 14$

Note: **i)** ***Answer any seven questions.***

ii) ***Question No.30 is compulsory.***

21) Write $\frac{3+4i}{5-12i}$ in the $x + iy$ form; hence find its real and imaginary parts.

22) Construct a cubic equation with roots 2, $\frac{1}{2}$ and 1.

23) If $\cos^{-1} x = \tan^{-1} x$, then find $\sin(\cos^{-1} x)$

24) If $y = 2\sqrt{2}x + c$ is a tangent to the circle $x^2 + y^2 = 16$, find the value of c.

25) Find the angle between the planes $\vec{r} \cdot (\hat{\imath} + \hat{\jmath} - 2\hat{k}) = 3$ and $2x - 2y + z = 2$

26) Find differential dy of the function $y = (3 + sin(2x))^{\frac{2}{3}}$.

27) Evaluate $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} x\ cosx\ dx$.

28) Determine the order and degree of the differential equation $(1 + y')^2 + 1 = y'^2$.

29) Let $A = \{\, a + \sqrt{5}\, b\ ;\ a, b \in \mathbb{Z}\,\}$. Check whether the usual multiplication is a binary operation on A.

30) If $\frac{1}{|A|} = (AB) = I$, $|A| \neq 0$ and I is the unit matrix, then find the matrix B ?

PART-C

$7 \times 3 = 21$

Note: **i)** ***Answer any seven questions.***

ii) ***Question No.40 is compulsory.***

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

32) Find the value of the real numbers x and y if the complex number $(2+i)x + (1-i)y + 2i - 3$ and $x + (-1+2i)y + 1 + i$ are equal.

33) Find the equation of circles that touch both the axes and pass through $(-4, -2)$ in general form.

34) Prove by vector method that the area of the quadrilateral ABCD having diagonals AC and BD is $\frac{1}{2}\left|\overrightarrow{AC} \times \overrightarrow{BD}\right|$.

35) Evaluate $\lim_{x \to \infty} \left(\frac{e^x}{x^m}\right), m \in N$.

36) Find Δf and df for the function f for the indicated values of $x, \Delta x$ and compare $f(x) = x^3 - 2x^2; x = 2, \Delta x = dx = 0.5$.

37) Solve the differential equation $\frac{dy}{dx} - x\sqrt{25 - x^2} = 0$.

38) A random variable X has the following probability mass function.

x	1	2	3	4	5
$f(x)$	k^2	$2k^2$	$3k^2$	$2k$	$3k$

Find (i) the value of k (ii) $P(2 \leq X < 5)$

39) Using the equivalence property, show that $p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$.

40) Evaluate $\int_0^\infty \frac{1}{e^x + e^{-x}} dx$.

PART-D

$7 \times 5 = 35$

Note: **i)** ***Answer all the questions.***

41) (a) A chemist has one solution which is 50% acid and another solution which is 25% acid. How much each should be mixed to make 10 litres of a 40% acid solution? (By Use Cramer's rule)

(**or**)

(*b*) Solve the following systems of linear equations by Gaussian elimination method

$2x + 4y + 6z = 22$, $3x + 8y + 5z = 27$, $-x + y + 2z = 2$

42) (*a*) If $z = x + iy$ is a complex number such that $Im\left(\frac{2z+1}{iz+1}\right) = -2$. Find the locus of P

(**or**)

(*b*) If $2 + i$ and $3 - \sqrt{2}$ are roots of the equation

$x^6 - 13x^5 + 62x^4 - 126x^3 + 65x^2 + 127x - 140$

43) (*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*) Find the foci, vertices and length of major and minor axis of the conic

$4x^2 + 36y^2 + 40x - 288y + 532 = 0$

44) (*a*) On lighting a rocket cracker it gets projected in a parabolic path and reaches a maximum height of $6m$ when it is $8\ m$ away from the point of projection. Finally it reaches the ground $16\ m$ away from the starting point. Find the angle of projection.

(**or**)

(*b*) If the curves $ax^2 + by^2 = 1$ and $cx^2 + dy^2 = 1$ intersect each other orthogonally then, show that $\frac{1}{a} - \frac{1}{b} = \frac{1}{c} - \frac{1}{d}$.

45) (*a*) Prove by vector method that the perpendiculars (attitudes) from the vertices to the opposite sides of a triangle are concurrent.

(**or**)

(*b*) Find the parametric vector, non-parametric vector and Cartesian form of the equations of the plane passing through the three non collinear points $(2,2,-1), (3,4,2)$ and $(7,0,6)$

46) (*a*) A hollow cone with base radius a cm and height b cm is placed on a table. Show that the volume of the largest cylinder that can be hidden underneath is $\frac{4}{9}$ times volume of the cone.

(**or**)

(b) A radioactive isotope has an initial mass 200 mg, which two years later is 50 mg. Find the expression for the amount of the isotope remaining at any time. What is its half-life? (Half-life means the times taken for the radioactivity of a specified isotope to fall to half its original value).

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

Find (i) the value of k (ii) the distribution function $(iii)\ P(X < 3)$

$(iv)\ P(5 \leq X)$ $(v)\ P(X \leq 4)$.

(or)

(b) Verify the (i) closure property (ii) commutative property (iii) associative property (iv) existence of identity and (v) existence of inverse for following operation on the given set. $m * n = m + n - mn\ ; m, n \in \mathbb{Z}$.