

QUEEN'S CONVENT SCHOOL, DELHI
HALF YEARLY EXAMINATION 2025-26
CLASS XI MATHEMATICS (SET 1)

M.M 80

TIME 3 HRS

GENERAL INSTRUCTIONS:

The question paper consisted of 38 questions divided into five sections:

- Section A: 18 multiple-choice questions and 2 Assertion-Reason questions of 1 mark each
- Section B: 5 very short answer questions of 2 marks
- Section C: 6 short answer questions of 3 marks each
- Section D: 4 long answer questions of 5 marks each
- Section E: 3 case study based questions of 4 marks.

Section A (1 X 20 = 20 Marks)

Q1 to Q 20 are Multiple Choice Question. Choose appropriate options out of the four given options

Q1. If $X = \{ 8^n - 7n - 1 : n \in N \}$ and $Y = \{ 49n - 49 : n \in N \}$ Then

- (a) $X \subseteq Y$ (b) $Y \subseteq X$ (c) $X = Y$ (d) $X \cap Y = \emptyset$

Q2. If $[x]^2 - 5[x] + 6 = 0$ where $[x]$ denotes the greatest integer function, then x belongs to

- (a) $(2, 3]$ (b) $(2, 3]$ (c) $[2, 3]$ (d) $[2, 4)$

Q3. The range of the function $\frac{1}{1-2\cos x}$ is:

- (a) $[\frac{1}{3}, 1]$ (b) $[-1, \frac{1}{3}]$ (c) $(-\infty, 1] \cup [\frac{1}{3}, \infty)$ (d) $[-\frac{1}{3}, 1]$

Q4. If A and B are two sets then $A \cap (A \cup B)$ is equal to

- (a) A (b) B (c) $\emptyset$ (d) $A \cap B$

Q5. Let $n(A) = m$, $n(B) = n$, then the total number of non empty relations from the set A to B is given by

- (a) m^n (b) n^m (c) $mn - 1$ (d) $2^{mn} - 1$

Q6. The value of $\frac{2 \tan 15^\circ}{1 + \tan^2 15^\circ}$ is

- (a) 1 (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{1}{2}$ (d) 2

Q7. If $\left(\frac{1+i}{1-i}\right)^x = 1$ then for $n \in N$, the value of x is:

- (a) $2n + 1$ (b) $4n$ (c) $2n$ (d) $4n + 1$

Q8. If $x < y$ and $b < 0$, then

- (a) $\frac{x}{a} > \frac{y}{b}$ (b) $\frac{x}{a} \geq \frac{y}{b}$ (c) $\frac{x}{a} < \frac{y}{b}$ (d) $\frac{x}{a} \leq \frac{y}{b}$

Q9. $|x - 1| > 5$ then the value of x lies in the interval

- (a) $[-4, 6]$ (b) $[-4, 6]$ (c) $(-\infty, -4) \cup (6, \infty)$ (d) $[-\infty, -4] \cup (6, \infty)$

Q10. The total number of 9 digit numbers which have all different digits is
(a) $10!$ (b) $9!$ (c) $10 \times 10!$ (d) $9 \times 9!$

Q11. Total number of terms in the expansion of $(a^2 + b^2 - 2ab)^{100}$ is

- (a) 102 (b) 203 (c) 204 (d) none of these

Q12. Total number of three letters words that can be formed using the letter of the word DELHI is

- (a) 60 (b) 120 (c) 24 (d) 20

Q13. Which one is smaller $\sin 64^\circ$ or $\cos 64^\circ$

- (a) $\sin 64^\circ$ (b) $\cos 64^\circ$ (c) both are equal (d) cannot be compared

Q14. The real part of $\frac{5+\sqrt{2}i}{1-\sqrt{2}i}$ is

- (a) 5 (b) 1 (c) 4 (d) $2\sqrt{2}$

Q15. The set $\{x: x \in \mathbb{R} : -3 \leq x < 2\}$

- (a) $\{-3, -2, -1, 0, 1\}$ (b) $\{-3, -2, -1, 0, 1, 2\}$ (c) $[-3, 2]$ (d) $[-3, 2)$

Q16. The value of $\cos 1^\circ \times \cos 2^\circ \times \cos 3^\circ \dots \cos 179^\circ$ is :

- (a) 1 (b) 0 (c) -1 (d) $\frac{1}{\sqrt{2}}$

Q17. The value of $\sin \frac{\pi}{10} \sin \frac{13\pi}{10}$ is.

- (a) $\frac{1}{2}$ (b) $-\frac{1}{4}$ (c) $-\frac{1}{2}$ (d) 1

Q18. If n th term of a GP is 2^n , then the sum of its first 6 terms is:

- (a) 126 (b) 124 (c) 190 (d) 154

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) : $\cos 15\pi = -1$

Reason (R) : $\cos(2n\pi + \theta) = \cos \theta$ and $\cos(\frac{\pi}{2} + \theta) = -\sin \theta$

Q20. Assertion (A) : If $n(A \times B) = 45$, then $n(A)$ cannot be 17.

Reason (R) : $n(A \times B) = n(A) \times n(B)$

Section B (2 x 5 = 10 Marks)

Q21. Show that for two sets A and B, $A \cup B = A \cap B$ implies $A = B$.

Q22. Prove that $\sin 4A = 4 \sin A \cos^3 A - 4 \cos A \sin^3 A$.

Q 23. Find domain and range of the function $f(x) = \frac{3}{2-x^2}$.

Q 24. Find the value of $\tan 22^\circ 30'$

OR

Q 24. If $\sin \theta + \cos \theta = 1$ find the value of θ .

Q 25. Prove that $\frac{\sec 8\theta - 1}{\sec 4\theta - 1} = \frac{\tan 8\theta}{\tan 2\theta}$

Section C (3 X 5 = 15 Marks)

Q 26. Using properties of sets, prove that

(a) $A = (A \cap B) \cup (A - B)$

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

Q 27. Solve $|Z| = Z + 1 + 2i$ where Z is a complex number.

Q 28. If ${}^nC_{r-1} = 36$, ${}^nC_r = 84$ and ${}^nC_{r+1} = 126$, find nC_2

Q 29. In how many ways can a team of 11 football players be selected from 16 players? How many

(a) include two particular players. (b) exclude two particular players.

OR

Q 29. How many words with or without meaning each of 2 vowels and 3 consonants can be made from the letters of the word 'EDUCATION'. Also find how many words can be formed using all the letters in which all the vowels occur together.

Q 30. Prove that $\cos \theta \cos \frac{\theta}{2} - \cos 3\theta \cos \frac{9\theta}{2} = \sin 7\theta \sin 8\theta$

Q 31. Express $\frac{1-3i}{1+2i}$ in polar form.

Section D (5 X 4 = 20 Marks)

Q 32 (a) Find the middle term in the expansion of the binomial expression $\left(\frac{x}{a} - \frac{a}{x}\right)^{10}$.

(b) Find r if the coefficient of $(2r+4)$ th and $(r-2)$ th terms in the expansion of $(1+x)^{18}$ are equal.

Q 33. (a) How many terms of the GP $3, \frac{3}{2}, \frac{3}{4}, \dots$ are required to get the sum $\frac{3069}{512}$.

(b) The sum of two numbers is 6 times their geometric mean. Prove that the numbers are in the ratio $(3+2\sqrt{2})$ and $(3-2\sqrt{2})$.

Q 34. (a) A manufacturer has 600 litres of 12% solution of acid. How many litres of 30% acid solution must be added to it so that the acid content in the resulting mixture will be more than 15% but less than 18%.

(b) Solve the following set of inequalities graphically:

$$x+2y \leq 40, 3x+y \geq 30, 4x+3y \geq 60, x, y \geq 0$$

(3)

Q 35.(a) Draw the graph of $\sin x$. Also write its domain and range.

(b) If $\cot x = \frac{-3}{4}$, find $\sin \frac{x}{2}$, $\cos \frac{x}{2}$, $\tan \frac{x}{2}$ if x lies in second quadrant.

Section E (Case Based Questions) (4 X 3= 12 Marks)

Q 36. Read the following passage and answer the questions given below.

There are five flags of different colors. Rajnikant wants to put these flags over a vertical staff one below the other, in order to make different signals.

- If exactly 2 flags are used to make the signals, then how many signals can be generated?
- If exactly 3 flags are used to make the signals, then how many signals can be generated?
- Find the number of different signals that can be generated by arranging at least 3 flags on a vertical staff.

Q 37. Two sets can be multiplied but algebra of sets is different from the arithmetic algebra. Further a relation can also be defined as a subset of cross product. Based on the concept of algebra of sets :

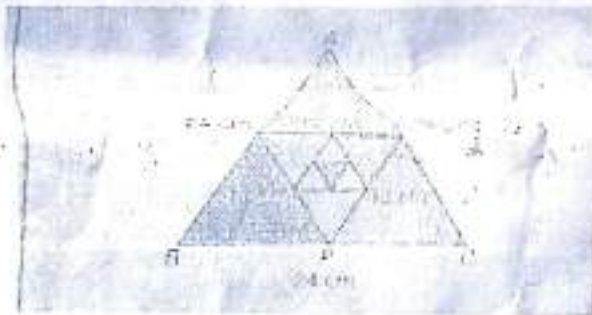
- Define Cartesian product of two sets.
- If $(x+2, 4) = (5, 2x+y)$, find x and y
- Let R be a relation on Q defined as $R = \{ (a, b) : a, b \in Q \text{ and } a - b \text{ is an even number} \}$

Show that (a) $(a, a) \in R$ for all $a \in Q$ (b) If $(a, b) \in R$ then $(b, a) \in R$

(c) If $(a, b) \in R, (b, c) \in R$ then $(a, c) \in R$.

38. In Rangoli competition in school, Preeti made Rangoli in the equilateral shape. Each side of an equilateral triangle is 24 cm. The mid-point of its sides are joined to form another triangle. This process is going continuously infinite.

Based on above information, answer the following questions.



- Find the side of the 5th triangle is (in cm) (1)
- Find the sum of perimeter of first 6 triangle is (in cm) (1)
- Find the area of all the triangle is (in sq cm). (2)

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21/1/20