Harshita Gupta
XI-C

Ambience Public School
Mid Term Exam: 2024-25
Subject: Mathematics
Class: XI
(20.09.2024)

Time: 3 hrs. MM: 80
Total no. of questions: 38
Total No. of printed pages: 5

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment of 4 marks each with sub-parts.

Section – A (Multiple Choice questions). Each question carries 1 mark

Q1. The roster form of the set {x: x is a positive integer < 10 and $2^x - 1$ is an odd number}
(A) {0,1,2,3,4,5,6,7,8,9} (B) {1, 3, 5, 7,9} (C) {1,2,3,4,5,6,7,8,9} (D) None of these

Q2. The set builder form of the set $\left\{\frac{3}{5}, \frac{5}{7}, \frac{7}{9}, \ldots\right\}$ is

(A) {x: x = p/q, where p and q are odd natural numbers >1}
(B) {x: x is a non-zero Rational number}
(C) {x: x=p/q, p, q are odd natural numbers, q – p = 2}
(D) {x: $x=\frac{2n+1}{2n+3}$, n ∈ N}

Q3. Which of the following is false
(A) If A⊂B, then A∩B=A (B) A – (A ∩ B) ≠ A – B (C) (A ∩ B) ⊂ A (D) A ⊂ (A ∪ B)

Q4. Solution of the linear inequality $5 \leq \frac{3x-2}{-4} < 8$ is given by the interval
(A) [6, 10) (B) (-10, -6] (C) [-6, 10) (D) [-10, -6)

Q5. If ${}^nC_9 = {}^nC_8$, The value of ${}^{18}C_n$ is
(A) 1 (B) 17 (C) 18 (D) 9

Q6. Number of 3 digit odd numbers which can be formed using the digits 0, 1, 2, 3, 4, 5 is
(A) 90 (B) 48 (C) 108 (D) None of these

Q7. Standard form of $i^6 + i^9$ is
(A) 1 - i (B) 1+i (C) -1+i (D) -1-i

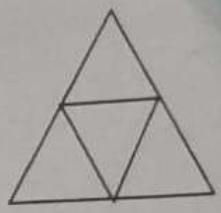
Q8. Roots of the quadratic equation $x^2 + 8 = 0$ are
(A) $\pm 2i$ (B) $\pm\sqrt{2}i$ (C) $\pm 2\sqrt{2}i$ (D) $\pm 2\sqrt{2}$

Q9. If $z=\frac{1-2i}{3-i}$ then $|z|^8$ is equal to
(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\frac{1}{16}$ (D) None of these

Q10. Number of chords can be drawn through 10 given points on a circle is
(A) 80 (B) 90 (C) 35 (D) 45

Q11. Number of subsets of the set A= {{}, 0} are
(A) 0 (B) 1 (C) 2 (D) 4

Q12. You have four colors red, green, Yellow and blue. The number of ways in which colors can be filled in the triangles shown in the figure, so that triangles with a common side must be filled with the different colors is:



(A) 12 (B) 24 (D) 36 (D) 108

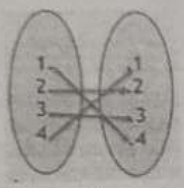
Q13. If $(3-4i)(\overline{x+iy}) = 2 - i$, then

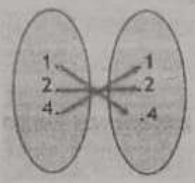
(A) $x=-\frac{2}{5}, y=\frac{1}{5}$ (B) $x=\frac{2}{5}, y=-\frac{1}{5}$ (C) $x=-\frac{2}{5}, y=-\frac{1}{5}$ (D) $x=\frac{2}{5}, y=\frac{1}{5}$

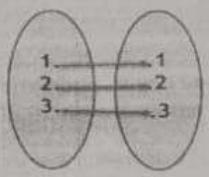
Q14. Two finite sets have m and n number of elements respectively. Total number of subsets of first set is 56 more than the number of subsets of second. Values of m and n respectively are:

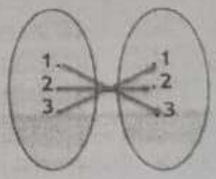
(A) 3, 6 (B) 3, 5 (C) 6, 3 (D) 5, 3

Q15 Arrow diagram of the relation $R = \{(X, y): x, y \in N, x + y = 4\}$

(A) 

(B) 

(C) 

(D) 

Q16. If $\tan\theta = \frac{1}{2}$ and $\tan\phi = \frac{1}{3}$, then the value of $\tan(\theta + \phi)$ is

(A) -1 (B) 1 (C) 2 (D) 0

Q17. The value of tan (75°) is

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

Q18. If $\cos x = \frac{a}{b}$, then the value of cos2x is

(A) $\frac{b^2-2a^2}{b^2}$ (B) $\frac{2a^2-b^2}{b^2}$ (C) $\frac{2a^2-b^2}{a^2}$ (D) $\frac{b^2-2a^2}{a^2}$

ASSERTION-REASON BASED QUESTIONS:

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

Q19. Assertion (A): If $\sin x = -\frac{\sqrt{3}}{2}$, where $0° < x < 360°$, then $x = 210°$ or $330°$

Reason (R): sinx is negative in 3rd and 4th quadrant.

Q20. Assertion (A): Number of functions from set A = {1, 3} to set the B = {-1, 0, 1} is 9

Reason(R): Number of functions from set A to set the B is $n(B)^{n(A)}$

Section – B (Very Short Answer type questions). Each question carries 2 marks

Q21. Write the domain and range of the following functions

(i) Greatest integer function: f(x) = [x]

(ii) Signum function: $f(x) = \begin{cases} 1, & if\ x > 0 \\ 0, & if\ x = 0 \\ -1, & if\ x < 0 \end{cases}$

Q22. Draw the Venn-diagrams for $(A' \cup B) \cap (C)$

Q23. If $P = 3.\sin 10^\circ - 4\sin^3 10^\circ$, find the value of $(2P^2 - 1)$

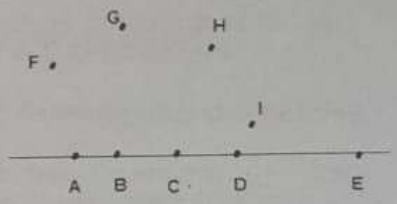
OR

Prove that $3\left(\sin\frac{5\pi}{6}\right)\left(\sec\frac{\pi}{3}\right) - 4\left(\sin\frac{\pi}{6}\right)\left(\tan\frac{\pi}{4}\right) = 1$

Q24. If A = {2, 3, 4, 5, 6, 7, 8, 9} and R is a relation on the set A defined as
R= {(x, y): x, y ∈ A, x ≠ y and x divides y}

(i) Write the roster form of R
(ii) What is the domain and Range of R?

Q25. (a) Given 5 collinear points (A, B, C, D, E) and 4 non-collinear points (F, G, H, I). How many triangles can be drawn by joining any three points from given 9 points



OR

(b) How many words with or without meaning can be formed using the all the letters of the word EQUATION if all the vowels never come together.

Section – C (Short Answer type questions). Each question carries 3 marks

Q26. (a) Longest side of a triangle is 3 times the shortest side and the third side is 2cm shorter than the longest side. If the perimeter of the triangle is at least 33cm. Also 3 times the third side is at most twice the sum of other two sides.
Represent the above situation as a system of linear inequalities. Solve the system of linear inequalities and find the range for the length of the shortest side.

OR

(b) How many litres of a 30% acid solution to be added to 600 litres of 12% acid solution, so that the acid content in the resulting mixture will be between 15% and 18%.

Q27. Solve the system of inequalities $5(2x-7) - 3(2x+3) \leq 0$, $2x+19 \leq 6x+47$, $\frac{x-5}{-3} < 0$

Write the common solution in the interval form and represent it on the number line.

Q28. Find the domain of the following functions:

(a) $f(x) = \sqrt{9-x^2}$ (b) $g(x) = 1 - \frac{2}{x^2}$ (c) $h(x) = \frac{3x+1}{x^2+4x+3}$

Q29. (a) Two cards are drawn at random from a pack of 52 playing cards. In how many ways we can get:

(i) both red cards
(ii) one black and one red card
(iii) both the cards of same suit.

OR

(b) If five coins are tossed together, find in how many ways we get

(i) 3 heads and 2 tails
(ii) exactly 2 heads
(iii) at least 4 heads

Q30. (a) If $(x-iy)^3 = a-ib$, then prove that $\frac{a}{x}-\frac{b}{y} = -2(x^2+y^2)$

OR

(b) Find the value of θ if $0° \le \theta \le 180°$ and for which $\frac{3+2i\sin\theta}{1-2i\sin\theta}$ is

(i) Purely real (ii) Purely imaginary

Q31. (a) Show that for any sets A and B

(i) $(A \cap B)' \cap (A' \cup B) = A'$

(ii) $A \cap (B \cup A') = A \cap B$

OR

(b) Let A and B be sets. If $A \cap X = B \cap X = \phi$ and $A \cup X = B \cup X$ for some set X, then show that A = B.

Section – D (Long Answer type questions). Each question carries 5 marks

Q32. (i) Find the number of words can be formed using all the letters of the word AGAIN? 1

(ii) Find, how many of them are starting with the letter A. 1

(iii) Find, How many words starting with the letter G? 1

(iv) If all the words arranged as in the dictionary, find the 49th word. 2

Q33. (a) Find the value of $\sin\frac{x}{2}$, $\cos\frac{x}{2}$ and $\cot\frac{x}{2}$, if $\cos x = \frac{1}{3}$ where $\frac{3\pi}{2} < x < 2\pi$

OR

(a) Prove that Sin 10° Sin 50° Sin 60° Sin 70° $= \frac{\sqrt{3}}{16}$

Q34. (a) Prove that $\cos 2x\left(\cos\frac{x}{2}\right) - \cos 3x\left(\cos\frac{9x}{2}\right) = \sin 5x\left(\sin\frac{5x}{2}\right)$

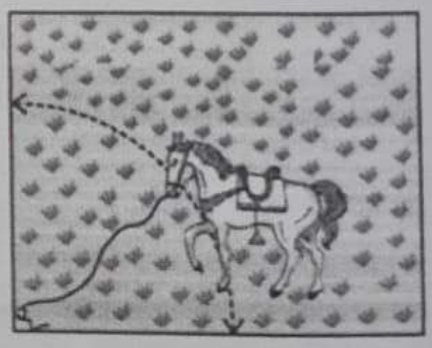
OR

(b) Prove that $\cos^2 A + \cos^2\left(A+\frac{2\pi}{3}\right) + \cos^2\left(A-\frac{2\pi}{3}\right) = \frac{3}{2}$

Q35. If α and β are different complex numbers with $|\alpha| = 1$, then using the properties of complex numbers find the value of $\left|\frac{\bar{\alpha}-\bar{\beta}}{1-\beta\bar{\alpha}}\right|$.

Section – E (Case based questions). Each question carries 4 marks

Q36. A horse is tied to a post by a rope. The horse moves along a circular path, always keeping the rope tight. (Take $\pi = \frac{22}{7}$



Based on the above information, answer the following questions:

(i) When the horse traces a 42° angle at the centre of the circular path and describes a distance of 88m. find the length of the rope.

(ii) If the angle traced by horse at the centre of the circular path is $\frac{\pi}{5}$ radians and the length of the rope is found to be 35m, then find the length of the arc traced.

237. Dheeraj appears in an examination. While reading the instructions, he observed that the question paper consists of 12 questions divided into two parts: part-I & part-II, containing 4 and 8 questions respectively. Dheeraj has to attempt exactly 7 questions in all.

Based on the above information answer the following questions:

(i) In how many ways he can attempt all the 7 questions from Part-II? 1

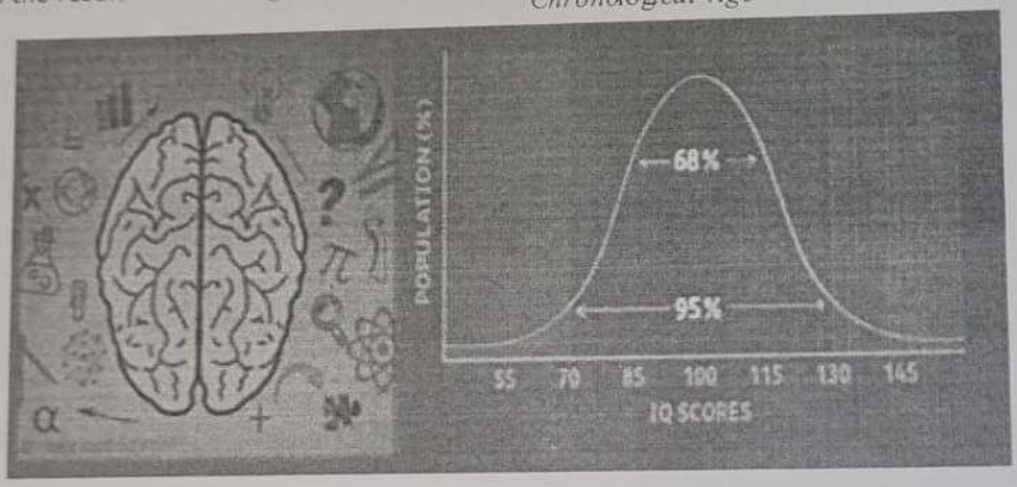
(ii) In how many ways he can attempt 3 questions from part-I and remaining from Part-II? 1

(iii) (a) In how many ways he can attempt at least 3 questions from each part? 2

OR

(iii) (b) In how many ways he can attempt at most 2 questions from part-I 2

238. Sheena is psychology student and now a days she is learning about intelligence Quotient. She knows the result: $Intelligence\ Quotient(IQ) = \frac{Mental\ Age}{Chronological\ Age} \times 100$



Based on the above information answer the following questions:

(i) Find the mental age of a 14 year old child if his(her) IQ is 100 1

(ii) For a child of age 10 years, find the range of mental age if IQ > 100? 1

(iii) (a) Find the range of mental age if a group of children with chronological age of 15 years have the IQ range as $90 \leq IQ \leq 150$? 2

OR

(iii) (b) Find the range of IQ if a group of children with age of 12 years have the mental age (MA) range as $9 \leq MA \leq 15$? 2