



Manipur

SAMPLE PAPER

Class 10



HIGHER MATHEMATICS

Full Marks: **80**

Pass Marks: **20**

Time: Three hours

Attempt all questions

The figures in the right hand margin indicate full marks for the questions

1. The identity element for the algebraic structure $(Q, *)$ where $x * y = \frac{xy}{3}, x, y \in Q$ is 1
(A) 3 (B) $\frac{1}{3}$ (C) -3 (D) $-\frac{1}{3}$
2. The n^{th} term of a G.P. with first term a and common ratio r is 1
(A) $a + (n-1)r$ (B) $a + nr$
(C) ar^{n-1} (D) ar^n
3. The middle term in the expansion of $(x+y)^8$ is 1
(A) T_4 (B) T_5 (C) T_6 (D) T_7
4. If A is a 2×2 matrix and B, a 2×3 matrix, then the order of the matrix AB is 1
(A) 2×2 (B) 3×3 (C) 2×3 (D) 3×2
5. Which of the following angles is coterminal with -60° ? 1
(A) -300° (B) 300° (C) -240° (D) 420°
6. If P(n) is the statement " $n^2 + 2$ is divisible by 3", is P(2) true? 1
7. What is the number of terms in the expansion of $(1-2x)^{15}$? 1

8. When are two matrices said to be equal? 1
9. Compute the product $\begin{bmatrix} 2 \\ -2 \\ 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \end{bmatrix}$. 1
10. If a matrix A has 7 elements, find all possible orders A may have. 1
11. When are two angles said to be allied to each other? 1
12. Find the value of $\tan \frac{4\pi}{3}$. 1
13. Define principal solutions of a trigonometric equation. 1
14. Prove that the identity element for an algebraic structure, if it exists, is unique. 2
15. Find the term independent of x in the expansion of $\left(x + \frac{1}{x^2}\right)^{12}$. 2
16. For any matrix A, show that $(A')' = A$. 2
17. Simplify: $\sin 405^\circ \cos 300^\circ - \cos 420^\circ \sin 225^\circ$. 2
18. If A, B, C denote the angles of a triangle, show that $\tan \frac{A+B}{2} = \cot \frac{C}{2}$. 2
19. Show that the binary operation $*$ on N defined by $a * b = b$ is associative but not commutative. 3
20. Find the sum of first n terms of a G.P. whose first term and common ratio are respectively a and r . 3
21. Insert three harmonic means between $2\frac{2}{5}$ and 12. 3
22. What are the basic steps of the method of mathematical induction in proving a mathematical proposition? 3

23. If $A = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$, show that $A^2 - 6A + 5I = 0$, where I is the unit matrix of order 2. 3

24. Solve for $\theta (0^\circ < \theta < 360^\circ)$: $\cos \theta + \sqrt{3} \sin \theta = 2$. 3

25. Form the composition table for the set $S = \{1, 2, 3, 4, 5, 6\}$ with respect to the binary operation of multiplication modulo 7. From the table, find the identity element and the inverse of each element of S . 4

26. Prove by using the principle of mathematical induction that $\forall n \in N$,
 $2 + 4 + 6 + \dots + 2n = n(n+1)$. 4

OR

$3^{2n} - 1$ is divisible by 4.

27. If $A = \begin{bmatrix} 1 & 1 \\ -1 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 4 \\ 1 & -1 \end{bmatrix}$, show that $A^2 - B^2 \neq (A+B)(A-B)$. 5

28. If S be the sum, P , the product and R , the sum of the reciprocals of n terms of a G.P., prove that $P^2 = \left(\frac{S}{R}\right)^n$. 5

Or

Sum the series $1.2.3 + 2.3.4 + 3.4.5 + \dots$ to n terms.

29. Prove that every square matrix can be expressed in one and only way, as a sum of a symmetric matrix and a skew-symmetric matrix. 5

30. Find the trigonometric ratios of $(90^\circ + \theta)$ in terms of those of θ . 5

31. 150 workers were engaged to finish a piece of work in a certain number of days. Four workers dropped the second day, four more workers dropped the third day and so on. It takes 8 more days to finish the work now. Find the number of days in which the work was completed. 6

Or

The digits in the one's place, ten's place and hundred's place of a positive integer having three digits are in A.P. and their sum is 15. The number obtained by reversing the digits is 594 less than the original number. Find the number.

32. Without using principle of mathematical induction, prove that $2^{3n} - 7n (n \in N)$ always leaves the remainder 1 when divided by 49. 6

