

CLASS: XI
MID-TERM EXAMINATION (2025 - 26)
SUBJECT: MATHEMATICS (041)
SET-B1

Time: 3 Hrs.

Max. Mark: 80

General Instructions:

Read the following instructions very carefully and strictly follow them:

- i) This Question paper contains 38 questions. All questions are compulsory.
- ii) This Question paper is divided into five Sections - A, B, C, D and E.
- iii) In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
- iv) In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
- v) In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
- vi) In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
- vii) In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.
- viii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E

SECTION A

(Multiple Choice Questions) Each question carries 1 mark.

1. Empty set is a.....

- a) Infinite set b) Finite set c) Unknown set d) Universal set

2. If A and B are two sets, then $A \cap (A \cup B)$ equals:

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

3. If A and B are two sets, then $A \cup B = A \cap B$ iff

- a) $\emptyset$ b) $A \subseteq B$ c) $B \subseteq A$ d) $A = B$

4. If $A = \{1, 2, 4\}$, $B = \{2, 4, 5\}$, $C = \{2, 5\}$ then $(A - B) \times (B - C)$ is

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

5. If $f(x) = \frac{x}{x-1}$, then $\frac{f(a)}{f(a+1)} =$

- a) $f(-a)$ b) $f\left(\frac{1}{a}\right)$ c) $f(a^2)$ d) $f\left(\frac{-a}{a-1}\right)$

6. The number of functions from $A = \{1, 2, 3\}$ to $B = \{4, 6, 8, 10\}$ is

- a) 81 b) 64 c) 32 d) 12



7. The value of $2 \sin 75^\circ \sin 15^\circ$ is

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

8. If $\sin \theta = -\frac{4}{5}$ and θ lies in third quadrant when the value of $\cos \frac{\theta}{2}$ is

- a) $\frac{1}{5}$ b) $-\frac{1}{\sqrt{10}}$ c) $-\frac{1}{\sqrt{5}}$ d) $\frac{1}{\sqrt{10}}$

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

- a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$ c) π d) $\frac{\pi}{6}$

10. The value of $\left(\frac{i^{4n+1} - i^{4n-1}}{2}\right)$ is

- a) $2i$ b) $-2i$ c) $-i$ d) i

11. Let $x, y \in \mathbb{R}$, then $x + iy$ is a non-real complex number if

- a) $x = 0$ b) $y = 0$ c) $y \neq 0$ d) $x \neq 0$

12. The third term of a G.P. is 9, then the product of the first five terms is

- a) 3^9 b) 3^{10} c) 3^{11} d) 3^{12}

13. If A be the arithmetic mean between two numbers and S be the sum of n arithmetic means between the same numbers, then

- a) $S = nA$ b) $A = nS$ c) $A = S$ d) $A + n = S$

14. If second term of a G.P. is 2 and the sum of its infinite term is 8, then its first term is

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

15. The equation of the line passing through $(2, -3)$ and parallel to y -axis is

- a) $y = -3$ b) $y = 2$ c) $x = 2$ d) $x = -3$

16. The x -intercept of the line $5x - 7 = 6y$ is

- a) $\frac{7}{6}$ b) $\frac{7}{5}$ c) $\frac{5}{7}$ d) $-\frac{6}{7}$

17. Variance of the numbers 3, 7, 10, 18, 22 is equal to

- a) 12 b) 64 c) $\sqrt{49.2}$ d) 49.2

18. The mean deviation of the data 2, 9, 9, 3, 6, 9, 4 from the mean is

- a) 2.23 b) 2.57 c) 3.23 d) 3.57

ASSERTION-REASON:

Of the following statements, choose the correct one.

- a) Both A and R are true and R is the correct explanation of A.

- b) Both A and R are true and R is not correct explanation of A.
 c) A is true but R is false. d) A is false but R is true.
19. Assertion (A): Additive inverse of $1 - i$ is $(-1 + i)$.

Reason (R): Additive inverse of the complex number is the conjugate of the complex number.

20. Assertion (A): Equation of line passing through origin is $y = mx$.

Reason (R): For the line $y = mx$, the intercepts on the x & y -axes is 0.

SECTION B

(All Questions are compulsory. In case of internal Choice, attempt any one question only)

21. Show that $A \cap B = A \cap C$ need not imply $B = C$. *take out*

OR

Using Venn diagram, prove that $(A \cup B)' = A' \cap B'$.

22. The cartesian product $A \times A$ has 9 elements among which are found $(-1, 0)$ and $(0, 1)$. Find the set A and the remaining elements of $A \times A$.

23. Prove that: $\frac{\cos 4x + \cos 3x + \cos 2x}{\sin 4x + \sin 3x + \sin 2x} = \cot 3x$.

24. If A.M. and G.M. of roots of a quadratic equation are 8 and 5, respectively, then obtain the quadratic equation. *AM = $\frac{a+b}{2}$, GM = $\sqrt{ab}$*

OR

The first term of a G.P. is 1. The sum of the third term and fifth term is 90. Find the common ratio of G.P. *$a_1 = 1$, $a_3 + a_5 = 90$*

25. Find equation of the line parallel to the line $3x - 4y + 2 = 0$ and passing through the point $(-2, 3)$.

SECTION C

(This section comprises of short answer type questions (SA) of 3 marks each.)

26. Let $A = \{1, 2, 3, 4, 6\}$. Let R be the relation on A defined by:

$\{(a, b) : a, b \in A, b \text{ is exactly divisible by } a\}$. Write R in the roster form and also, find the domain, range and codomain of R.

OR

If f and g are two real valued functions defined as $f(x) = 2x + 1$, $g(x) = x^2 + 1$, then find $(f - g)(x)$. Also, find the domain of $\sqrt{(f - g)(x)}$.

27. Prove that: $2 \cos \frac{\pi}{13} \cos \frac{9\pi}{13} + \cos \frac{3\pi}{13} + \cos \frac{5\pi}{13} = 0$.

OR

If $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$, then show that $\frac{\tan x}{\tan y} = \frac{a}{b}$.

28. Reduce $\left(\frac{1}{1-4t} - \frac{2}{1+t}\right)\left(\frac{3-4t}{5+t}\right)$ to the standard form.

29. Find four numbers forming a G.P. in which the third term is greater than the first term by 9, and the second term is greater than the 4th by 18.

30. Find the angle between the lines $y - \sqrt{3}x - 5 = 0$ and $\sqrt{3}y - x + 6 = 0$.

OR

Find the equation of the line passing through the point (2,2) and cutting off intercepts on the axes whose sum is 9.

31. Find the mean deviation about the median of the following distribution:

Marks Obtained	10	11	12	14	15
No. of students	2	3	8	3	4

SECTION D

(This section comprises of long answer type questions (LA) of 5 marks each.)

32. If θ lies in the first quadrant and $\cos \theta = \frac{8}{17}$, then find the value of:

$$\cos(30^\circ + \theta) + \cos(45^\circ - \theta) + \cos(120^\circ - \theta).$$

OR

Prove that: $\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ = \frac{3}{16}$.

33. Given a, b, c, d are positive real numbers and form a G.P. If a and b are the roots of $x^2 - 3x + p = 0$ and c, d are roots of $x^2 - 12x + q = 0$. Prove that $(q + p) : (q - p) = 17 : 15$.

34. Assuming that straight lines work as the plane mirror for a point, find the image of the point (1,2) in the line $x - 3y + 4 = 0$.

35. Mean and Standard deviation of 100 observations were found to be 40 and 10 respectively. If at the time of calculation two observations were wrongly taken as 30 and 70 in place of 3 and 27 respectively, then find the correct standard deviation.

OR

Calculate the mean, variance and standard deviation for the following distribution:

Class	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	3	7	12	15	8	3	2

SECTION E

(This section comprises of 3 case-study/passage-based questions of 4 marks each with subparts. The first two case study questions have three subparts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study question has two subparts of 2 marks each)

36. A mathematics teacher of class XI write three sets A, B and C from Universal set U such that $U = \{x: x \text{ is a natural number } \leq 12\}$, $A = \{1, 3, 5, 7, 9\}$, $B = \{2, 4, 6, 8\}$ and $C = \{2, 3, 5, 7, 11\}$.

Based on the given information, answer the following questions:

i) Write the set C in the set builder form.

ii) Find $A - (A \cap B)$.

iii) a) Find $(A \cap B') \cup (B \cap C')$.

OR

b) Find $U - (A' \cap B' \cap C')$.

37. Let $z = a + ib$ then $\bar{z} = a - ib$, where $a, b \in R$, are real numbers are conjugate of each other.

Based on the above information, answer the following questions:

i) If $z_1 = 3 + 2i$, $z_2 = 2 - i$, then find $\overline{z_1 + z_2}$.

ii) Find the conjugate of $(6 + 5i)^2$.

iii) a) If the complex numbers $-3 + i(x^2y)$ and $x^2 + y + 4i$, where $a, b \in R$ are conjugate of each other, then find x & y .

OR

b) If $(a + ib)(c + id)(e + if) = (A + iB)$ then prove that

$$(a^2 + b^2)(c^2 + d^2)(e^2 + f^2) = (A^2 + B^2)$$

38. Two students of class XI are talking about the ages of their friends. The ages of the students are represented by f and g be real functions defined by

$$f(x) = \sqrt{x+4} \text{ and } g(x) = \sqrt{16-x^2}.$$

Answer the following questions based on their ages.

i) Find the domains of $f(x)$ and $g(x)$.

ii) Find the domain of sum of both ages.