



MATHEMATICS HSSC-I

Time allowed: 2:35 Hours

Total Marks Sections B and C: 80

NOTE: Attempt any ten parts from Section 'B' and any five questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly. Graph paper will be provided on request.

SECTION - B (Marks 40)

Q. 2 Attempt any TEN parts. All parts carry equal marks.

(10 x 4 = 40)

- Express the complex number $1 + i\sqrt{3}$ in polar form.
- Show that $(A \cup B)' = A' \cap B'$ (Demorgan's Law). Where A and B are subsets of a universal set U .
- If a, b are elements of a group G under the operation of multiplication. Then show that $(ab)^{-1} = b^{-1}a^{-1}$
- If $A = [a_{ij}]_{3 \times 3}$, and $\lambda \in \mathbb{R}$, then show that $\lambda A - A = (\lambda - 1)A$
- Determine whether $p \rightarrow (q \rightarrow p)$ is a tautology, a contingency or an absurdity.
- Discuss the nature of roots of $2x^2 - 5x + 1 = 0$.
- If a number exceeds its square root by 56. Find the number.
- Find the 13th term of the sequence $x, 1, 2 - x, 3 - 2x, \dots$
- Find the sum of n terms of the series whose n^{th} term is $3n^2 + n + 1$.
- A box contains 10 red, 30 white and 20 black marbles. A marble is drawn at random. Find the probability that it is either red or white.
- If x is so small that its square and higher powers can be neglected, then show that $\frac{\sqrt{4+x}}{(1-x)^3} \cong 2 + \frac{25}{4}x$
- Prove that $\frac{\sin^2(\pi + \theta) \tan(\frac{3\pi}{2} + \theta)}{\cot^2(\frac{3\pi}{2} - \theta) \cos^2(\pi - \theta) \operatorname{cosec}(2\pi - \theta)} = \cos \theta$
- If a triangle ABC is with $a = \sqrt{3} - 1$, $b = \sqrt{3} + 1$ and $\gamma = 60^\circ$ then find c .
- Without using calculator or table, prove that $2 \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{7} = \frac{\pi}{4}$

SECTION - C (Marks 40)

Note: Attempt any FIVE questions. All questions carry equal marks.

(5 x 8 = 40)

Q. 3 Find the value of λ for which the system:

$$x + y + z = 0$$

$$2x + y - \lambda z = 0$$

$$x + 2y - 2z = 0$$

has a non-trivial solution. Also solve the system.

Q. 4 Show that roots of $x^2 + (mx + c)^2 = a^2$ will be equal if $c^2 = a^2(1 + m^2)$

Q. 5 Sum the following series to n terms: $\frac{1^2}{1} + \frac{1^2 + 2^2}{2} + \frac{1^2 + 2^2 + 3^2}{3} + \dots$ to n terms.

Q. 6 By the principle of mathematical induction, show that $x + y$ is a factor of $x^{2n-1} + y^{2n-1}$ ($x \neq -y$), for all positive integer n .

Q. 7 Without using calculator / table, prove that $\sin 10^\circ \sin 30^\circ \sin 50^\circ \sin 70^\circ = \frac{1}{16}$

Q. 8 In a triangle ABC , with usual notations, prove that:

$$\text{Area of Triangle } \Delta = \sqrt{s(s-a)(s-b)(s-c)} \text{ (The Hero's Formula)}$$

Q. 9 Solve the trigonometric equation $\cos \theta + \cos 3\theta + \cos 5\theta + \cos 7\theta = 0$ for its general solution.