Roll No _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2020 – 2022 to 2023 – 2025)**

Q.PAPER – I (Objective Type) 224-1st Annual-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – I Maximum Marks : 20

PAPER CODE = 6195

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	Rank of the matrix $\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$ is :			
	(A) 0	(B) 1 ●	(C) 2	(D) 3
2	The fraction $\frac{x+1}{x^2+2}$ is :			
	(A) Improper fraction	(B) Proper fraction ●	(C) Identity	(D) Mixed
3	The multiplicative inverse of (1 , 0) is :			
	(A) (1 , 0) ●	(B) (0 , 1)	(C) (– 1 , 0)	(D) (0 , – 1)
4	The roots of $2x^2 - 7x + 3 = 0$, are :			
	(A) Equal	(B) Complex	(C) Irrational	(D) Rational ●
5	The value of $(-i)^9$ is :			
	(A) – 1	(B) 1	(C) i	(D) – i ●
6	If A is a square matrix of order 3 and $\lvert A \rvert = 2$, then $\lvert 2A \rvert$ = :			
	(A) 16 ●	(B) 8	(C) 6	(D) 2
7	The number of elements of the power set of A = { a, { b , c } } are :			
	(A) 2	(B) 4 ●	(C) 6	(D) 8
8	If $A \subseteq B$, then :			
	(A) $A \cup B = A$	(B) $A \cap B = B$	(C) $B \cup A = A$	(D) $A \cup B = B$ ●
9	If ω is a cube root of unity, then value of $(1+\omega-\omega^2)^3$ is :			
	(A) 8ω	(B) $8\omega^2$	(C) – 8 ●	(D) 8
10	The converse of $\sim p \rightarrow q$ is :			
	(A) $p \rightarrow q$	(B) $p \rightarrow \sim q$	(C) $\sim q \rightarrow p$	(D) $q \rightarrow \sim p$ ●
11	$\cos 2\theta$ =:			
	(A) $1 - \sin^2\theta$	(B) $1 - 2\sin\theta$	(C) ● $1 - 2\sin^2\theta$	(D) $2\sin^2\theta - 1$
12	The G.M. between $\frac{1}{a}$ and $\frac{1}{b}$ is :			
	(A) $\pm\sqrt{ab}$	(B) $\pm\frac{1}{ab}$	(C) $\pm\sqrt{\frac{1}{ab}}$ ●	(D) ab

1-13	If $\cos x = -\frac{\sqrt{3}}{2}$, then the reference angle is : (A) $\frac{\pi}{3}$ (B) $\frac{\pi}{6}$ ● (C) $-\frac{\pi}{3}$ (D) $-\frac{\pi}{6}$
14	If $\sin\theta < 0$ and $\cot\theta > 0$, then θ lies in quadrant : (A) IV (B) III ● (C) II (D) I
15	The value of $\sin^{-1}(\cos\frac{\pi}{6})$ is equal to : (A) $\frac{\pi}{3}$ ● (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{2}$ (D) $\frac{3\pi}{2}$
16	The relation between A, G, H is : (A) $G^2 = AH$ ● (B) $H^2 = AG$ (C) $A^2 = HG$ (D) $A > G < H$
17	The number of terms in the expansion of $(a+x)^n$ is : (A) n – 1 (B) n (C) n + 2 (D) n + 1 ●
18	$\sqrt{\frac{s(s-c)}{ab}} =$: (A) $\cos\frac{\alpha}{2}$ (B) $\sin\frac{\alpha}{2}$ (C) $\cos\frac{\gamma}{2}$ ● (D) $\sin\frac{\gamma}{2}$
19	A die is thrown, what is the probability to get 3 dots : (A) $\frac{1}{6}$ ● (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$
20	The period of $\cos\frac{x}{6}$ is : (A) 2π (B) 3π (C) 6π (D) 12π ●

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2020 – 2022 to 2023 – 2025)

MATHEMATICS 224-1st Annual-(INTER PART – I) Time Allowed : 2.30 hours
PAPER – I (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Write the symmetric property and transitive property of equality of the real numbers.

(ii) Show that $z\bar{z} = |z|^2 \ \forall z \in C$

(iii) Find out real and imaginary parts of $(\sqrt{3}+i)^3$

(iv) Find the modulus of $1-i\sqrt{3}$

(v) Construct truth table for $(p \wedge \sim p) \rightarrow q$

(vi) If a, b are elements of a group G, then show that $(ab)^{-1} = b^{-1}a^{-1}$

(vii) If $A = \begin{bmatrix} 1 & 2 \\ a & b \end{bmatrix}$ and $A^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$, find the values of a and b.

(viii) If A and B are square matrices of the same order, then explain why in general $(A-B)^2 \neq A^2 - 2AB + B^2$.

(ix) Define skew-hermitain matrix.

(x) Evaluate $\omega^{28} + \omega^{29} + 1$

(xi) When $x^4 + 2x^3 + kx^2 + 3$ is divided by $x-2$, the remainder is 1. Find the value of k.

(xii) If α, β are the roots of $x^2 - px - p - c = 0$, prove that $(1+\alpha)(1+\beta) = 1-c$

3. Write short answers to any EIGHT (8) questions : **16**

(i) Define partial fractions.

(ii) If $\frac{7x+25}{(x+3)(x+4)} = \frac{A}{x+3} + \frac{B}{x+4}$, then find B.

(iii) Find the number of terms in A.P if $a_1 = 3$; $d = 7$ and $a_n = 59$

(iv) If $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in G.P., show that common ratio is $\pm\sqrt{\frac{a}{c}}$

(v) Find the sum of $\frac{9}{4} + \frac{3}{2} + 1 + \frac{2}{3} + - - - - - \infty$

(vi) If 5 is H.M. between 2 and b, then find b.

(vii) Write $\frac{(n+1)(n)(n-1)}{3.2.1}$ in factorial form.

(viii) Prove that ${}^nP_r = n \cdot {}^{n-1}P_{r-1}$

(ix) Determine probability of getting 2 heads in two successive tosses of balanced coin.

(x) Show that $8.10^n - 2$ is divisible by 6 for n = 1 and n = 2

(xi) Find the 6th term in the expansion of $\left(x^2 - \frac{3}{2x}\right)^{10}$

(xii) Using binomial theorem, find value of $\sqrt[3]{65}$ correct to three places of decimal.

(Turn Over)

4. Write short answers to any NINE (9) questions : 18

(i) Verify $\tan 2\theta = \dfrac{2\tan\theta}{1-\tan^2\theta}$ for $\theta = 45°$

(ii) Prove the identity $\dfrac{1+\cos\theta}{1-\cos\theta} = (\operatorname{cosec}\theta + \cot\theta)^2$

(iii) If α, β and γ are the angles of triangle ABC then prove that $\tan(\alpha+\beta) - \tan\gamma = 0$

(iv) Express as product $\cos 6\theta + \cos 3\theta$

(v) Prove that $1 + \tan\alpha \tan 2\alpha = \sec 2\alpha$

(vi) Prove that period of cosine is 2π

(vii) Find the period of $\operatorname{cosec} 10x$

(viii) Draw the graph of the function $y = \cos x$, $x \in \left[-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right]$

(ix) Write formula for $\cos\dfrac{\alpha}{2}$ and $\cos\dfrac{\gamma}{2}$

(x) Measure of two sides of a triangle are in the ratio 3 : 2 and angle including these sides is 57°. Find the remaining two angles.

(xi) Define circum centre.

(xii) Without using calculator / table, show that $2\cos^{-1}\dfrac{4}{5} = \sin^{-1}\dfrac{24}{25}$

(xiii) Solve the trigonometric equation $\operatorname{cosec}^2\theta = \dfrac{4}{3}$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Show that $\begin{vmatrix} a+\lambda & b & c \\ a & b+\lambda & c \\ a & b & c+\lambda \end{vmatrix} = \lambda^2(a+b+c+\lambda)$ 5

(b) If the roots of the equation $x^2 - px + q = 0$ differ by unity, prove that $p^2 = 4q+1$ 5

6. (a) Resolve $\dfrac{1}{(x-3)^2(x+1)}$ into partial fractions 5

(b) Find n so that $\dfrac{a^n + b^n}{a^{n-1} + b^{n-1}}$ may be the A.M. between a and b 5

7. (a) Two dice are thrown. E_1 is the event that the sum of their dots is an odd numbers and E_2 is the event that 1 is the dot on the top of the first die. Show that $P(E_1 \cap E_2) = P(E_1) \cdot P(E_2)$ 5

(b) If $y = \dfrac{1}{3} + \dfrac{1.3}{2!}\left(\dfrac{1}{3}\right)^2 + \dfrac{1.3.5}{3!}\left(\dfrac{1}{3}\right)^3 + \text{----}$ prove that $y^2 + 2y - 2 = 0$ 5

8. (a) Reduce $\sin^4\theta$ to an expression involving only function of multiple of θ, raised to the first power. 5

(b) Prove that $\Delta = r^2 \cot\dfrac{\alpha}{2}\cot\dfrac{\beta}{2}\cot\dfrac{\gamma}{2}$ 5

9. (a) Find the values of all the trigonometric functions of the angle $-675°$. 5

(b) Prove that $\sin^{-1}\dfrac{5}{13} + \sin^{-1}\dfrac{7}{25} = \cos^{-1}\dfrac{253}{325}$ 5

Roll No _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2020 – 2022 to 2023 – 2025)**

Q.PAPER – I (Objective Type) 224-1st Annual-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – II Maximum Marks : 20

PAPER CODE = 6196

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If A is a matrix of order 2×3, then order of A^tA is : (A) 3×3 ● (B) 2×3 (C) 3×2 (D) 2×2
2	The equation $x(x-1)=x^2-x$ is : (A) Conditional (B) Identity ● (C) Exponential (D) Radical
3	The multiplicative inverse of $-i$ is : (A) $(1,-1)$ (B) $(0,-1)$ (C) $(0,1)$ ● (D) $(1,0)$
4	If ω is a cube root of unity, then $(1+\omega+\omega^2)^8 =$: (A) 0 ● (B) 256 (C) 256ω (D) $256\omega^2$
5	Which of the following sets has closure property w.r.t. addition : (A) $\{1\}$ (B) $\{0\}$ ● (C) $\{0,1\}$ (D) $\{1,-1\}$
6	If $\lvert A\rvert=9$, then $\lvert A^t\rvert$ is : (A) 81 (B) $\frac{1}{9}$ (C) -9 (D) 9 ●
7	The converse of $p \rightarrow q$ is : (A) $\sim p \rightarrow \sim q$ (B) $\sim q \rightarrow p$ (C) $q \rightarrow p$ ● (D) $p \rightarrow \sim q$
8	If $A=\{\}$, then the power set of A is : (A) ϕ (B) $\{0\}$ (C) $\{\}$ (D) $\{\phi\}$ ●
9	If $4^{1+x}=2$, then $x=$: (A) 0 (B) -2 (C) $-\frac{1}{2}$ ● (D) $\frac{1}{2}$
10	If $A \cap B = A$, then : (A) $B \subseteq A$ (B) $A \subseteq B$ ● (C) $A \cup B = A$ (D) $B \cup A = A$
11	$\sin(270° + \theta) =$: (A) $\sin\theta$ (B) $\cos\theta$ (C) $-\cos\theta$ ● (D) $-\sin\theta$
12	Which cannot be the term of a G P : (A) 1 (B) -1 (C) 0 ● (D) i

1-13	If $\sin x = -\frac{\sqrt{3}}{2}$, then the reference angle is : (A) $-\frac{\pi}{6}$ (B) $\frac{\pi}{6}$ (C) $-\frac{\pi}{3}$ (D) $\frac{\pi}{3}$ ●
14	Which angle is quadrantal angle : (A) 45° (B) 60° (C) 120° (D) 270° ●
15	With usual notation, $\frac{abc}{4R} =$: (A) r (B) r_1 (C) Δ ● (D) r_2
16	H.M. between 3 and 7 is : (A) 5 (B) $\sqrt{21}$ (C) $\pm\sqrt{21}$ (D) $\frac{21}{5}$ ●
17	The number of terms in the expansion of $(a+x)^n$ is : (A) n – 1 (B) n (C) n + 2 (D) n + 1 ●
18	The period of $\cos 2x$ is : (A) π ● (B) 2π (C) 4π (D) $\frac{\pi}{2}$
19	If r = n, then ${}^nC_r =$: (A) 0 (B) 1 ● (C) n (D) n!
20	$\sin^{-1}(0) + \cos^{-1}(0) =$: (A) 0 (B) $\frac{\pi}{2}$ ● (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{4}$

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2020 – 2022 to 2023 – 2025)

MATHEMATICS 224-1st Annual-(INTER PART – I) Time Allowed : 2.30 hours

PAPER – I (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Show that $z^2\bar{z}^2$ is a real number.

(ii) Find the modulus of $1-i\sqrt{3}$

(iii) Simplify by justifying each step $\dfrac{\frac{1}{4}+\frac{1}{5}}{\frac{1}{4}-\frac{1}{5}}$

(iv) Check the closure property w.r.t. addition and multiplication for the set $\{0, -1\}$

(v) Determine whether the statement $p \wedge \sim p$ is tautology or not.

(vi) Define semi-group.

(vii) If $A=\begin{bmatrix}1\\1+i\\i\end{bmatrix}$, find $A(\bar{A})^t$

(viii) Define reduced echelon form of a matrix, with example.

(ix) If $A=\begin{bmatrix}2 & -1\\3 & 1\end{bmatrix}$, verify that $(A^{-1})^t=(A^t)^{-1}$

(x) Discuss nature of roots of $9x^2-12x+4=0$

(xi) Solve the equations $x^2+y^2=25$, $2x^2+3y^2=6$

(xii) Find the condition that one root of $x^2+px+q=0$ is square of other.

3. Write short answers to any EIGHT (8) questions : **16**

(i) Define proper rational fraction.

(ii) For the identity $\dfrac{1}{(x-1)(2x-1)(3x-1)}=\dfrac{A}{x-1}+\dfrac{B}{2x-1}+\dfrac{C}{3x-1}$ calculate the value of A.

(iii) Find the next two terms of 1, 3, 7, 15, 31, ----

(iv) How many terms are there in the A.P. in which $a_1=11$, $a_n=68$, $d=3$

(v) Find three A.Ms between $\sqrt{2}$ and $3\sqrt{2}$.

(vi) Find the 12th term of $1+i, 2i, -2+2i, \ldots$

(vii) Show that ${}^{16}C_{11}+{}^{16}C_{10}={}^{17}C_{11}$

(viii) Evaluate ${}^{12}C_3$

(ix) What is sample space and events?

(x) State principle of mathematical induction.

(xi) Calculate $(9.98)^4$ by means of binomial theorem.

(xii) Prove that $n!>2^n-1$ for $n=4,5$

4. Write short answers to any NINE (9) questions : **18**

(i) What is length of an arc intercepted on a circle of radius 14 cm by the arms of a central angle 45^o?

(ii) Convert $54°45'$ into radians.

(Turn Over)

4. (iii) If α, β, γ are angles of triangle ABC then prove that $\cos\left(\frac{\alpha+\beta}{2}\right)=\sin\frac{\gamma}{2}$

(iv) Find the value of $\cos\frac{\pi}{12}$

(v) Express $\sin(x+30°)+\sin(x-30°)$ as a product.

(vi) Define periodic function and period of trigonometric function.

(vii) Find period of $\cos\frac{x}{6}$

(viii) Draw the graph of $y=\sin x$ from 0 to π.

(ix) State law of sines.

(x) If sides of triangle are 16, 20, 23, find its greatest angle.

(xi) Show that $r_1 = s\tan\frac{\alpha}{2}$

(xii) Find value of $\cos\left(\sin^{-1}\frac{1}{\sqrt{2}}\right)$

(xiii) Show that $\tan\left(\sin^{-1}x\right)=\frac{x}{\sqrt{1-x^2}}$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Solve the system of equations by Cramer's rule : 5

$$2x+2y+z=3$$
$$3x-2y-2z=1$$
$$5x+y-3z=2$$

(b) If α, β roots of $x^2-3x+5=0$ form the equation whose roots are $\frac{1-\alpha}{1+\alpha}$ and $\frac{1-\beta}{1+\beta}$ 5

6. (a) Resolve $\frac{x^4}{1-x^4}$ into partial fractions 5

(b) The sum of an infinite geo-metric series is 9 and the sum of the squares of its terms is $\frac{81}{5}$. Find the series. 5

7. (a) Find the values of n and r when ${}^{n-1}C_{r-1} : {}^{n}C_{r} : {}^{n+1}C_{r+1} = 3:6:11$ 5

(b) If x is so small that its cube and higher powers can be neglected, then show that : $\sqrt{\frac{1-x}{1+x}} \approx 1-x+\frac{x^2}{2}$ 5

8. (a) Reduce $\cos^4\theta$ to an expression involving only function of multiples of θ, raised to the first power. 5

(b) Prove that $r_3 = 4R\cos\frac{\alpha}{2}\cos\frac{\beta}{2}\sin\frac{\gamma}{2}$ 5

9. (a) Show that the area of a sector of a circular region of radius r is $\frac{1}{2}r^2\theta$, where θ is the circular measure of the central angle of the sector. 5

(b) Prove that $\sin^{-1}\frac{1}{\sqrt{5}}+\cot^{-1}3=\frac{\pi}{4}$ 5

Roll No _____ Lahore Board-2023 _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2019 – 2021 to 2022 – 2024)**

Q.PAPER – I (Objective Type) 223-1st Annual-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – I Maximum Marks : 20

PAPER CODE = 6195

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	Sum of cube roots of unity is : (A) $2i$ (B) -1 (C) 0 (D) 1
2	If ${}^{n}P_{2}=30$ then n = : (A) 5 (B) 6 (C) 7 (D) 8
3	The modulus of complex number $1-i\sqrt{3}$ is : (A) $1+i\sqrt{3}$ (B) $-1+i\sqrt{3}$ (C) 2 (D) $\frac{1}{2}$
4	Arithmetic mean between $\sqrt{2}$ and $3\sqrt{2}$ is : (A) $2\sqrt{2}$ (B) $\sqrt{6}$ (C) $\frac{3}{\sqrt{2}}$ (D) $\frac{\sqrt{2}}{2}$
5	If a function $f: A \to B$ is such that Ran $f \subset B$ i.e. Ran $f \neq B$ then f is called : (A) Into function (B) Onto function (C) Injective function (D) Bijective function
6	Partial fractions of $\frac{x^2+1}{(x+1)(x-1)}$ are of the type : (A) $\frac{A}{x+1}+\frac{B}{x-1}$ (B) $1-\frac{A}{x+1}-\frac{B}{x-1}$ (C) $1+\frac{A}{x+1}+\frac{B}{x-1}$ (D) $\frac{Ax+B}{x+1}+\frac{C}{x-1}$
7	Quadratic equation whose roots are 2 and 3 : (A) $x^2-5x+6=0$ (B) $x^2+5x+6=0$ (C) $x^2-5x-6=0$ (D) $x^2+5x-6=0$
8	If A is a square matrix of order 3 then $\lvert KA\rvert$ = : (A) $K\lvert A\rvert$ (B) $K^3\lvert A\rvert$ (C) $K^2\lvert A\rvert$ (D) $\lvert A\rvert$
9	7th term of the sequence 2, 6, 11, 17, ---- is : (A) 24 (B) 26 (C) 30 (D) 32
10	The trivial solution of homogeneous linear equation is : (A) (0 , 0 , 1) (B) (0 , 1 , 0) (C) (1 , 0 , 0) (D) (0 , 0 , 0)
11	Domain of the function $y = \cot x$ is : (A) $-\infty < x < +\infty$ (B) $-\infty < x < +\infty$, $x \neq \frac{(2n+1)\pi}{2}$, $n \in Z$ (C) $-1 \leq x \leq 1$ (D) $-\infty < x < +\infty$, $x \neq n\pi$, $n \in Z$

(Turn Over)

1-12	If A and B are overlapping events then $P(A \cup B) = ---$: (A) $P(A)+P(B)$ (B) $1-P(A)$ (C) $P(A)+P(B)-P(A \cap B)$ (D) $1-P(B)$
13	The solutions of $\operatorname{cosec}\theta = 2$ which lie in $[0, 2\pi]$: (A) $\frac{4\pi}{3}, \frac{5\pi}{3}$ (B) $\frac{2\pi}{3}, \frac{4\pi}{3}$ (C) $\frac{\pi}{4}, \frac{3\pi}{4}$ (D) $\frac{\pi}{6}, \frac{5\pi}{6}$
14	$\cos\left(\frac{\pi}{2}-\beta\right) = ---$: (A) $-\sin\beta$ (B) $\sin\beta$ (C) $\cos\beta$ (D) $-\cos\beta$
15	$\cos^{-1}(-x) =$: (A) $\cos^{-1}x$ (B) $-\cos^{-1}x$ (C) $\pi-\cos^{-1}x$ (D) $2\pi-\cos^{-1}x$
16	2nd term in the expansion of $\left(\frac{a}{2}-\frac{2}{a}\right)^6$ is : (A) $\frac{a^6}{64}$ (B) $\frac{15}{4}a^2$ (C) -20 (D) $-\frac{3}{8}a^4$
17	If $\sin\theta = \frac{12}{13}$ and terminal arm is in quad – I then $\cos\theta = ---$: (A) $\frac{13}{5}$ (B) $\frac{-5}{13}$ (C) $\frac{5}{13}$ (D) $\frac{-13}{5}$
18	In any triangle with usual notations $\sin\frac{\gamma}{2} =$: (A) $\sqrt{\frac{(s-a)(s-b)}{ab}}$ (B) $\sqrt{\frac{(s-b)(s-c)}{bc}}$ (C) $\sqrt{\frac{(s-c)(s-a)}{ca}}$ (D) $\sqrt{\frac{s(s-c)}{ab}}$
19	If n is odd in the expansion of $(a+x)^n$ then number of middle term are : (A) 2 (B) 3 (C) 4 (D) 1
20	In law of cosine if $\beta = 90°$ then it reduces to : (A) $b^2+c^2=a^2$ (B) $c^2+a^2=b^2$ (C) $a^2+b^2=c^2$ (D) $c^2-a^2=b^2$

.oll No _____ Lahore Board-2023 _____ (To be filled in by the candidate)

(Academic Sessions 2019 – 2021 to 2022 – 2024)

MATHEMATICS 223-1st Annual-(INTER PART – I) Time Allowed : 2.30 hours

PAPER – I (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Show that $z^2 + \bar{z}^2$ is a real number where $z \in C$

(ii) Find the multiplicative inverse of $1-2i$

(iii) Write the descriptive and tabular form of $\{x \mid x \in P \wedge x < 12\}$

(iv) Define disjunction.

(v) If a, b are elements of a group G, solve $ax = b$

(vi) Find x and y if $\begin{bmatrix} x+3 & 1 \\ -3 & 3y-4 \end{bmatrix} = \begin{bmatrix} y & 1 \\ -3 & 2x \end{bmatrix}$

(vii) Find the cofactors A_{12} and A_{22} if $A = \begin{bmatrix} 1 & -2 & 3 \\ -2 & 3 & 1 \\ 4 & -3 & 2 \end{bmatrix}$

(viii) Without expansion show that $\begin{vmatrix} 2 & 3 & -1 \\ 1 & 1 & 0 \\ 2 & -3 & 5 \end{vmatrix} = 0$

(ix) Solve the equation $4^{1+x} + 4^{1-x} = 10$

(x) Show that the product of all the three cube roots of unity is unity.

(xi) If α, β are the roots of $ax^2 + bx + c = 0$, $a \neq 0$, find the value of $\alpha^2 + \beta^2$

(xii) The sum of a positive number and its reciprocal is $\frac{26}{5}$. Find the number.

3. Write short answers to any EIGHT (8) questions : **16**

(i) Resolve $\frac{7x+25}{(x+3)(x+4)}$ into partial fraction.

(ii) If $\frac{1}{a}, \frac{1}{b}$ and $\frac{1}{c}$ are in A.P., show that $b = \frac{2ac}{a+c}$

(iii) Sum the series $(x-a) + (x+a) + (x+3a) + \text{----}$ to n terms.

(iv) Find the 5th term of G.P 3, 6, 12, -----

(v) If 5 is harmonic mean between 2 and b, find b.

(vi) Find the sum to n terms of the series whose nth term is $3n^2 + n + 1$

(vii) Find the value of n when ${}^nP_4 : {}^{n-1}P_3 = 9:1$

(viii) How many necklaces can be made from 6 beads of different colours?

(ix) Find the value of n, when ${}^nC_{10} = \frac{12 \times 11}{2!}$

(x) Verify the statement $1+2+4+\text{------}+2^{n-1} = 2^n - 1$ for $n = 1, 2$

(xi) Calculate by means of binomial theorem $(0.97)^3$ upto three decimal places.

(xii) Expand $(1-x)^{1/2}$ upto three terms.

(Turn Over)

4. Write short answers to any NINE (9) questions : **18**

(i) Convert $21.256°$ to the $D°M'S''$ form.

(ii) Verify $\sin 2\theta = 2\sin\theta\cos\theta$, when $\theta = 45°$

(iii) Prove the identity $\cos\theta + \tan\theta\sin\theta = \sec\theta$

(iv) Prove that $\sin(180° + \alpha)\sin(90° - \alpha) = -\sin\alpha\cos\alpha$

(v) Prove that $\dfrac{\cos 11° + \sin 11°}{\cos 11° - \sin 11°} = \tan 56°$

(vi) Find the values of $\cos 105°$

(vii) Find the period of $\sin\dfrac{x}{5}$

(viii) Find θ, if $\cos\theta = 0.9316$

(ix) Write any two laws of tangents.

(x) Find the value of R, if $a = 13$, $b = 14$, $c = 15$

(xi) Find the value of $\tan\left(\cos^{-1}\dfrac{\sqrt{3}}{2}\right)$

(xii) Define trigonometric equation. Give one example.

(xiii) Find the values of θ, satisfying the equation $2\sin^2\theta - \sin\theta = 0$; $\theta \in [0, 2\pi]$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Prove that $\begin{vmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{vmatrix} = 4abc$ 5

(b) Solve the equation $x^4 - 3x^3 + 4x^2 - 3x + 1 = 0$ 5

6. (a) Resolve into partial fractions $\dfrac{5x^2 - 2x + 3}{(x+2)^3}$ 5

(b) Find the value of n and r when ${}^{n-1}C_{r-1} : {}^{n}C_{r} : {}^{n+1}C_{r+1} = 3:6:11$ 5

7. (a) If $\dfrac{1}{a}, \dfrac{1}{b}, \dfrac{1}{c}$ are in G.P., show that the common ratio is $\pm\sqrt{\dfrac{a}{c}}$ 5

(b) Show that $\binom{n}{1} + \binom{n}{3} + \binom{n}{5} + \text{------} + \binom{n}{n-1} = 2^{n-1}$ 5

8. (a) Prove that $\dfrac{1}{\operatorname{cosec}\theta - \cot\theta} - \dfrac{1}{\sin\theta} = \dfrac{1}{\sin\theta} - \dfrac{1}{\operatorname{cosec}\theta + \cot\theta}$ 5

(b) Reduce $\sin^4\theta$ to an expression involving only function of multiples of θ, raised to first power. 5

9. (a) Solve the triangle using first law of tangents and then law of sines 5
$a = 36.21$, $b = 42.09$, $\gamma = 40°29'$

(b) Prove that $\sin^{-1}\dfrac{5}{13} + \sin^{-1}\dfrac{7}{25} = \cos^{-1}\dfrac{253}{325}$ 5

Roll No _____ Lahore Board-2023 _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2019 – 2021 to 2022 – 2024)**

Q.PAPER – I (Objective Type) 223-1st Annual-(INTER PART – I) GROUP – II

Time Allowed : 30 Minutes

Maximum Marks : 20

PAPER CODE = 6192

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	The multiplicative inverse of (1 , 0) is :			
	(A) 0	(B) 1	(C) (1 , 0)	(D) (0 , 1)
2	Which one of them is unary operation :			
	(A) Addition	(B) Multiplication	(C) Subtraction	(D) Negation
3	If A is a square matrix of order 3×3 then $\lvert KA \rvert$ = :			
	(A) $K\lvert A\rvert$	(B) $K^2\lvert A\rvert$	(C) $K^3\lvert A\rvert$	(D) $K^9\lvert A\rvert$
4	A square matrix $A=[a_{ij}]$ is called a skew-symmetric if :			
	(A) $A^t = A$	(B) $A^t = -A$	(C) $A^t = \pm A$	(D) $A^{-1} = A$
5	Roots of quadratic equation $x^2 - 7x + 10 = 0$ are :			
	(A) 2 , 5	(B) -2 , 5	(C) 2 , -5	(D) -2 , -5
6	Product of all three cube roots of unity is :			
	(A) i	(B) $-i$	(C) 1	(D) -1
7	Types of rational fractions are :			
	(A) 1	(B) 2	(C) 3	(D) 4
8	A.M. between $x-3$ and $x+5$ is :			
	(A) $x+1$	(B) $2x+1$	(C) $2x+2$	(D) 2
9	G.M. between 1 and 16 is :			
	(A) -5	(B) 4	(C) 6	(D) 8
10	P(E) represents the probability of an event " E " and $0 \le P(E) \le 1$ for P(E) = 0 the event will be :			
	(A) Certain	(B) One	(C) Possible	(D) Impossible
11	The probability that an event does not occur, $P(\overline{E})$ = :			
	(A) $1-P(E)$	(B) $1+P(E)$	(C) $2-P(E)$	(D) $2+P(E)$
12	The total number of terms in the expansion of $(a+x)^n$ is :			
	(A) n + 2	(B) n + 1	(C) n	(D) n – 1
13	The statement $n^2 > n+3$ hold for n = :			
	(A) 0	(B) 1	(C) 2	(D) 3

(Turn Over)

14	$\frac{2\pi}{3}$ radian in degree is : (A) $75°$ (B) $100°$ (C) $110°$ (D) $120°$
15	$1-2\sin^2\alpha =$: (A) $\sin 2\alpha$ (B) $\sin\frac{\alpha}{2}$ (C) $\cos 2\alpha$ (D) $\cos\alpha$
16	The period of tangent function is : (A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$ (C) $\frac{\pi}{3}$ (D) π
17	$\sqrt{s(s-a)(s-b)(s-c)} =$: (A) r (B) Δ (C) Δs (D) r_1
18	$\frac{\Delta}{s} =$: (A) r (B) r_1 (C) r_2 (D) r_3
19	$\cos^{-1}\left(\frac{1}{2}\right) =$: (A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{2}$
20	Solution of the equation $\sin x = \frac{1}{2}$ in $[0, 2\pi]$ is : (A) $\frac{\pi}{2}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{3}$

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2019 – 2021 to 2022 – 2024)

MATHEMATICS 223-1st Annual-(INTER PART – I) Time Allowed : 2.30 hours

PAPER – I (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Show that $\forall z \in C$, $(z-\bar{z})^2$ is a real number.

(ii) Simplify $(a+bi)^{-2}$

(iii) Write the power set of $\{+,-,\times,\div\}$

(iv) Write the converse, inverse of $\sim p \rightarrow q$

(v) Just, convert $(A \cup B)' = A' \cap B'$ and $(A \cap B)' = A' \cup B'$ into logical form.

(vi) If $A = \begin{bmatrix} 1 & 2 \\ a & b \end{bmatrix}$ and $A^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$, find the values of a and b

(vii) Solve the equations $2x_1 - 3x_2 = 5$, $5x_1 + x_2 = 4$

(viii) Define cofactor of an element of matrix.

(ix) Solve the equation $x^3 + x^2 + x + 1 = 0$

(x) If α , β are the roots of $x^2 - px - p - c = 0$, prove that $(1+\alpha)(1+\beta) = 1 - c$

(xi) Discuss the nature of roots $2x^2 - 5x + 1 = 0$

(xii) Give the statement of factor theorem.

3. Write short answers to any EIGHT (8) questions : **16**

(i) Without finding constants, write $\frac{9x-7}{(x^2+1)(x+3)}$ into partial fraction form.

(ii) If $a_{n-3} = 2n - 5$, find nth term of A.P.

(iii) Sum the series $3 + 5 - 7 + 9 + 11 - 13 + 15 + 17 - 19 + \text{---} + 3n$ terms.

(iv) If $\frac{1}{a}$, $\frac{1}{b}$ and $\frac{1}{c}$ are in G.P, then show that common ratio is $\pm\sqrt{\frac{a}{c}}$

(v) If 5 is the H.M. between 2 and b, find the value of b.

(vi) Write formula for $\sum_{k=1}^{n} k$ and $\sum_{k=1}^{n} k^3$

(vii) If ${}^{11}P_n = 11.10.9$, then find n

(viii) How many signals can be given by 5 flags of different colours using 3 flags at a time?

(ix) A die is thrown twice. What is the probability that sum of dots shown is either 3 or 11?

(x) Using binomial theorem, expand $\left(3a - \frac{x}{3a}\right)^4$

(xi) Find middle term in the expansion of $\left(\frac{x}{2} + \frac{2}{x^2}\right)^{12}$

(xii) Expand $(1-2x)^{1/3}$ upto first three terms.

(Turn Over)

4. Write short answers to any NINE (9) questions : 18

(i) Define angle in the standard position.

(ii) If $\tan\theta = -\frac{1}{3}$ and the terminal arm of angle is in second quadrant then find $\sec\theta$

(iii) Find $\sin\theta$ and $\cos\theta$ for $\theta = \frac{19\pi}{3}$

(iv) If α , β , γ are angles of triangle ABC then prove $\sin(\alpha+\beta) = \sin\gamma$

(v) Without calculator or table, find $\cos(75°)$

(vi) Prove that $\tan(45° + A)\tan(45° - A) = 1$

(vii) Define period of a trigonometric function.

(viii) Solve the right triangle ABC in which $r = 90°$, $a = 3.28$, $b = 5.74$

(ix) By using the law of cosine , write the formula of cosα and cosβ

(x) Solve the triangle ABC if $\beta = 60°$, $\gamma = 15°$ and $b = \sqrt{6}$

(xi) Define the principal sin function.

(xii) Solve the equation $\sin x = \frac{1}{2}$

(xiii) Solve the equation $\sin x + \cos x = 0$ and find its general solution set.

SECTION – II

Note : Attempt any THREE questions.

5. (a) If $A = \begin{bmatrix} i & 1+i \\ 1 & -i \end{bmatrix}$ show that $A - (\overline{A})^t$ is skew-hermitian. 5

(b) When $x^4 + 2x^3 + kx^2 + 3$ is divided by $x - 2$ and remainder is 1, find the value of k. 5

6. (a) Resolve into partial fraction $\frac{1}{(x-1)^2(x+1)}$ 5

(b) Prove that ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$ 5

7. (a) Find ' n ' so that $\frac{a^{n+1} + b^{n+1}}{a^n + b^n}$ may be H.M. between a and b 5

(b) Find $(2n+1)$th term from the end in expansion of $\left(x - \frac{1}{2x}\right)^{3n}$ 5

8. (a) If $\tan\theta = \frac{1}{\sqrt{7}}$ and the terminal arm of the angle is not in the III quad., find the value of $\frac{\operatorname{cosec}^2\theta - \sec^2\theta}{\operatorname{cosec}^2\theta + \sec^2\theta}$ 5

(b) Prove that $\cos 20° \cos 40° \cos 60° \cos 80° = \frac{1}{16}$ 5

9. (a) Solve the triangle ABC if $a = 7$, b = 3 , $\gamma = 38°13'$ 5

(b) Prove that $\tan^{-1}\frac{3}{4} + \tan^{-1}\frac{3}{5} - \tan^{-1}\frac{8}{19} = \frac{\pi}{4}$ 5

Roll No _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2017 – 2019 to 2020 – 2022)**

Q.PAPER – I (Objective Type) 221-(INTER PART – I) GROUP – I

Time Allowed : 30 Minutes

Maximum Marks : 20

PAPER CODE = 6197

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If $\begin{vmatrix} k & 4 \\ 4 & k \end{vmatrix} = 0$, then value of k is : (A) ± 16 (B) 0 (C) ± 4 (D) ± 8
2	Partial fraction of $\frac{1}{x^2-1}$ will be of the form : (A) $\frac{Ax+B}{x^2-1}$ (B) $\frac{A}{x+1}+\frac{B}{x-1}$ (C) $\frac{A}{x+1}$ (D) $\frac{B}{x-1}$
3	If H is H.M. between a and b then H = : (A) $\frac{2ab}{a+b}$ (B) $\frac{a+b}{2ab}$ (C) $\frac{a+b}{2}$ (D) $\pm\sqrt{ab}$
4	When $p(x)=x^3+4x^2-2x+5$ is divided by $(x-1)$ then remainder is : (A) 10 (B) -10 (C) 8 (D) -8
5	The trivial solution of the homogeneous linear equation in three variables is : (A) (0 , 0 , 0) (B) (1 , 0 , 0) (C) (0 , 1 , 0) (D) (0 , 0 , 1)
6	The property used in $(a+1)+\frac{3}{4}=a+(1+\frac{3}{4})$ is : (A) Closure (B) Associative (C) Commutative (D) Additive
7	The number of roots of polynomial equation $8x^6-19x^3-27=0$ are : (A) 2 (B) 4 (C) 6 (D) 8
8	If $a_{n-3}=2n-5$ then 7^{th} term is = : (A) 9 (B) 15 (C) 11 (D) 13
9	For an infinite geometric series of which $\lvert r \rvert < 1$ we have S_∞ = : (A) $\frac{a(1+r)}{1-r}$ (B) $\frac{a}{1+r}$ (C) $\frac{a}{2r}$ (D) $\frac{a}{1-r}$
10	The converse of $p \to q$ is : (A) $\sim p \to q$ (B) $p \to \sim q$ (C) $q \to p$ (D) $\sim p \to \sim q$
11	The middle term in expansion of $(a+x)^n$ when n is even : (A) $\left(\frac{n}{2}+1\right)$th term (B) $\left(\frac{n}{2}-1\right)$th term (C) $\left(\frac{n}{2}\right)$th term (D) $\left(\frac{n+1}{2}\right)$th term

1-12	If Δ is the area of a triangle ABC then $\Delta =$: (A) $\frac{1}{2}bc\sin\beta$ (B) $\frac{1}{2}ab\sin\alpha$ (C) $\frac{1}{2}bc\sin\alpha$ (D) $ab\sin\alpha$
13	$\frac{9\pi}{5}$ rad in degree measure is : (A) 321° (B) 322° (C) 323° (D) 324°
14	With usual notations, the value of $a+b+c$ is : (A) s (B) 2s (C) 3s (D) $\frac{s}{2}$
15	The factorial of a positive integer ' n ' is : (A) $n!=n(n-1)!(n-2)!$ (B) $n!=n(n+2)!$ (C) $n!=n(n-1)!$ (D) $n!=n(n-2)!$
16	The solution of $1+\cos x=0$ if $0\le x\le 2\pi$ is equal to : (A) $\{0\}$ (B) $\left\{\frac{\pi}{2}\right\}$ (C) $\left\{\frac{\pi}{3}\right\}$ (D) $\{\pi\}$
17	In anti-clockwise direction $\frac{1}{4}$ rotation is equal to : (A) 90° (B) 180° (C) 270° (D) 45°
18	The period of $3\cos(\frac{x}{5})$ is : (A) π (B) 10π (C) $\frac{\pi}{10}$ (D) $\frac{\pi}{5}$
19	$\sec\left[\cos^{-1}\left(\frac{1}{2}\right)\right] =$: (A) $\frac{1}{2}$ (B) 2 (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{6}$
20	$\cos 48^\circ+\cos 12^\circ =$: (A) $2\cos 18^\circ$ (B) $3\cos 18^\circ$ (C) $\sqrt{3}\cos 18^\circ$ (D) $\sqrt{2}\cos 18^\circ$

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2017 – 2019 to 2020 – 2022)

MATHEMATICS 221-(INTER PART – I) Time Allowed : 2.30 hours

PAPER – I (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Prove that $\frac{a}{b}=\frac{ka}{kb}$, $k\neq 0$

(ii) Simplify $(5,-4)\div(-3,-8)$ and write the answer as a complex number.

(iii) Find the real and imaginary parts of $(\sqrt{3}+i)^3$

(iv) If $B=\{1,2,3\}$, then find the power set of B, i.e., P(B)

(v) Construct the truth table for the statement : $\sim(p\rightarrow q)\leftrightarrow(p\wedge\sim q)$

(vi) For the set $A=\{1,2,3,4\}$, find a relation in A which satisfy $\{(x,y)\,|\,y+x=5\}$

(vii) Find the matrix X, if $2X-3A=B$ and $A=\begin{bmatrix}1&-1&2\\-2&4&5\end{bmatrix}$, $B=\begin{bmatrix}3&-1&0\\4&2&1\end{bmatrix}$

(viii) Find A^{-1} if $A=\begin{bmatrix}5&3\\1&1\end{bmatrix}$

(ix) Without expansion, show that $\begin{vmatrix}\alpha&\beta+\gamma&1\\\beta&\gamma+\alpha&1\\\gamma&\alpha+\beta&1\end{vmatrix}=0$

(x) Prove that sum of cube roots of unity is zero i.e., $1+\omega+\omega^2=0$

(xi) Find the numerical value of k, when the polynomial x^3+kx^2-7x+6 has a remainder of -4 when divided by $x+2$.

(xii) Show that the roots of equation $x^2+(mx+c)^2=a^2$ will be equal if $c^2=a^2(1+m^2)$

3. Write short answers to any EIGHT (8) questions : **16**

(i) Resolve $\frac{4x^2}{(x^2+1)^2(x-1)}$ into partial fractions without finding the constants.

(ii) Resolve $\frac{7x+25}{(x+3)(x+4)}$ into partial fractions without finding the constants.

(iii) Write the first four terms of the sequence, $a_n=(-1)^n n^2$

(iv) If $a_{n-3}=2n-5$, find nth term of the sequence.

(v) Insert two G.M's between 2 and 16.

(vi) Sum the infinite geometric series $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+-----$

(vii) Find the value of n, when ${}^{11}P_n=11.10.9$

(viii) Evaluate ${}^{12}C_3$

(ix) A die is rolled. What is the probability that the dots on the top are greater than 4?

(x) Check the truth of the statement $1+5+9+\text{------}+(4n-3)=n(2n-1)$ for $n=1,2$

(xi) Calculate by means of binomial theorem $(2.02)^4$

(xii) If x is so small that its square and higher powers can be neglected, then show that $\frac{\sqrt{1+2x}}{\sqrt{1-x}}\approx 1+\frac{3}{2}x$

(Turn Over)

4. Write short answers to any NINE (9) questions : 18

(i) Convert $54°45'$ into radians.

(ii) If $\cot\theta = \frac{15}{8}$ and the terminal arm of the angle is not in quadrant I, find the value of cosecθ.

(iii) Verify $2\sin 45° + \frac{1}{2}\cos ec45° = \frac{3}{\sqrt{2}}$

(iv) Prove that $\cot(\alpha+\beta) = \frac{\cot\alpha\cot\beta - 1}{\cot\alpha + \cot\beta}$

(v) Prove that $\tan(180°+\theta) = \tan\theta$

(vi) Express $2\sin 7\theta \sin 2\theta$ as sums or differences.

(vii) Find the period of $\tan\frac{x}{7}$

(viii) A vertical pole is 8 m high and the length of its shadow is 6m. What is the angle of elevation of the sun at that moment?

(ix) Find area of the triangle ABC if $a = 200$, $b = 120$, $\gamma = 150°$

(x) Prove that $r r_1 r_2 r_3 = \Delta^2$

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

(xii) Show that $r = (s-a)\tan(\frac{\alpha}{2})$

(xiii) Find the solution of $\cos ec\theta = 2$ which lies in the interval $[0, 2\pi]$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Solve by Cramer's rule
$$2x_1 - x_2 + x_3 = 8$$
$$x_1 + 2x_2 + 2x_3 = 6$$
$$x_1 - 2x_2 - x_3 = 1$$ 5

(b) If α, β are roots of equation $ax^2 + bx + c = 0$, form the equation whose roots are $\alpha + \frac{1}{\alpha}, \beta + \frac{1}{\beta}$ 5

6. (a) Resolve $\frac{3x-11}{(x^2+1)(x+3)}$ into partial fraction. 5

(b) If $S_n = n(2n-1)$, then find the series. 5

7. (a) Prove that ${}^{n-1}C_r + {}^{n-1}C_{r-1} = {}^{n}C_r$ 5

(b) Use mathematical induction to prove $\binom{3}{3} + \binom{4}{3} + \binom{5}{3} + \dots + \binom{n+2}{3} = \binom{n+3}{4}$ for every positive integers n. 5

8. (a) Two cities A and B lies on the equator, such that their longitudes are 45° E and 25° W respectively. Find the distance between the two cities, taking the radius of the earth as 6400 kms. 5

(b) Prove that $\frac{\sin\theta + \sin 3\theta + \sin 5\theta + \sin 7\theta}{\cos\theta + \cos 3\theta + \cos 5\theta + \cos 7\theta} = \tan 4\theta$ 5

9. (a) Solve the triangle ABC, if $a = 53$, $\beta = 88°36'$, $\gamma = 31°54'$ 5

(b) Prove that $\tan^{-1}\frac{1}{11} + \tan^{-1}\frac{5}{6} = \tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{2}$ 5

Roll No _____ Lahore Board-2021 _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2017 – 2019 to 2020 – 2022)**

Q.PAPER – I (Objective Type) 221-(INTER PART – I) GROUP – II

Time Allowed : 30 Minutes

Maximum Marks : 20

PAPER CODE = 6194

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	$\tan 2\theta$ = : (A) $\frac{2\tan\theta}{1+\tan^2\theta}$ (B) $\frac{\tan\theta}{1-\tan^2\theta}$ (C) $\frac{2\tan\theta}{1-\tan^2\theta}$ (D) $\frac{1-\tan^2\theta}{1+\tan^2\theta}$
2	A die is rolled then n(s) is : (A) 36 (B) 6 (C) 1 (D) 9
3	$\sin^{-1}A+\sin^{-1}B$ equals : (A) $\cos^{-1}(AB-\sqrt{(1-A^2)(1-B^2)})$ (B) $\cos^{-1}(AB+\sqrt{(1-A^2)(1-B^2)})$ (C) $\sin^{-1}(A\sqrt{1-B^2}+B\sqrt{1-A^2})$ (D) $\sin^{-1}(A\sqrt{1-B^2}-B\sqrt{1-A^2})$
4	With usual notation ℓ equals to : (A) r (B) θ (C) $r\theta$ (D) $2\pi r$
5	If $\cos 2x = 0$, then solution in I quadrant is : (A) 30° (B) 60° (C) 45° (D) 15°
6	The middle term in the expansion $(a+x)^n$, when n is even : (A) $\left(\frac{n}{2}+1\right)$th term (B) $\left(\frac{n}{2}-1\right)$th term (C) $\left(\frac{n}{2}\right)$th term (D) $\left(\frac{n+1}{2}\right)$th term
7	For a triangle ABC with usual notation $\sqrt{\frac{(s-a)(s-b)}{s(s-c)}}$ equals : (A) $\tan\gamma$ (B) $\tan\frac{\gamma}{2}$ (C) $\cot\gamma$ (D) $\cot\frac{\gamma}{2}$
8	The range of *sin x* is : (A) $[-1,0]$ (B) $[-1,1]$ (C) $[0,2]$ (D) $[-2,2]$
9	An angle is said to be in standard position if its vertex is : (A) (0,0) (B) (0,1) (C) (1,1) (D) (1,0)
10	The circum radius ' R ' is equal to : (A) $\frac{abc}{\Delta}$ (B) $\frac{4abc}{\Delta}$ (C) $\frac{\Delta}{s}$ (D) $\frac{abc}{4\Delta}$
11	If ω is the cube root of unity then $(1+\omega-\omega^2)^8$ = : (A) 256 (B) -256 (C) -256ω (D) 256ω

(Turn Over)

1-12	If $z = \cos\theta + i\sin\theta$ then $\lvert z \rvert$ is equal to : (A) 0 (B) 1 (C) 2 (D) -1
13	No term of geometric series is : (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) Zero (D) 1
14	The inverse of a square matrix exists if A is : (A) Symmetric (B) Non-singular (C) Singular (D) Rectangular
15	The arithmetic mean between $1-x+x^2$ and $1+x+x^2$ is : (A) $x+1$ (B) x^2+1 (C) $\frac{x+1}{2}$ (D) $\frac{x^2+1}{2}$
16	The roots of the equation $ax^2+bx+c=0$ are complex if : (A) $b^2-4ac<0$ (B) $b^2-4ac=0$ (C) $b^2-4ac>0$ (D) Both B and C
17	The geometric mean between $\frac{1}{a}$ and $\frac{1}{b}$ is : (A) $\pm\sqrt{\frac{1}{ab}}$ (B) $\pm\sqrt{ab}$ (C) $\frac{1}{ab}$ (D) ab
18	Number of ways in which a set can be described as : (A) 1 (B) 2 (C) 3 (D) 4
19	The given form $(x-4)^2 = x^2-8x+16$ is called : (A) Transidental equation (B) Cubic equation (C) An equation (D) An identity
20	A system of linear equations is said to be inconsistent if the system has : (A) Many solutions (B) Unique solution (C) No solution (D) Two solutions only

4. Write short answers to any NINE (9) questions :

(i) Convert $75°6'30''$ into radians.

(ii) Evaluate $\dfrac{1-\tan^2(\frac{\pi}{3})}{1+\tan^2(\frac{\pi}{3})}$

(iii) Prove that $\sec^2 A + \cos ec^2(A) = \sec^2(A)\cos ec^2(A)$ where $(A \neq \frac{n\pi}{2}, n \in z)$

(iv) Prove that $\tan(180° + \theta) = \tan\theta$

(v) Prove that $\cot(\alpha+\beta) = \dfrac{\cot\alpha\cot\beta - 1}{\cot\alpha + \cot\beta}$

(vi) Prove that $\dfrac{\sin 2\alpha}{1+\cos 2\alpha} = \tan\alpha$

(vii) Find the period of $\tan\dfrac{x}{7}$

(viii) In ΔABC if $\beta = 60°$, $\gamma = 15°$ and $b = \sqrt{6}$ then find 'c'.

(ix) In ΔABC if $a = 34$, $b = 20$ and $c = 42$, find angle ' r '.

(x) Show that $r = (s-a)\tan(\frac{\alpha}{2})$

(xi) Show that $\cos^{-1}(-x) = \pi - \cos^{-1}(x)$

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

(xiii) Find the solution of $\cos ec\theta = 2$ which lie in $[0, 2\pi]$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Solve the system of equations by Cramer's rule $\begin{aligned} 2x + 2y + z &= 3 \\ 3x - 2y - 2z &= 1 \\ 5x + y - 3z &= 2 \end{aligned}$ 5

(b) Solve the system of equations $2x - y = 4$; $2x^2 - 4xy - y^2 = 6$ 5

6. (a) Resolve $\dfrac{x-1}{(x-2)(x+1)^3}$ into partial fraction. 5

(b) Find four A.Ms between $\sqrt{2}$ and $\dfrac{12}{\sqrt{2}}$ 5

7. (a) Find the values of n and r when ${}^nC_r = 35$ and ${}^nP_r = 210$ 5

(b) Find the term involving x^4 in the expansion of $(3-2x)^7$ 5

8. (a) Prove that $\dfrac{1+\cos\theta}{1-\cos\theta} = (\cos ec\theta + \cot\theta)^2$ 5

(b) Prove that $\dfrac{\cos 3\theta}{\cos\theta} + \dfrac{\sin 3\theta}{\sin\theta} = 4\cos 2\theta$ 5

9. (a) Prove that $(r_1 + r_2)\tan(\frac{\gamma}{2}) = c$ 5

(b) Prove that $\sin^{-1}\dfrac{5}{13} + \sin^{-1}\dfrac{7}{25} = \cos^{-1}\dfrac{253}{325}$ 5

Roll No _____ (To be filled in by the candidate)

(Academic Sessions 2017 – 2019 to 2020 – 2022)

MATHEMATICS 221-(INTER PART – I) Time Allowed : 2.30 hours

PAPER – I (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(i) Separate into real and imaginary parts $\frac{2-7i}{4+5i}$

(ii) Prove that for $\forall z \in c \quad z.\bar{z} = |z|^2$

(iii) Find out real and imaginary parts of complex number $(\sqrt{3}+i)^3$

(iv) If G be a group and $a, b \in G$, then show that $(ab)^{-1} = b^{-1}a^{-1}$

(v) Give a table for addition of elements of the set of residue classes modulo 5.

(vi) Show that $(p \wedge q) \rightarrow p$ is a tautology.

(vii) Find x and y if $\begin{bmatrix} x+3 & 1 \\ -3 & 3y-4 \end{bmatrix} = \begin{bmatrix} y & 1 \\ -3 & 2x \end{bmatrix}$

(viii) Find the inverse of $\begin{bmatrix} -2 & 3 \\ -4 & 5 \end{bmatrix}$

(ix) Without expansion verify that $\begin{vmatrix} bc & ca & ab \\ \frac{1}{a} & \frac{1}{b} & \frac{1}{c} \\ a & b & c \end{vmatrix} = 0$

(x) Convert $x^{\frac{1}{2}} - x^{\frac{1}{4}} - 6 = 0$ into quadratic equation.

(xi) Evaluate $(-1+\sqrt{-3})^5 + (-1-\sqrt{-3})^5$

(xii) Discuss the nature of the roots of $2x^2 - 5x + 1 = 0$

3. Write short answers to any EIGHT (8) questions : 16

(i) Write $\frac{1}{(1-ax)(1-bx)(1-cx)}$ into partial fraction without finding the values of constants A, B and C.

(ii) Write $\frac{4x^2}{(x^2+1)^2(x-1)}$ into partial fraction without finding the values of unknown constants.

(iii) If $a_{n-3} = 2n-5$, find nth term of the sequence.

(iv) Find G.M. between $-2i$ and $8i$.

(v) If the numbers $\frac{1}{k}, \frac{1}{2k+1}, \frac{1}{4k-1}$ are in H.P. find the value of k.

(vi) Find A, G and H if $a = 2i$, $b = 4i$

(vii) Find the value of n when ${}^nP_2 = 30$

(viii) Find the number of the diagonals of a 6-sided figure.

(ix) A die is rolled. What is the probability that the dots on the top are greater than 4?

(x) Calculate $(9.98)^4$ by using binomial theorem.

(xi) Expand $(4-3x)^{1/2}$ upto 4 terms by using binomial theorem.

(xii) Evaluate ${}^{12}C_3$

(Turn Over)

Roll No _____ Lahore Board-2019 _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2015 – 2017 to 2018 – 2020)**

).PAPER – I (Objective Type) 219-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – I Maximum Marks : 20

PAPER CODE = 6195

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	If $x-a$ is a factor of polynomial $f(x)$, then $f(a)$ is :			
	(A) $=0$	(B) <0	(C) >0	(D) $\neq 0$
2	If ${}^nC_5={}^nC_4$, then n is :			
	(A) 9	(B) 7	(C) 6	(D) 5
3	The multiplicative inverse of $(1,-2)=$:			
	(A) $(\frac{1}{5},\frac{-2}{5})$	(B) $(\frac{-1}{5},\frac{-2}{5})$	(C) $(\frac{1}{5},\frac{2}{5})$	(D) $(\frac{-1}{5},\frac{2}{5})$
4	9th term in the sequence $\frac{1}{3},\frac{1}{5},\frac{1}{7},----$ is :			
	(A) $\frac{1}{13}$	(B) $\frac{1}{15}$	(C) $\frac{1}{17}$	(D) $\frac{1}{19}$
5	The contrapositive of $\sim p \rightarrow \sim q$ is :			
	(A) $p \rightarrow q$	(B) $q \rightarrow p$	(C) $\sim q \rightarrow \sim p$	(D) $\sim q \rightarrow p$
6	From the identity $5x+4=A(x-1)+B(x+2)$, then value of B = :			
	(A) -3	(B) 3	(C) -2	(D) 2
7	The sum of four 4^{th} roots of 16 is :			
	(A) 0	(B) 2	(C) 4	(D) 16
8	If $\begin{bmatrix} x-3 & 1 \\ -5 & -4 \end{bmatrix}=\begin{bmatrix} 2 & 1 \\ -5 & -4 \end{bmatrix}$, then $x=$:			
	(A) 5	(B) -5	(C) -1	(D) 1
9	The arithmetic mean between $\sqrt{2}$ and $3\sqrt{2}$ is :			
	(A) $3\sqrt{2}$	(B) $2\sqrt{2}$	(C) $4\sqrt{2}$	(D) $\sqrt{2}$
10	If $A=\begin{bmatrix} 1 & 2 & -2 \\ 0 & 0 & 5 \\ 6 & 7 & 3 \end{bmatrix}$, then $A_{33}=$:			
	(A) -1	(B) 1	(C) 3	(D) 0
11	Period of $\cot\theta$ is :			
	(A) π	(B) 2π	(C) $\frac{\pi}{2}$	(D) $\frac{3\pi}{2}$

1-12	Number of signals can be made with 4 flags when one flag is used at a time are : (A) ${}^4C_0$ (B) ${}^4C_1$ (C) ${}^4C_2$ (D) ${}^4C_3$
13	The equation $\sin^2 x - \sec x = \frac{3}{4}$ is called : (A) Trigonometric equation (B) Linear equation (C) Quadratic equation (D) Quantic equation
14	$3\sin\alpha - 4\sin^3\alpha$ = : (A) $\sin\alpha$ (B) $\sin 2\alpha$ (C) $\sin 3\alpha$ (D) $\sin 4\alpha$
15	Domain of the function $y = \sin^{-1} x$ is : (A) $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$ (B) $-1 \le y \le 1$ (C) $-1 \le x \le 1$ (D) $-\frac{\pi}{2} \le y \le \frac{\pi}{2}$
16	Francesco Mourolico devised the method of : (A) Partial fraction (B) Induction (C) Logarithms (D) Binomial
17	If $\ell = 35$ cm and $\theta = 1$ rad, then r = : (A) 35^c (B) 35 cm (C) 35 rad (D) 35 m
18	In any ΔABC with usual notations, $\frac{\Delta}{s-c}$ = : (A) r (B) r_1 (C) r_2 (D) r_3
19	The general term in the expansion of $(a+x)^n$ is : (A) $\binom{n}{a}a^{n-r}x^r$ (B) $\binom{n}{x}a^{n-r}x^r$ (C) $\binom{n}{r}a^{n-r}x^r$ (D) $\binom{n}{r}a^{n-r}x$
20	If sides of a ΔABC are $a = 4584$, b = 5140 and c = 3624, then greatest angle will be : (A) α (B) β (C) γ (D) a

Roll No _____ Lahore Board-2019 _____ (To be filled in by the candidate)

(Academic Sessions 2015 – 2017 to 2018 – 2020)

MATHEMATICS 219-(INTER PART – I) Time Allowed : 2.30 hours

PAPER – I (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(i) If z_1 and z_2 are complex numbers then show that $\overline{z_1 + z_2} = \overline{z_1} + \overline{z_2}$

(ii) Find out real and imaginary parts of $\left(\sqrt{3}+i\right)^3$

(iii) Factorize $a^2 + 4b^2$

(iv) Define power set of a set and give an example.

(v) Define a bijective function.

(vi) Construct truth table and show that the statement $\sim(p \rightarrow q) \rightarrow p$ is a tautology or not.

(vii) Find the matrix X if $X\begin{bmatrix} 5 & 2 \\ -2 & 1 \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 12 & 3 \end{bmatrix}$

(viii) For the matrix $A = \begin{bmatrix} 1 & -2 & 3 \\ -2 & 3 & 1 \\ 4 & -3 & 2 \end{bmatrix}$ find cofactor A_{12}

(ix) Without expansion show that $\begin{vmatrix} \alpha & \beta+\gamma & 1 \\ \beta & \gamma+\alpha & 1 \\ \gamma & \alpha+\beta & 1 \end{vmatrix} = 0$

(x) When $x^4 + 2x^3 + kx^2 + 3$ is divided by $(x-2)$, the remainder is 1. Find the value of k.

(xi) If α, β are the roots of $ax^2 + bx + c = 0$, $a \neq 0$ then find the value of $\alpha^2 + \beta^2$

(xii) The sum of a positive number and its square is 380. Find the number.

3. Write short answers to any EIGHT (8) questions : 16

(i) Define partial fraction.

(ii) In the identity $7x + 25 = A(x+4) + B(x+3)$, calculate values of A and B.

(iii) Resolve $\frac{1}{x^2-1}$ into partial fractions.

(iv) Write the first four terms of the sequence, if $a_n - a_{n-1} = n + 2$, $a_1 = 2$

(v) Which term of the arithmetic sequence 5, 2, – 1, ---- is – 85.

(vi) Find three A.Ms between 3 and 11.

(vii) If $\frac{1}{a}, \frac{1}{b}$ and $\frac{1}{c}$ are in G.P, show that common ratio is $\pm\sqrt{\frac{a}{c}}$

(viii) Insert two G.Ms between 2 and 16.

(ix) Find the value of n when ${}^nC_{10} = \frac{12 \times 11}{2!}$

(x) Show that $\frac{n^3 + 2n}{3}$ represents an integer for n = 2, 3.

(xi) Expand $\left(1 - \frac{3}{2}x\right)^{-2}$ upto 4 terms.

(xii) If x is so small that its square and higher power can be neglected, then show that $\frac{\sqrt{1+2x}}{\sqrt{1-x}} \approx 1 + \frac{3}{2}x$

(Turn Over)

4. Write short answers to any NINE (9) questions : 18

(i) Find ℓ, if $\theta = 65°20'$, r = 18 mm

(ii) Prove $\sin^2\frac{\pi}{6} : \sin^2\frac{\pi}{4} : \sin^2\frac{\pi}{3} : \sin^2\frac{\pi}{2} = 1:2:3:4$

(iii) Prove $\cos^2\theta - \sin^2\theta = \frac{1-\tan^2\theta}{1+\tan^2\theta}$

(iv) Prove that $\tan 56° = \frac{\cos 11° + \sin 11°}{\cos 11° - \sin 11°}$

(v) Prove $\frac{1-\cos\alpha}{\sin\alpha} = \tan\frac{\alpha}{2}$

(vi) Prove $\cos 20° + \cos 100° + \cos 140° = 0$

(vii) Find the period of $\tan\frac{x}{7}$

(viii) In ΔABC, $\beta = 60°$, $\gamma = 15°$, $b = \sqrt{6}$, find c.

(ix) If $a = 200$, b = 120 , $\gamma = 150°$, find the area of a triangle ABC

(x) Prove that $r_1 r_2 r_3 = rs^2$

(xi) Prove $\sin(2\cos^{-1}x) = 2x\sqrt{1-x^2}$

(xii) Solve $1 + \cos x = 0$

(xiii) Find the solutions of $\sin x = -\frac{\sqrt{3}}{2}$ in $[0, 2\pi]$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Prove that all 2×2 non-singular matrices over the real field form a non-abelian group under multiplication. 5

(b) Find three, consecutive numbers in G.P whose sum is 26 and their product is 216. 5

6. (a) Find the inverse of the matrix $A = \begin{bmatrix} 2 & 5 & -1 \\ 3 & 4 & 2 \\ 1 & 2 & -2 \end{bmatrix}$ by using row operation. 5

(b) Prove that ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$ 5

7. (a) Solve the system of equations :

$12x^2 - 25xy + 12y^2 = 0$

$4x^2 + 7y^2 = 148$ 5

(b) If $y = \frac{1}{3} + \frac{1.3}{2!}(\frac{1}{3})^2 + \frac{1.3.5}{3!}(\frac{1}{3})^3 + \text{-----}$ then prove that $y^2 + 2y - 2 = 0$ 5

8. (a) Prove that $\sqrt{\frac{1-\sin\theta}{1+\sin\theta}} = \sec\theta - \tan\theta$ where θ is not an odd multiple of $\frac{\pi}{2}$ 5

(b) If α, β, γ are the angles of a triangle ABC, then show that :

$\cot\frac{\alpha}{2} + \cot\frac{\beta}{2} + \cot\frac{\gamma}{2} = \cot\frac{\alpha}{2}\cot\frac{\beta}{2}\cot\frac{\gamma}{2}$ 5

9. (a) The sides of a triangle are $x^2 + x + 1$, $2x + 1$ and $x^2 - 1$. Prove that the greatest angle of the triangle is 120°. 5

(b) Prove that $\tan^{-1}\frac{3}{4} + \tan^{-1}\frac{3}{5} - \tan^{-1}\frac{8}{19} = \frac{\pi}{4}$ 5

oll No _____ (To be filled in by the candidate)

(Academic Sessions 2015 – 2017 to 2018 – 2020)

MATHEMATICS / PAPER – I (Essay Type)

219-(INTER PART – I)

GROUP – II

Time Allowed : 2.30 hours

Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(i) Prove the rule of addition $\frac{a}{c}+\frac{b}{c}=\frac{a+b}{c}$

(ii) Find the multiplicative inverse of $\left(\sqrt{2}, -\sqrt{5}\right)$

(iii) Express the complex number $1+i\sqrt{3}$ in polar form.

(iv) Write the power set of $\{a,\{b,c\}\}$

(v) Show that the statement $p \rightarrow (p \vee q)$ is tautology.

(vi) Prove that the identity element e in a group G is unique.

(vii) If $A=\begin{bmatrix}1 & -1\\ a & b\end{bmatrix}$ and $A^2=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$, find a and b

(viii) If $B=\begin{bmatrix}5 & -2 & 5\\ 3 & -1 & 4\\ -2 & 1 & -2\end{bmatrix}$. find cofactor B_{21}

(ix) If A is a skew-symmetric matrix, then show that A^2 is a symmetric matrix

(x) Solve $x^{-2}-10=3x^{-1}$.

(xi) If α, β are the roots of $x^2-px+q-c=0$ then prove that $(1+\alpha)(1+\beta)=1-c$

(xii) Discuss the nature of roots of the equation $x^2-5x+6=0$

3. Write short answers to any EIGHT (8) questions : 16

(i) Define proper fraction.

(ii) If $\frac{x^2-10x+13}{(x-1)(x^2-5x+6)}=\frac{A}{x-1}+\frac{B}{x-2}+\frac{C}{x-3}$, find value of A

(iii) If $\frac{x}{(x-a)(x-b)(x-c)}=\frac{A}{x-a}+\frac{B}{x-b}+\frac{C}{x-c}$, find value of B

(iv) If the numbers $\frac{1}{k}, \frac{1}{2k+1}$ and $\frac{1}{4k-1}$ are in harmonic sequence, find k

(v) Find sum of infinite geometric series 2 + 1 + 0.5 + ----

(vi) Define geometric mean.

(vii) If 5, 8 are two A.Ms between a and b , find a and b

(viii) If $\frac{1}{a}, \frac{1}{b}$ and $\frac{1}{c}$ are in A.P , show that $b=\frac{2ac}{a+c}$

(ix) Prove that ${}^nC_r = {}^nC_{n-r}$

(x) Expand $(1+x)^{\frac{-1}{3}}$ upto 3 terms.

(xi) Evaluate $\sqrt[3]{30}$ correct to three places of decimal.

(xii) Check whether the statement 5^n-2^n is divisible by 3 for n – 2 , 3 is true or false.

(Turn Over)

4. Write short answers to any NINE (9) questions : 18

(i) Find r , when $\ell = 56cm, \theta = 45°$

(ii) Find the values of all trigonometric functions for -15π

(iii) Prove that $\frac{1-\sin\theta}{\cos\theta} = \frac{\cos\theta}{1+\sin\theta}$

(iv) Express the difference $\cos 7\theta - \cos\theta$ as product.

(v) Prove $\frac{1-\cos\alpha}{\sin\alpha} = \tan\frac{\alpha}{2}$

(vi) Find the value of $\cos 105°$ without using calculator.

(vii) Find the period of $3\sin\frac{2x}{5}$

(viii) With usual notations prove that $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3}$

(ix) Define in-circle of the triangle ABC.

(x) State the law of tangent. (any two)

(xi) Show that $\cos(2\sin^{-1}x) = 1 - 2x^2$

(xii) Solve the equation for $\theta \in [0, \pi]$ $\cot^2\theta = \frac{4}{3}$

(xiii) Solve the equation for $\theta \in [0, \pi]$ $2\sin\theta + \cos^2 - 1 = 0$

SECTION – II

Note : Attempt any THREE questions.

5. (a) If G is a group under the operation " ※ " and $a, b \in G$, find the solutions of the equations : (i) $a ※ x = b$ (ii) $x ※ a = b$ 5

(b) If 7^{th} and 10^{th} terms of an H.P are $\frac{1}{3}$ and $\frac{5}{21}$ respectively, find its 14^{th} term 5

6. (a) Show that $\begin{vmatrix} a+\ell & a & a \\ a & a+\ell & a \\ a & a & a+\ell \end{vmatrix} = \ell^2(3a+1)$ 5

(b) Prove that ${}^{n-1}C_r + {}^{n-1}C_{r-1} = {}^nC_r$ 5

7. (a) If α, β are the roots of $5x^2 - x - 2 = 0$ form the equation whose roots are $\frac{3}{\alpha}$ and $\frac{3}{\beta}$ 5

(b) Use mathematical induction to prove that $n! > n^2$ for integral values of $n \geq 4$. 5

8. (a) A railway train is running on a circular track of radius 500 meters at the rate of 30 km per hour. Through what angle will it turn in 10 sec? 5

(b) Reduce $\sin^4\theta$ to an expression involving only function of multiples of θ raised to the first power. 5

9. (a) Prove that $r_1r_2 + r_2r_3 + r_3r_1 = s^2$ 5

(b) Prove that $\tan^{-1}A + \tan^{-1}B = \tan^{-1}\frac{A+B}{1-AB}$ 5

Roll No _____ Lahore Board-2019 _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2015 – 2017 to 2018 – 2020)**

Q.PAPER – I (Objective Type) 219-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – II Maximum Marks : 20

PAPER CODE = 6194

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	$\cos\left(\frac{3\pi}{2}-\theta\right)$ is equal to : (A) $-\sin\theta$ (B) $\sin\theta$ (C) $\cos\theta$ (D) $-\cos\theta$
2	Probability of impossible event is : (A) $\frac{1}{2}$ (B) 1 (C) 0 (D) 2
3	$2\tan^{-1}A$ equals : (A) $\tan^{-1}\left(\frac{A}{1-A^2}\right)$ (B) $\tan^{-1}\left(\frac{2A}{1-A^2}\right)$ (C) $\tan^{-1}\left(\frac{2A}{1+A^2}\right)$ (D) $\tan^{-1}\left(\frac{A}{1+A^2}\right)$
4	Which angle is quadrantal angle : (A) 45° (B) 60° (C) 270° (D) 120°
5	Solution of equation $\tan x=\frac{1}{\sqrt{2}}$ lies in the quadrants : (A) I and II (B) II and III (C) I and III (D) I and IV
6	Middle terms in the expansion of $(x+y)^{11}$ are : (A) T_6, T_7 (B) T_5, T_6 (C) T_7, T_8 (D) T_8, T_9
7	If Δ is the area of a triangle ABC, then with usual notation $\Delta =$: (A) $\frac{1}{2}bc\sin\beta$ (B) $\frac{1}{2}ab\sin\alpha$ (C) $\frac{1}{3}bc\sin\alpha$ (D) $\frac{1}{2}bc\sin\alpha$
8	Range of cotangent function is : (A) N (B) Z (C) R (D) C
9	Expansion of $(3-5x)^{\frac{1}{2}}$ is valid if : (A) $\lvert x\rvert<\frac{3}{5}$ (B) $\lvert x\rvert<\frac{5}{3}$ (C) $\lvert x\rvert<5$ (D) $\lvert x\rvert<3$
10	With usual notation R = : (A) $\frac{b}{2\sin\gamma}$ (B) $\frac{a}{2\sin\alpha}$ (C) $\frac{c}{2\sin\alpha}$ (D) $\frac{a}{2\sin\beta}$
11	The sum of the four fourth roots of 81 is : (A) 0 (B) 81 (C) –81 (D) 3

(Turn Over)

1-12	The property $\forall a,b \in \mathbb{R}$, $a=b \Rightarrow b=a$ is called : (A) Commutative (B) Transitive (C) Symmetric (D) Reflexive
13	The value of $4!.0!.1!$ is : (A) 0 (B) 1 (C) 4 (D) 24
14	A square matrix $A=[a_{ij}]$ in which $a_{ij}=0$ for all $i>j$ is called : (A) Upper triangular (B) Lower triangular (C) Symmetric (D) Skew-symmetric
15	$\sum_{k=1}^{n}(1)^k =$: (A) $\frac{n(n-1)}{2}$ (B) $\frac{n}{2}$ (C) n (D) $\frac{n(n+1)}{2}$
16	If $b^2-4ac>0$ but not a perfect square, then roots are : (A) Equal (B) Complex (C) Rational (D) Irrational
17	No term of geometric sequence can be : (A) 0 (B) 1 (C) 2 (D) 3
18	If A and B are two sets, then A – B = : (A) $A \cup B^c$ (B) $A \cap B^c$ (C) $(A \cup B)^c$ (D) $(A \cap B)^c$
19	Partial fractions of $\frac{1}{x^3-1}$ will be of the form : (A) $\frac{A}{x+1}+\frac{Bx+C}{x^2+x+1}$ (B) $\frac{A}{x-1}+\frac{Bx+C}{x^2+x+1}$ (C) $\frac{A}{x-1}+\frac{Bx+C}{x^2-x+1}$ (D) $\frac{A}{x+1}+\frac{Bx+C}{x^2-x+1}$
20	If $A=[a_{ij}]_{2\times 2}$, then $\lvert kA\rvert =$: (A) $\lvert A\rvert$ (B) $k^2\lvert A\rvert$ (C) $k\lvert A\rvert$ (D) $k\lvert A\rvert^2$

Roll No _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2014 – 2016 to 2017 – 2019)**

Q.PAPER – I (Objective Type) 218-(INTER PART – I) Time Allowed : 30 Minutes

GROUP – I Maximum Marks : 20

PAPER CODE = 6191

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	The set { 0 , 1 } is closed under :			
	(A) Addition	(B) Multiplication	(C) Division	(D) Subtraction
2	If A and B are two sets, then A – B = :			
	(A) $A \cup B^c$	(B) $(A \cup B)^c$	(C) $A \cap B^c$	(D) $(A \cap B)^c$
3	A square matrix A is skew symmetric if A^t = :			
	(A) –A	(B) A	(C) $\overline{A}$	(D) A^t
4	If order of a matrix A is m × n, then order of A^t is :			
	(A) m × n	(B) m × m	(C) n × m	(D) n × n
5	Sum of roots of quadratic equation $ax^2 + bx + c = 0$ is :			
	(A) $\frac{a}{b}$	(B) $\frac{b}{a}$	(C) $\frac{c}{a}$	(D) $-\frac{b}{a}$
6	Product of all fourth roots of unity is :			
	(A) – 1	(B) 0	(C) 1	(D) i
7	The fraction $\frac{3x^2+5}{x+1}$ is :			
	(A) Proper fraction	(B) Polynomial		
	(C) Partial fraction	(D) Improper fraction		
8	Geometric mean between – 2 and 8 is :			
	(A) 4	(B) ± 4	(C) 8	(D) ± 4i
9	The 10th term of $\frac{1}{2}, \frac{1}{5}, \frac{1}{8}, ----$ is :			
	(A) 30	(B) 28	(C) $\frac{1}{29}$	(D) $\frac{1}{32}$
10	The value of $\frac{4!}{0!}$ is :			
	(A) 24	(B) 4	(C) 0	(D) Infinity
11	If A and B are mutually exclusive events, then $P(A \cup B)$ = :			
	(A) P (A) ∪ P (B)	(B) P (A) + P (B)		
	(C) P (A ∩ B)	(D) P (A) – P (B)		

1-12	$4^n > 3^n + 4$ is true for integral values of n = : (A) 1 (B) $n \leq 1$ (C) 0 (D) $n \geq 2$
13	The 2^{nd} term in expansion of $\left(1-\frac{1}{3}x\right)^{-1}$ is : (A) $\frac{1}{3}x$ (B) $-\frac{1}{3}x$ (C) $3x$ (D) $2x$
14	If $\sin\theta < 0$ and $\cot\theta > 0$, then θ lies in quadrant : (A) 1 (B) 2 (C) 3 (D) 4
15	If α, β, γ are angles of triangle then $\tan(\alpha+\beta)+\tan\gamma$ = : (A) 1 (B) 0 (C) 2 (D) -1
16	Period of $\cos\left(\frac{x}{2}\right)$ = : (A) 2π (B) $\frac{\pi}{2}$ (C) 3π (D) 4π
17	Radius of escribed circle opposite to vertex 'c' of the triangle is : (A) $\frac{\Delta}{s}$ (B) $\frac{\Delta}{s-a}$ (C) $\frac{\Delta}{s-c}$ (D) $\frac{\Delta}{s-b}$
18	The value escribed circle r_1 = : (A) $\frac{\Delta}{s-a}$ (B) $\frac{\Delta}{s-c}$ (C) $\frac{\Delta}{s}$ (D) $\frac{\Delta}{a}$
19	The value of $\cos(\tan^{-1} 0)$ = : (A) -1 (B) 1 (C) 0 (D) ∞
20	If $\cos x = -\frac{1}{2}$, then reference angle is : (A) $\frac{\pi}{6}$ (B) $-\frac{\pi}{3}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

Roll No _____ Lahore Board-2018 _____ (To be filled in by the candidate)

(Academic Sessions 2014 – 2016 to 2017 – 2019)

MATHEMATICS 218-(INTER PART – I) Time Allowed : 2.30 hours

PAPER – I (Essay Type) GROUP – I Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(i) Simplify $(-1)^{-21}$

(ii) Express the complex number $(1+i\sqrt{3})$ in polar form.

(iii) Find the multiplicative inverse of $(-4, 7)$

(iv) Is there any set which has no proper subset? If so name that set.

(v) Write the converse and contrapositive of $\sim q \rightarrow \sim p$

(vi) For $A = \{1, 2, 3, 4\}$, find the relation in A for $R = \{(x, y) | x + y < 5\}$, also write the range of R.

(vii) If $A = \begin{bmatrix} 1 & 2 \\ a & b \end{bmatrix}, A^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$, find the values of a and b.

(viii) Find the multiplicative inverse of the matrix $\begin{bmatrix} 2i & i \\ i & -i \end{bmatrix}$

(ix) Show that $\begin{vmatrix} 1 & 1 & 1 \\ x & y & z \\ yz & zx & xy \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ x & y & z \\ x^2 & y^2 & z^2 \end{vmatrix}$

(x) Solve the equation $x^4 - 6x^2 + 8 = 0$

(xi) Show that $x^3 - y^3 = (x - y)(x - \omega y)(x - \omega^2 y)$, ω is complex cube root of unity.

(xii) If α, β are the roots of $3x^2 - 2x + 4 = 0$, then find the value of $\frac{1}{\alpha^3} + \frac{1}{\beta^3}$

3. Write short answers to any EIGHT (8) questions : 16

(i) Resolve $\frac{x^2+1}{(x+1)(x-1)}$ into partial fractions.

(ii) If $a_{n-2} = 3n - 11$, find the nth term of the sequence

(iii) If 5 , 8 are two A.Ms between a and b, find a and b

(iv) Which term of the A.P. 5, 2 , – 1, ------- is – 85 ?

(v) Insert two G.Ms between 1 and 8.

(vi) If 5 is the harmonic mean between 2 and b, find b

(vii) Define fundamental principle of counting.

(viii) Find the number of the diagonals of a 6-sided figure.

(ix) What is probability that a slip of numbers divisible by 4 are picked from the slips bearing number 1, 2, 3, ----- 10?

(x) State the principle of mathematical induction.

(xi) If x is so small that its square and higher powers can be neglected, then show that $\frac{1-x}{\sqrt{1+x}} = 1 - \frac{3}{2}x$

(xii) Find the 6th term in the expansion of $\left(x^2 - \frac{3}{2x}\right)^{10}$

4. Write short answers to any NINE (9) questions :

(i) An arc subtends an angle of 70° at the center of a circle and its length is 132 m. Find the radius of the circle.

(ii) Define coterminal angles.

(iii) Verify $\sin^2\frac{\pi}{6}+\sin^2\frac{\pi}{3}+\tan^2\frac{\pi}{4}=2$

(iv) If α,β,γ are angles of a triangle ΔABC, then prove that $\tan(\alpha+\beta)+\tan\gamma=0$

(v) Find the value of $\sin 105^\circ$, without calculator.

(vi) Prove that $\cot\alpha-\tan\alpha=2\cot 2\alpha$

(vii) Write the domain of $y=\sin x$

(viii) A vertical pole is 8m high and the length of its shadow is 6m. What is the angle of elevation of the sun at that moment?

(ix) Find α and β in the triangle ΔABC in which $a=7$, $b=7$, $c=9$

(x) Find the area of the triangle ΔABC in which $a=200$, $b=120$, $\gamma=150^\circ$

(xi) Evaluate without using calculator $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$

(xii) Solve the equation $2\sin x-1=0$

(xiii) Find the solution of the equation which lie in interval $[0,2\pi]$: $\sec x=-2$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Consider the set $S=\{1,-1,i,-i\}$. Set up its multiplication table and show that the set S is an abelian group under multiplication. 5

(b) If $A=\begin{bmatrix}1&0&2\\0&2&1\\1&-1&1\end{bmatrix}$ then find A^{-1} by using adjoint of the matrix. 5

6. (a) Solve the system of equations : $x+y=a+b$; *and* $\frac{a}{x}+\frac{b}{y}=2$ 5

(b) Resolve $\frac{9x-7}{(x^2+1)(x+3)}$ into partial fractions. 5

7. (a) Find four numbers in arithmetic sequence (A.P.) whose sum is 32 and the sum of whose squares is 276. 5

(b) Use binomial series to show that $1+\frac{1}{4}+\frac{1\times3}{4\times8}+\frac{1\times3\times5}{4\times8\times12}+---=\sqrt{2}$ 5

8. (a) If $\operatorname{cosec}\theta=\frac{m^2+1}{2m}$ and $m>0\left(0<\theta<\frac{\pi}{2}\right)$, find the values of the all remaining trigonometric ratios. 5

(b) Prove that $\sin\frac{\pi}{9}\sin\frac{2\pi}{9}\sin\frac{\pi}{3}\sin\frac{4\pi}{9}=\frac{3}{16}$ without using calculator. 5

9. (a) With usual notations, prove that $r_1=\frac{\Delta}{s}$ 5

(b) Prove that $\sin^{-1}\frac{3}{5}+\sin^{-1}\frac{8}{17}=\sin^{-1}\frac{77}{85}$ 5

Roll No _____ (To be filled in by the candidate)

MATHEMATICS **(Academic Sessions 2014 – 2016 to 2017 – 2019)**

Q.PAPER – I (Objective Type) 218-(INTER PART – I) GROUP – II

Time Allowed : 30 Minutes
Maximum Marks : 20

PAPER CODE = 6194

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	$2\sin\left(\frac{P+Q}{2}\right)\cos\left(\frac{P-Q}{2}\right)$ = - - - - - : (A) $\sin P+\sin Q$ (B) $\sin P-\sin Q$ (C) $\cos P+\cos Q$ (D) $\cos P-\cos Q$
2	With usual notation ${}^nC_0$ = : (A) 1 (B) 0 (C) n (D) 2
3	$\sin^{-1}A-\sin^{-1}$ = ---- : (A) $\sin^{-1}(A\sqrt{1-B^2}-B\sqrt{1-A^2})$ (B) $\sin^{-1}(A\sqrt{1-B^2}+B\sqrt{1-A^2})$ (C) $\cos^{-1}(A\sqrt{1-B^2}-B\sqrt{1-A^2})$ (D) $\cos^{-1}(A\sqrt{1-B^2}+B\sqrt{1-A^2})$
4	Values of trigonometric functions of the quadrantal angle 765° are same as of the angle : (A) 30° (B) 45° (C) 60° (D) 90°
5	Solution of $\cot\theta=\frac{1}{\sqrt{3}}$ in quadrant – (A) $\frac{5\pi}{4}$ (B) $\frac{7\pi}{6}$ (C) $\frac{6\pi}{3}$ (D) π
6	The sum of coefficients in the binomial expansion when n = 4 is : (A) 1 (B) 8 (C) 16 (D) 32
7	With usual notation the " circum-radius" R = ---- : (A) $\frac{\Delta}{s}$ (B) $\frac{abc}{4\Delta}$ (C) $\frac{\Delta}{abc}$ (D) $\frac{s}{\Delta}$
8	Period of $3\sin 2x$ is : (A) 6π (B) 2π (C) π (D) $\frac{\pi}{2}$
9	Which one is divisible by 2 for all positive integral values of n : (A) n^3-n (B) 5^n-1 (C) 5^n-2^n (D) n^2+n
10	In law of tangents $\frac{\tan\left(\frac{\beta-\gamma}{2}\right)}{\tan\left(\frac{\beta+\gamma}{2}\right)}$ = : (A) $\frac{a-b}{a+b}$ (B) $\frac{c-a}{c+a}$ (C) $\frac{c-b}{c+b}$ (D) $\frac{b-c}{b+c}$
11	If 'ω' be the cube root of unity, then ω^2 = : (A) $\frac{-1-\sqrt{3}i}{2}$ (B) $\frac{1-\sqrt{3}i}{2}$ (C) 1 (D) $\frac{1+\sqrt{3}i}{2}$

1-12	Multiplicative inverse of complex number $-3-5i$ is : (A) $\frac{3}{34}+\frac{5}{34}i$ (B) $\frac{-3}{34}-\frac{5}{34}i$ (C) $\frac{-3}{34}+\frac{5}{34}i$ (D) $\frac{-3}{\sqrt{34}}+\frac{5}{\sqrt{34}}i$
13	Simplify form of $\frac{10!}{7!}$ is equal to : (A) 720 (B) 620 (C) 520 (D) 420
14	If matrix $\begin{bmatrix} x & 4 \\ 2 & 8 \end{bmatrix}$ is singular then $x=$: (A) 0 (B) -1 (C) 2 (D) 1
15	Geometric mean between 4 and 16 are : (A) 10 (B) ± 8 (C) $\frac{32}{5}$ (D) 64
16	Roots of the equation $x^2-7x+10=0$ are : (A) $(2,-5)$ (B) $(-2,5)$ (C) $(2,5)$ (D) $(-2,-5)$
17	Formula for the sum of terms of A.P. (Arithmetic progression) : (A) $a_n=a_1+(n-1)$ (B) $s_n=\frac{n}{2}(a_1+a_n)$ (C) $s_n=\frac{a_1(1-r^n)}{1-r}$
18	Tabular form of $\{x \mid x \in E,\ 4<x$ (A) $\{\}$ (B) $\{4\}$ (C) $\{6\}$ (D) $\{4,6\}$
19	Partial fractions of $\frac{1}{(x^2+1)(x-1)}$ are of the form : (A) $\frac{A}{x^2+1}+\frac{B}{x-1}$ (B) $\frac{A}{x+1}+\frac{B}{(x^2+1)}+\frac{C}{x-1}$ (C) $\frac{A}{x^2+1}+\frac{Bx+C}{x-1}$ (D) $\frac{Ax+B}{x^2+1}+\frac{C}{x-1}$
20	A matrix A is said to be symmetric if : (A) $A^t=-A$ (B) $A^t=A$ (C) $(\bar{A})^t=A$ (D) $(\bar{A})^t=-A$

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PAPER – I (Essay Type) GROUP – II Maximum Marks : 80

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(i) Does the set $\{1, -1\}$ close w.r.t. : (a) addition (b) multiplication

(ii) Find multiplicative inverse of the complex number $(-4, 7)$

(iii) If $z = 1 - i\sqrt{3}$, then find $|z|$

(iv) Write inverse and contrapositive of $q \rightarrow p$

(v) If $A = \{a, b, c\}$, then write all subsets of A and find P (A)

(vi) Show that set of natural number is not a group w.r.t. addition.

(vii) Define diagonal matrix with an example.

(viii) If $A = \begin{bmatrix} 2 & 1 \\ 6 & 3 \end{bmatrix}$, then find A^{-1}

(ix) Without expansion show that $\begin{vmatrix} 6 & 7 & 8 \\ 3 & 4 & 5 \\ 2 & 3 & 4 \end{vmatrix} = 0$

(x) Find four 4^{th} roots of unity.

(xi) If α, β are roots of $x^2 - px - p - c = 0$, show that $(1-\alpha)(1+\beta$

(xii) Find quadratic equation whose roots are $2\omega, 2\omega^2$, where ω is cube roots of unity.

3. Write short answers to any EIGHT (8) questions : 16

(i) Resolve $\frac{x^2+1}{(x+1)(x-1)}$ into partial fractions.

(ii) Find the indicated term of the sequence 2, 6, 11, 17, ----- $a_7 = ?$

(iii) Sum the series upto n-terms $\frac{1}{1-\sqrt{x}} + \frac{1}{1-x} + \frac{1}{1+\sqrt{x}} - - - - - -$

(iv) Insert two G.Ms between 1 and 8.

(v) Find the sum of the infinite geometric series $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + - - -$

(vi) Find the 12^{th} term of the harmonic sequence $\frac{1}{3}, \frac{2}{9}, \frac{1}{6}, - - - - -$

(vii) Evaluate $\frac{15!}{15!(15-15)!}$

(viii) Find the value of n, when $\frac{12 \times 11}{2!} = {}^nC_{10}$

(ix) There are 5 green and 3 red balls in a box, one ball is taken out, find the probability that the ball drawn is green.

(x) Find the number of the diagonals of a 6-sided figure.

(xi) Find the term involving x^4 in the expansion of $(3-2x)^7$.

(xii) Using binomial theorem find the value of $(1.03)^{\frac{1}{3}}$ upto three decimal places.

4. Write short answers to any NINE (9) questions : 18

(i) Define angle in the standard position with figure.

(ii) Find x, if $\tan^2 45° - \cos^2 60° = x \sin 45° \cos 45° \tan 60°$

(iii) Prove that $\frac{1}{1+\sin\theta} - \frac{1}{1-\sin\theta} = 2\sec^2\theta$

4. (iv) Find the value of $\sin 540°$ without using calculator.

(v) Prove that $\tan\left(\frac{\pi}{4}-\theta\right)+\tan\left(\frac{3\pi}{4}+\theta\right)=0$

(vi) Express $\sin(x+45°)\sin(x-45°)$ as sum or difference.

(vii) Find the period of $\cos\frac{x}{6}$

(viii) Find the area of triangle ΔABC, in which $b = 37$, $c = 45$ and $\alpha = 30°50'$

(ix) Prove that $r r_1 r_2 r_3 = \Delta^2$ (Using usual notation)

(x) Prove that $(r_1 + r_2)\tan\frac{\gamma}{2} = c$ (Using usual notation)

(xi) Find domain and range of $y = \cos^{-1} x$

(xii) Solve the equation $\sin x = \frac{1}{2}$

(xiii) Find solutions of $\cot\theta = \frac{1}{\sqrt{3}}$ which lie in $[0, 2\pi]$

SECTION – II

Note : Attempt any THREE questions.

5. (a) Convert the following theorem to logical form and prove it by constructing truth table. 5

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

(b) Solve the following system by reducing their augmented matrices to the echelon form : 5

$x + 2y + z = 2$

$2x + y + 2z = -1$

$2x + 3y - z = 9$

6. (a) If α, β are the roots of the equation $ax^2 + bx + c = 0$ then find the equation whose roots are $\frac{-1}{\alpha^3}, \frac{1}{\beta^3}$ 5

(b) Resolve $\frac{2x^4}{(x-3)(x+2)^2}$ into partial fraction. 5

7. (a) For what value of n, $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$ is the positive geometric mean (G.M.) between a and b 5

(b) If x is so small that its square and higher powers can be neglected, then show that : 5

$$\frac{(1-x)^{\frac{1}{2}}(9-4x)^{\frac{1}{2}}}{(8+3x)^{\frac{1}{3}}} \approx \frac{3}{2} - \frac{61}{48}x.$$

8. (a) If $\operatorname{cosec}\theta = \frac{m^2+1}{2m}$ and $m > 0$, $\left(0 < \theta < \frac{\pi}{2}\right)$, find the values of the remaining trigonometric ratios. 5

(b) Prove without using calculator that $\cos 20° \cos 40° \cos 60° \cos 80° = \frac{1}{16}$ 5

9. (a) The sides of a triangle are $x^2 + x + 1$, $2x + 1$ and $x^2 - 1$. Prove that the greatest angle of the triangle is $120°$. 5

(b) Prove that $2\tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{7} = \frac{\pi}{4}$ 5