2026

MATHEMATICS

Full Marks : 100

Pass Marks : 33

Time : Three hours

Attempt all Questions.

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

For Question Nos. 1 – 10, write the letter associated with the correct answer. Question Nos. 11 and 12 are Assertion and Reason bassed questions of 1 mark each.

1. If A and B are two sets, then A – B is equal to 1

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

   (C) $B - A$ (D) $A \cap B'$

2. The length of the arc of a circle of radius 5 cm subtending a central angle of 15° *is* 1

   (A) 1.2 cm (B) 1.3 cm

   (C) 1.4 cm (D) 1.5 cm

3. Radian measure of 25° is 1

   (A) $\left(\frac{3\pi}{36}\right)^c$ (B) $\left(\frac{5\pi}{36}\right)^c$

   (C) $\left(\frac{8\pi}{35}\right)^c$ (D) $\left(\frac{7\pi}{35}\right)^c$

4. The value of $\sin 15^\circ$ is 1

(A) $\frac{\sqrt{3}}{2\sqrt{2}+1}$ (B) $\frac{\sqrt{3}}{2\sqrt{2}-1}$

(C) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ (D) $\frac{\sqrt{3}+1}{2\sqrt{2}}$

5. Multiplicative inverse of complex number $\sqrt{5}+3i$ is 1

(A) $\frac{\sqrt{5}}{14}-\frac{3}{14}i$ (B) $\frac{\sqrt{5}}{14}+\frac{3}{14}i$

(C) $\frac{3}{14}-\frac{\sqrt{5}}{14}i$ (D) $\frac{3}{14}+\frac{\sqrt{5}}{14}i$

6. If $\frac{1}{5!}+\frac{1}{6!}=\frac{x}{7!}$, then x equals to 1

(A) 25 (B) 36

(C) 49 (D) 64

7. The number of permutation of the letters of the world MANIPUR is 1

(A) 5040 (B) 4050

(C) 4540 (D) 5450

8. A person has two parents, four grandparents, eight great grandparents and so on. Then the number of his ancestors during the ten generations preceeding to his own is 1

(A) 1084 (B) 1024

(C) 2250 (D) 2046

9. $\lim_{x \to 0} \frac{\sin x}{x(1+\cos x)}$ is equal to 1

(A) 0 (B) 1

(C) $-\frac{1}{2}$ (D) $\frac{1}{2}$

10. If E and F are two events associated with a random experiment such that $P(E)=\frac{1}{4}, P(F)=\frac{1}{2}, P(E \text{ and } F)=\frac{1}{8}$, then $P(\overline{E} \text{ and } \overline{F})$ is 1

(A) $\frac{5}{8}$ (B) $\frac{4}{8}$

(C) $\frac{3}{8}$ (D) $\frac{2}{8}$

Question numbers 11 and 12 are assertion and reason based questions. Two statements are given, one lebelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (A), (B), (C), and (D) are given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A)

(B) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A)

(C) Assertion (A) is true but Reason (R) is false

(D) Assertion (A) is false, but Reason (R) is true

11. Assertion (A) : The number of ways of arranging the letters of the word APPLE is $\frac{5!}{2!}$. 1

Reason (R) : The number of permutations of n different objects taken r at a time, where repetition is allowed, is n^r.

12. Assertion (A) : The middle term in the expansion of $(a+b)^6$ is the 3rd term. 1

Reason (R) : The number of terms in the expansion of $(a+b)^n$ is $(n+1)$.

13. If A is the set of real numbers and B is the set of rational numbers, then what is A – B? 1

14. Write the value of $\cos\frac{5\pi}{3}$. 1

15. Evaluate : $\sin 50^\circ \cos 10^\circ + \cos 50^\circ \sin 10^\circ$. 1

16. Express i^{-35} in the form of $a + ib$. 1

17. In the binomial expansion of $(x+y)^n$, the co-efficient of the 4th and 13th terms are equal, what is the value of n? 1

18. Write the number of terms in the given siquence 3, 7, 11 .... 51. 1

19. If $x+9, x-6, 4$ are in G.P, then what are the values of x? 1

20. One card is drawn from a well shuffled deck of 52 cards. If each outcomes is equally likely, then what is the probability that the card will not be a diamond. 1

21. Prove that $\cos\left(\frac{\pi}{4}+x\right)+\cos\left(\frac{\pi}{4}-x\right)=\sqrt{2}\cos x$ 2

22. Prove that $\left(\frac{3+2i}{2-3i}\right)+\left(\frac{3-2i}{2+3i}\right)$ is purely real. 2

23. Find the modulus of $\frac{1+i}{1-i}-\frac{1-i}{1+i}$ 2

24. Write an equation of a line perpendicular to the line $3x-2y+5=0$ and passing through the point (1, –3). 2

25. (a) Find the radius and centre of the given circle
$x^2 + y^2 - 4x + 10y - 21 = 0$ 2

OR

(b) Find the co-ordinate of foci and eccentricity of the hyperbola $\frac{x^2}{9} - \frac{y^2}{16} = 1$

26. Evaluate : $\lim_{x \to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{\sin x}$ 2

27. (a) Prove that $\tan x \tan 2x \tan 3x = \tan 3x - \tan 2x - \tan x$ 3

OR

(b) Prove that $(\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 4\cos^2\left(\frac{x+y}{2}\right)$

28. If $U = \{1,2,3,4,.....,10\}, A = \{1,2,3,5\}, B = \{2,4,6,7\}$ and $C = \{2,3,4,8\}$, then find
(i) $(C - A)'$ (ii) $(A \cap B \cap C)'$ (iii) $(A \cup B)'$ 3

29. (a) If Z_1, Z_2 are two complex numbers, then show that

(i) $\overline{Z_1 Z_2} = \overline{Z}_1 \overline{Z}_2$

(ii) $\overline{Z_1 + Z_2} = \overline{Z}_1 + \overline{Z}_2$ 3

OR

(b) If $x + iy = \frac{a+ib}{a-ib}$, prove that $x^2 + y^2 = 1$

30. Find the derivative of the function $f(x) = \frac{1}{x}$ from first principle. 3

31. Let $A=\{x \in W : x<3\}, B=\{x \in N : 2 \leq x \leq 5\}$ and $C=\{3,5\}$ verify that $A \times (B \cup C)=(A \times B) \cup (A \cup B)$ 4

32. Draw the graph of the function defined by

$$f(x)=\begin{cases} 2-x & , \quad x<0 \\ 2 & , \quad x=0 \\ x+2 & , \quad x>0 \end{cases}$$ 4

33. A manafactures has 600 litres of a 12% solution of acid. How many litres of a 30% acid solution must be added to it so that acid content in the resulting mixture will be more than 15% but less than 18% ? 4

34. (a) Using Binomial Theorem, prove that $6^n - 5n - 1$ is always divisible by 25, where n is any natural number. 4

OR

(b) Find the value of $\left(x^2+\sqrt{x^2-1}\right)^4+\left(x^2-\sqrt{x^2-1}\right)^4$

CASE-STUDY BASED QUESTION

35. (a) In a relay race, there are five teams A,B,C,D and E.

(i) What is the probability that A,B and C finish first, second and third respectively?

(ii) What is the probability that A, B and C are first three to finish (in any order)? Assume that the finishing orders are equal likely. 4

OR

(b) Two students Chaoba and Tomba appeared in an examination. The probability that Chaoba will qualify the examination is 0.06 and that

Tomba will qualify the examination is 0.10. The probability that both will qualify the examination is 0.03. Find the probability that –

(i) Both Chaoba and Tomba will not qualify the examination.

(ii) Only one of them will qualify the examination.

36. (a) If $\sin\theta+\sin\phi=a$ *and* $\cos\theta+\cos\phi=b$

then find (i) $\sin(\theta+\phi)$ (ii) $\cos(\theta+\phi)$ 6

OR

(b) If $\sin x=\frac{-4}{5}, \pi<x<\frac{3\pi}{2}$, then find $\sin\frac{x}{2}, \cos\frac{x}{2}, \tan\frac{x}{2}$

37. A question paper contains 12 questions, divided into three parts. Part A contains 6 questions, while part B and part C contains 3 questions each. A candidate is required to attempt 6 questions selecting atleast two from part A and atleast one from each of part B and C. In how many ways can the candidate select 6 questions? 6

38. 150 workers were engaged to finish a job in a certain number of days. 4 workers dropped out on second days, 4 more workers dropped out on the third days and so on. It took 8 more days to finish the work. Find the number of days in which the work was completed. 6

39. (a) Find the equation of the line through the point (0,4) making an angle $\frac{2\pi}{3}$ with the positive direction of X - axis. Also, find the equation of the line parallel to it and crossing the Y - axis at a distance of 4 unit below the origin. 6

OR

(b) A person standing at the junction (crossing) of two straight path represented by the equations $2x-3y+4=0$ and $3x+4y-5=0$ wants to reach the path whose equation is $6x-7y+8=0$ in the least time. Find the equation of the path that he should follow.

40. (a) Derive the standard equation of an ellipse whose centre is at the origin and major axis in along the X - axis. 6

OR

(b) Define a parabola. Derive the standard equation of parabola whose vertex is at the origin and axis along X - axis.

41. Find the mean and standard deviation for the following data by using shortcut method. 6

Class :	25-30	30-35	35-40	40-45	45-50	50-55
Frequency :	30	23	29	14	10	3