B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

NABET

INDIAN PUBLIC SCHOOLS' CONFERENCE

TERM-1 EAMINATION, 2025-26
MARKING SCHEME-MATHEMATICS

Class: XI	**Time: 3hr**
Date: 12/09/25	**Max Marks: 80**
Admission no:	**Roll no:**

General Instructions:
1. This Question Paper has 5 Sections A, B, C, D and E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case-based integrated units of assessment (04 marks each) with sub-parts.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks have been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION A

1. If A, B and C are any three sets, then A × (B ∪ C) is equal to: **1m**
   (a) (A × B) ∪ (A × C) (b) (A ∪ B) × (A ∪ C) (C) (A × B) ∩ (A × C) (d) none of these

2. The cardinality of the power set of {x: x ∈ N, x ≤ 10} is ______. **1m**
   (a) 1024 (b) 1023 (C) 2048 (d) none of these

3. If tan A = 1/2 and tan B = 1/3, then the value of (A + B) is **1m**
   (a) $\pi/6$ (b) π (c) 0 *(d) $\pi/4$*

4. The value of sin 50° – sin 70° + sin 10° is equal to **1m**
   (a) 1 *(b) 0* (c) 1/2 (d) none of these

5. The domain of the function $f(x) = x / (x^2 + 3x + 2)$ is **1m**
   (a) [-2, -1] (b) R – {1, 2} *(c) R – {-1, -2}* (d) R – {2}

6. In a function from set A to set B, every element of set A has___________ image in set B. **1m**
   (a) one and only one (b) different (c) many (d) none of these

7. (x+3) + i(y-2) = 5+i2, find the values of x and y. **1m**
   (a) x=8 and y=4 *(b) x=2 and y=4* (c) x=2 and y=0 (d) x=8 and y=0

8. 0+0i is ______________________for complex number z. **1m**
   (a) additive inverse *(b) additive identity element* (c)multiplicative identity element (d)multiplicative inverse

9. If – 3x + 17 < – 13, then **1m**
   (a) x ∈ (10, ∞) (b) x ∈ [10, ∞) (c) x ∈ (– ∞, 10] (d) none of these

10. If |x −1| > 5, then **1m**

(a) $x \in (-4, 6)$ (b) $x \in [-4, 6]$ *(c) $x \in (-\infty, -4) \cup (6, \infty)$* (d) none of these

11. The range of $f(x) = \sqrt{(25 - x^2)}$ is — 1m

(a) (0,5) (b) [0,5] (c)(-5,5) (d)[1,5]

12. The number of ways in which 8 students can be seated in a line is — 1m

(a) 5040 (b) 50400 (c) 40230 *(d) 40320*

13 The number of ways 10-digit numbers can be written using the digits 1 and 2 is — 1m

(a) 2^{10} (b) ${}^{10}C_2$ (c) 10! (d) ${}^{10}C_1 + {}^{9}C_2$

14 The coefficient of the middle term in the expansion of $(2+3x)^4$ is: — 1m

(a) 5! (b) 6 *(c) 216* (d) none of these

15 The coefficient of x^3y^4 in $(2x+3y^2)^5$ is — 1m

(a) 360 *(b) 720* (c) 240 (d) none of these

16 The value of cos 1° cos 2° cos 3° … cos 179° is — 1m

(a) $1/\sqrt{2}$ *(b) 0* (c) 1 (d) none of these

17 Value of i^{-37} is — 1m

(a) 13/i *(b) 1/i* (c) 1 (d) none of these

18 There are 10 true-false questions in an examination. These questions can be answered in: — 1m

(a) 20 ways (b) 100 ways *(c) 1024 ways* (d) none of these

19 Assertion (A):- The power set of {1, 2} is {∅,{1},{2},{1, 2}} . — 1m

Reason (R):- The power set is the set of all subsets.

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

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).

(c) Assertion (A) is true and Reason (R) is false.

(d) Assertion (A) is false and Reason (R) is true.

20 Assertion (A): If the letters W, I, F, E are arranged in a row in all possible ways and the words (with or without meaning) so formed are written as in a dictionary, then the word WIFE occurs in the 24th position. — 1m

Reason (R): The number of ways of arranging four distinct objects taken all at a time is C (4,4).

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

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).

(c) Assertion (A) is true and Reason (R) is false.

(d) Assertion (A) is false and Reason (R) is true.

SECTION B

21 Given L, = {1,2, 3,4}, M= {3,4, 5, 6} and N= {1,3,5} — 2m

Verify that L - (M ⋃ N) = (L - M) ⋂ (L - N)

A:- **Sol:** Given L = {1,2, 3,4}, M = {3,4,5,6} and N = {1,3,5}

M∪N = {1,3,4, 5,6}

L − (M∪N) = {2} **1m**

Now, L-M = {1, 2} and L-N = {2,4}

{L-M) ∩{L-N} = {2}

Hence, L-{M∪N) = {L-M) ∩ (L-N). **1m**

OR

Given that N = {1,2,3, …, 100}. Then write
(i) the subset of N whose elements are even numbers.
(ii) the subset of N whose element are perfect square numbers.

A:- **Sol:** We have, N = {1,2, 3,4,..., 100}

(i) subset of N whose elements are even numbers = {2,4, 6, 8,..., 100} **1m**

(ii) subset of N whose elements are perfect square = {1,4, 9, 16, 25, 36,49, 64, 81, 100} **1m**

22. $\cos^2 2x - \cos^2 6x = \sin 4x \sin 8x$ **2m**

A:- **Solution:**

Consider

L.H.S. = $\cos^2 2x - \cos^2 6x$

Using the formula

$$\cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

$$\cos A - \cos B = -2\sin\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)$$

So we get

= $(\cos 2x + \cos 6x)(\cos 2x - 6x)$

By further calculation

$$= \left[2\cos\left(\frac{2x+6x}{2}\right)\cos\left(\frac{2x-6x}{2}\right)\right]\left[-2\sin\left(\frac{2x+6x}{2}\right)\sin\frac{(2x-6x)}{2}\right]$$ **1m**

We get

= [2 cos 4x cos (-2x)] [-2 sin 4x sin (-2x)]

It can be written as

= [2 cos 4*x* cos 2*x*] [−2 sin 4*x* (−sin 2*x*)]

So we get

= (2 sin 4*x* cos 4*x*) (2 sin 2*x* cos 2*x*)

= sin 8x sin 4x

= RHS **1m**

23 **Find the modulus of the following complex numbers:** **2m**
(i) 3+4i
(ii) 1−i

A:- Modulus of $z = a + ib$ is $|z| = \sqrt{a^2 + b^2}$

(i)

$$|3 + 4i| = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$$ **1m**

(ii)

$$|1 - i| = \sqrt{1^2 + (-1)^2} = \sqrt{1 + 1} = \sqrt{2}$$ **1m**

24 **Ravi scored 70 and 75 in two-unit tests. Find the minimum marks he must score in the third test to achieve an average of at least 60.** **2m**

A:- Average of three tests:

$$\frac{70+75+x}{3} \geq 60$$

$$\frac{145+x}{3} \geq 60$$ **1m**

Multiply both sides by 3:

$$145 + x \geq 180$$

$$x \geq 180 - 145$$

$$x \geq 35$$ **1m**

OR

Solve the inequalities:

(a) $5x - 3 < 7$

(b) $2 - 3x \geq 5$

A:- (a) $5x - 3 < 7$

$5x < 10$

$x < 2$ **1m**

(b) $2 - 3x \geq 5$

$-3x \geq 3$

$x \leq -1$ **2m**

25 Expand the expression $(x+a)^3$ using the Binomial Theorem. **2m**

A:- We know from the **Binomial Theorem**:

$$(x+a)^n = \sum_{k=0}^{n} \binom{n}{k} x^{n-k} a^k$$

For $n = 3$, we have: **1m**

$$(x+a)^3 = \binom{3}{0}x^3a^0 + \binom{3}{1}x^2a^1 + \binom{3}{2}x^1a^2 + \binom{3}{3}x^0a^3$$

Now calculate the binomial coefficients:

$$= 1 \cdot x^3 + 3 \cdot x^2 a + 3 \cdot x a^2 + 1 \cdot a^3$$ **1m**

SECTION C

26 Let A, B and C be sets. Then show that A ∩ (B ∪ C) = (A ∩ B)∪ (A ∩ C). **3m**

A:- **Sol.** Let $x \in A \cap (B \cup C)$

$\Rightarrow$ $x \in A$ and $x \in (B \cup C)$

$\Rightarrow$ $x \in A$ and ($x \in B$ or $x \in C$)

$\Rightarrow$ ($x \in A$ and $x \in B$) or ($x \in A$ and $x \in C$)

$\Rightarrow$ $x \in A \cap B$ or $x \in A \cap C$

$\Rightarrow$ $x \in (A \cap B) \cup (A \cap C)$ **2m**

$\Rightarrow$ $A \cap (B \cup C) \subset (A \cap B) \cup (A \cap C)$ (i)

Now, let $y \in (A \cap B) \cup (A \cap C)$

$\Rightarrow$ $y \in (A \cap B)$ or $y \in (A \cap C)$

$\Rightarrow$ ($y \in A$ and $y \in B$) or ($y \in A$ and $y \in C$)

$\Rightarrow$ $y \in A$ and ($y \in B$ or $y \in C$)

$\Rightarrow$ $y \in A$ and $y \in B \cup C$

$\Rightarrow$ $y \in A \cap (B \cup C)$

$\Rightarrow$ $(A \cap B) \cup (A \cap C) \subset A \cap (B \cup C)$ (ii) **1m**

27 Let the relation R be defined on the set {0,1,2,3,4,5} as: **3m**

R = {(x, x+5): x∈ {0,1,2,3,4,5}}
Find the domain and range of the relation.

A:- We list the ordered pairs in R:

- When $x = 0$: $(0,\ 0+5) = (0,\ 5)$
- $x = 1$: $(1,\ 6)$
- $x = 2$: $(2,\ 7)$
- $x = 3$: $(3,\ 8)$
- $x = 4$: $(4,\ 9)$
- $x = 5$: $(5,\ 10)$ **1m**

Thus,

$$R = \{(0,5),\ (1,6),\ (2,7),\ (3,8),\ (4,9),\ (5,10)\}$$ **1m**

- **Domain of** R = all first elements = $\{0, 1, 2, 3, 4, 5\}$
- **Range of** R = all second elements = $\{5, 6, 7, 8, 9, 10\}$

1m

OR

Find the domain and range of the following functions:

(i) $f(x) = \sqrt{4 - x^2}$
(ii) $g(x) = \frac{1}{x-3}$

A:- (i) $f(x) = \sqrt{4 - x^2}$

- Condition: $4 - x^2 \geq 0 \Rightarrow -2 \leq x \leq 2$
- **Domain:** $[-2, 2]$
- Range: $\sqrt{4 - x^2} \in [0, 2]$ **2m**
- **Range:** $[0, 2]$

(ii) $g(x) = \frac{1}{x-3}$

- Condition: $x \neq 3$
- **Domain:** $\mathbb{R} \setminus \{3\}$
- Range: $y \neq 0$ (since numerator is 1)
- **Range:** $\mathbb{R} \setminus \{0\}$ **1m**

28 **cos 6*x* = 32 cos^6 *x* – 48 cos^4 *x* + 18 cos^2 *x* – 1** **3m**

A:- **Solution:**

Consider

L.H.S. = cos $6x$

It can be written as

= cos $3(2x)$

Using the formula $\cos 3A = 4\cos^3 A - 3\cos A$ **1m**

= $4\cos^3 2x - 3\cos 2x$

Again by using formula $\cos 2x = 2\cos^2 x - 1$

= $4[(2\cos^2 x - 1)^3 - 3(2\cos^2 x - 1)$

By further simplification

= $4[(2\cos^2 x)^3 - (1)^3 - 3(2\cos^2 x)^2 + 3(2\cos^2 x)] - 6\cos^2 x + 3$

We get **1m**

= $4[8\cos^6 x - 1 - 12\cos^4 x + 6\cos^2 x] - 6\cos^2 x + 3$

By multiplication

= $32\cos^6 x - 4 - 48\cos^4 x + 24\cos^2 x - 6\cos^2 x + 3$

On further calculation

= $32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1$ **1m**

= R.H.S.

29 **Express the following in the form a+ib:** **3m**

$$\frac{(3+i\sqrt{5})(3-i\sqrt{5})}{(\sqrt{3}+\sqrt{2}\,i)\ -\ (\sqrt{3}-\sqrt{2}\,i)}$$

A:- **Numerator:**

$$(3+i\sqrt{5})(3-i\sqrt{5}) = 3^2 - (i\sqrt{5})^2 = 9+5 = 14$$

Denominator:

$$(\sqrt{3}+\sqrt{2}i) - (\sqrt{3}-\sqrt{2}i) = 2\sqrt{2}i$$

1m

Now:

$$\frac{14}{2\sqrt{2}i} = \frac{7}{\sqrt{2}i} = \frac{7}{\sqrt{2}} \cdot \frac{1}{i}$$

1m

Since $\frac{1}{i} = -i$,

$$= -\frac{7}{\sqrt{2}}i = -\frac{7\sqrt{2}}{2}i$$

1m

30 **From a class of 8 students (5 boys and 3 girls) a committee of 4 is to be chosen.** **3m**
(a) How many different committees of 4 can be formed?
(b) How many committees contain at least two girls?

A:- (a) Total ways $= \binom{8}{4} = \frac{8 \cdot 7 \cdot 6 \cdot 5}{4 \cdot 3 \cdot 2 \cdot 1} = 70.$ **1m**

(b) Count committees with exactly 2 girls and with exactly 3 girls.

- Exactly 2 girls: $\binom{3}{2} \cdot \binom{5}{2} = 3 \cdot 10 = 30.$ **1m**

- Exactly 3 girls: $\binom{3}{3} \cdot \binom{5}{1} = 1 \cdot 5 = 5.$

So at least two girls $= 30 + 5 = 35.$ **1m**

31 **Solve the following in equation:** **3m**

$\frac{5x-2}{3} - \frac{7x-3}{5} > \frac{x}{4}$.

OR

Solve 5x-3< 3x+1 when (i) x is a real, (ii) x is integer number, (iii) x is a natural number.

A:- $\frac{5x-2}{3} - \frac{7x-3}{5} > \frac{x}{4}$ $= \frac{25x-10-21x+9}{15} > \frac{x}{4}$ = 16x-15x >4 = x>4, x∈(4,∞) **3m**

OR

5x-3< 3x+1 = 2x<4, x<2

I) x∈ $(-\infty, 2)$ ii) x= 1,0,-1,-2,-3,-4,... iii) x=1 **3m**

SECTION D

32 Prove that: **5m**

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

OR

Prove that: cot4x (sin5x+sin3x) = cotx (sin5x-sin3x)

A:- $(\cos x+\cos y)^2 + (\sin x-\sin y)^2$ = 1+1+2cosx cosy -2sinxsiny = 2+2$[\cos(x+y)]$ =2$[1+\cos(x+y)]$ = 2cos²(x+y/2). **2m** **3m**

5

OR

LHS: cot4x(sin5x+sin3x) = cot4x(2sin4xcosx) = 2cos4xcosx **2m**

RHS: cotx(sin5x-sin3x) = cotx(2sinxcos4x) = 2cos4x cosx. **3m**

33 Let X=3+4i and Y=1−2i. **5m**

Answer the following:

(a) Find X+Y in the form a+ib.

(b) Find product of X and Y.

(c) Find the modulus and argument of X.

(d) Find the multiplicative inverse of Y.

A:-

(a)

$X + Y = (3 + 4i) + (1 - 2i) = 4 + 2i$ **1m**

(b)

$X \cdot Y = (3 + 4i)(1 - 2i) = 3 - 6i + 4i - 8i^2 = 11 - 2i$ **1m**

(c)

$|X| = \sqrt{3^2 + 4^2} = \sqrt{25} = 5$ **1m**

(d)

$$\frac{1}{Y} = \frac{1}{1-2i} = \frac{1+2i}{1+4} = \frac{1+2i}{5} = \frac{1}{5} + \frac{2}{5}i$$ **2m**

Or

(a) Solve x^2- 2x +5 and write the roots in the form a + ib

(b) Find the modulus of each root.

A:- (a) $D = (-2)^2 - 4(1)(5) = 4 - 20 = -16$

$x = \frac{2\pm\sqrt{-16}}{2} = \frac{2\pm 4i}{2} = 1 \pm 2i$ **3m**

(b) Modulus of $1 \pm 2i$: $\sqrt{1^2 + (2)^2} = \sqrt{1+4} = \sqrt{5}$ **2m**

34 Find: **5m**

(a) The middle term(s) in the expansion of

$(2x - \frac{3}{x})^{10}$

(b) The term independent of x.

A:- **(a)** Number of terms = $10 + 1 = 11 \Rightarrow$ middle term = 6th term.

(b) General term:

$$T_{r+1} = \binom{10}{r}(2x)^{10-r}\left(-\frac{3}{x}\right)^r$$ **2m**

Power of x = $(10-r) - r = 10 - 2r$

For independence: $10 - 2r = 0 \Rightarrow r = 5$

$$T_6 = \binom{10}{5}(2x)^5\left(-\frac{3}{x}\right)^5 = 252 \cdot 32x^5 \cdot \frac{-243}{x^5} = -252 \cdot 32 \cdot 243 = -1953792$$

Independent term value = -1953792 **3m**

35 **The word 'MATHEMATICS' has 11 letters.** **5m**

(a) In how many distinct ways can all the letters be arranged?

(b) In how many ways can the letters be arranged if the vowels always come together?

A:- **(a)** Repeated letters: M(2), A(2), T(2).

$$\frac{11!}{2! \cdot 2! \cdot 2!} = \frac{39916800}{8} = 4989600$$ **2m**

(b) Vowels: A, E, A, I → 4 vowels, A repeats twice. Treat vowels as one block.

Number of arrangements =

$$\frac{8!}{2! \cdot 2!} \times \frac{4!}{2!} = \frac{40320}{4} \times 12 = 10080 \times 12 = 120960$$

3m

SECTION E

36 **A company makes two types of snack packs: Protein Pack (P) and Energy Pack (E).** **4m**

- **Each Protein Pack requires 4 hours of labour and 3 kg of raw materials.**
- **Each Energy Pack requires 3 hours of labour and 6 kg of raw materials.**
- **The factory has 60 hours of labour and 72 kg of raw materials available per week.**
- **The company wants to produce at least 5 Protein Packs and at least 4 Energy Packs per week to meet customer demand.**

Questions:

1. **Write the inequality representing the labour constraint.**
   Or
   Write the inequality representing the raw material constraint.
2. **Write the inequalities for the minimum demand conditions.**
3. **Check whether the point (8,6) lies inside the feasible region.**

A:- Let x = number of Protein Packs (P) and y = number of Energy Packs (E).

1. (a) Labour constraint:

Each P needs 4 hours, each E needs 3 hours, total available = 60 hours.

$$4x + 3y \leq 60$$

1. (b) Raw-materials constraint:

Each P uses 3 kg, each E uses 6 kg, total available = 72 kg.

$$3x + 6y \leq 72$$

2m

2. Minimum demand inequalities:

$$x \geq 5, \qquad y \geq 4$$

1m

3. Check the point $(8, 6)$:

Labour: $4(8) + 3(6) = 32 + 18 = 50 \leq 60$ ✓

Materials: $3(8) + 6(6) = 24 + 36 = 60 \leq 72$ ✓

Demand: $8 \geq 5,\ 6 \geq 4$ ✓

All conditions satisfied, so $(8, 6)$ lies inside the feasible region. **1m**

37 A Ferris wheel at an amusement park takes tourists on a full circular ride. The wheel completes one full rotation in 40 seconds. An operator measures the rotation in radians per second, while the ride manager prefers degrees per second for announcements. **4m**

Based on this scenario, answer the following questions:

Data:

- **Time for one complete rotation: 40 seconds**
- **One complete rotation = 2π radians = 360^0**

Questions:

1. **What is the angular speed of the Ferris wheel in radians per second?**
2. **Convert the angular speed into degrees per second.**
3. **How many radians will the wheel rotate in 15 seconds?**
   Or
   How many degrees will the wheel rotate in 25 seconds?

A:- **Q1. Angular speed in radians/second**

$$\omega = \frac{2\pi}{40} = \frac{\pi}{20}\ \text{rad/s}$$

1m

Q2. Angular speed in degrees/second

$$\frac{\pi}{20} \times \frac{180^\circ}{\pi} = 9^\circ\ /\text{s}$$

1m

Q3. Radians rotated in 15 seconds

$$\theta = 15 \times \frac{\pi}{20} = \frac{3\pi}{4}\ \text{rad}$$

2m

Q4. Degrees rotated in 25 seconds

$$\theta = 25 \times 9 = 225^\circ$$

38 To make himself Self dependent and to earn his living .A person decided to set up a small-scale business of manufacturing sanitizers He estimated the cost of **4m**

rupees 15,000 fixed for every month and a cost of rupees 30 per unit as manufacturing cost.

(a) If x units are manufactured per month. What is the cost function?

(b) If each unit are sold for Rs.45. What is selling function?

(c) What is the profit function?

Or

What is the profit per day in month of July, if 93 units are produced in that month ?

A:- **(a) $C(x) = 15000 + 30x$** **1m**

(b) $S(x) = 45x$ **1m**

(c) $P(x) = S(x) – C(x)$. **2m**

*********BEST OF LUCK**********