SS3

HALF YEARLY EXAM – SEPTEMBER 2025

SUBJECT – MATHEMATICS (SET II)

TIME DURATION: 3 hours **MM: 80**

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 20 questions of 1 mark each.
3. Section B has 5 questions of 2 marks each.
4. Section C has 6 questions of 3 marks each.
5. Section D has 4 questions of 5 marks each.
6. Section E has 3 case based questions of 4 marks each.

SECTION – A	
Q1	If $n(A \cup B) = 18$, $n(A - B) = 5$, $n(B - A) = 3$, then find $n(A \cap B)$.
Q2	If $(x - 1, 2x - y) = (-1, 3)$, then the value of y^x is____.
Q3	Find the number of arrangements of letters of word BANANA, so that the two N's are together.
Q4	If the origin is the centroid of ΔABC having vertices $A(a, 1, 3)$, $B(-2, b, -5)$ and $C(4, 7, 2)$, then find the value of $a+b$.
Q5	If the lines $3x + 4y + 1 = 0$, $5x + \lambda y + 3 = 0$ and $2x + y - 1 = 0$ are concurrent, then λ is equal to____
Q6	Runs scored by a batsman in his last ten matches are given by : 53, 46, 48, 50, 53, 53, 58, 60, 57, 52. What will be the range of this data?
Q7	If in an infinite G.P., the first term is equal to 10 times the sum of all successive terms, then find its common ratio.
Q8	Find the range of the function $f(x) = -\|5x - 3\|$.
Q9	If mean of first n natural numbers is $\frac{5n}{9}$, then value of n is ____.
Q10	The ratio of the sum of the first three terms to that of the first 6 terms of a G.P. is 125: 152. Find the common ratio.

Q11	Find the angle between the straight lines $x - y\sqrt{3} = 5$ and $\sqrt{3}x + y = 7$.
Q12	A point on y-axis which is at a distance of $\sqrt{10}$ units from the point $(1, 2, 3)$ is____.
Q13	If A and B are two given sets , then $A \cap (A \cap B)' =$____.
Q14	Let $A = \{1, 2, 3\}$, $B = \{4, 5, 6\}$. Let $S: A \to B$, where $S = \{(1, 4), (2, 5), (3, 6), (1, 5)\}$. Is S a function? Justify your answer.
Q15	Find the total number of 6 digit numbers which have all different digits .
Q16	The 4^{th} term of a G.P. is the square of its second term , and the first term is - 3. Then find the 7^{th} term of the G.P.
Q17	The mean deviation of the data 3, 10, 10, 4, 7, 10, 5 from the mean is ____
Q18	If $P(20, r): P(20, r - 1) = 15: 1$, find the value of r .

Assertion Reasoning Based Questions

Q19

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A The distance between the lines $4x + 3y = 11$ and $8x + 6y = 15$ is $\frac{7}{10}$

Reason R: The distance between the lines $ax + by = c_1$ and $ax + by = c_2$ is given by $\left|\frac{c_1 - c_2}{\sqrt{a^2 + b^2}}\right|$

In the above statements, choose the ***most appropriate*** answer from the options given below

a. Both **A** and **R** are correct and **R** is the correct explanation of **A**
b. Both **A** and **R** are correct but **R** is **NOT** the correct explanation of **A**
c. **A** is correct but **R** is not correct
d. **A** is not correct but **R** is correct

Q20

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: The perpendicular distance of the point P(6,3,3) from the Y-axis is $\sqrt{45}$ units.

Reason R: Coordinates of the foot of perpendicular of the point (x_1, y_1, z_1) on Y-axis is $(0, y_1, 0)$, therefore its perpendicular distance from Y-axis is $\sqrt{x_1^2 + y_1^2}$.

In the above statements, choose the ***most appropriate*** answer from the options given below

a. Both **A** and **R** are correct and **R** is the correct explanation of **A**
b. Both **A** and **R** are correct but **R** is **NOT** the correct explanation of **A**
c. **A** is correct but **R** is not correct
d. **A** is not correct but **R** is correct

SECTION – B

Q21 A relation is defined as $R = \{(x, y): x, y \in Z, x^2 + y^2 \leq 4\}$. Find the domain and range of R.

Q22 In how many ways can 5 girls and 3 boys be seated in a row so that no two boys are together ?

OR

In how many ways can 7 examination papers be arranged so that the best and the worst papers are never together ?

Q23 Find two positive numbers a and b whose AM and GM are 34 and 16 respectively.

Q24 Find the equation of a line which passes through the point $(-3, 7)$ and makes intercepts on the axes, equal in magnitude but opposite in sign.

OR

If the angle between two lines is $\frac{\pi}{4}$ and slope of one of the lines is $\frac{1}{2}$, find the slope of the other line.

Q25 Find the point on the y-axis which is equidistant from the points A (3,1,2) and B (5,5,2).

SECTION – C (Short Answer questions)

Q26 Let S be the sum, P the product and R the sum of reciprocals of n terms in a G.P. Prove that $P^2R^n = S^n$.

OR

The sum of the first three terms of a G.P. is $\frac{13}{12}$ and their product is -1. Find the common ratio and the terms.

Q27 How many different words can be formed by using all the letters of the word 'ALLAHABAD' ? In how many of these words
(i) Do the vowels occupy the even positions ?
(ii) Both the L's do not come together

Q28 There are 40 students in a chemistry class and 60 students in a physics class. Find the number of students which are either in physics class or chemistry class in the following cases:
(i) The two classes meet at the same hour.
(ii) The two classes meet at different hours and 20 students are enrolled in both the subjects.

Q29 The midpoints of the sides of a triangle are (1, 5, -1), (0, 4, -2) and (2, 3, 4). Find the vertices of the triangle.

OR

If A (-2, 2, 3) and B(13, -3, 13) are two points. Find the equation of the set of points P which move in such a way that $3PA = 2PB$.

Q30 If the ratio $C(2n, 3) : C(n, 3)$ is equal to 11:1, find n.

OR

If all the words, with or without meaning, using all the letters of the word 'KANPUR' are arranged as in a dictionary, then find the word at 440^{th} position in this arrangement.

Q31 If the sum of an infinite geometric series is 15 and the sum of the squares of these terms is 45, find the series.

SECTION – D

Q32 A survey of 500 television viewers produced the following information; 285 watch football, 195 watch hockey, 115 watch basketball, 45 watch football and basketball, 70 watch football and hockey, 50 watch hockey and basketball, 50 do not watch any of the three games.

(i) How many watch all the three games? (2)

(ii) How many watch exactly one of the three games ? (3)

Q33 Find the domain and range of the function $f(x) = \frac{7}{5 - x^2}$. Also find the value of $f(-2)$

OR

Find the domain and range of $f(x) = \sqrt{9 - x^2}$. Also find the value of $f(2)$.

Q34 Calculate the mean, variance and standard deviation for the following data:

Class	0-30	30-60	60-90	90-120	120-150	150-180	180-210
Frequency	2	3	5	10	3	5	2

Q35 If p and q are the lengths of perpendiculars from the origin to the lines $x\cos\theta - y\sin\theta = k\cos 2\theta$ and $x\sec\theta + y\operatorname{cosec}\theta = k$ respectively, prove that $p^2 + 4q^2 = k^2$.

OR

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

SECTION – E (Case Study questions)

Q36 A triangular park has two of its vertices as B(-4, 1) and C(2, 11) . The third vertex A is a point dividing the line joining the points (3, 1) and (6, 4) in the ratio 2:1 .

Based on the above information, answer the following questions.

(i) Find the coordinates of the third vertex A.

(ii) Find the equation of the line passing through B and C.

(iii) For the triangle ABC , Find the equation of the sides AB and AC .

OR

Find the distance of point B from line AC . (1+1+2)

Q37 A sequence of non-zero numbers is said to be a Geometric Progression if the ratio of each term, except the first one, by its preceding term is always constant.
Rahul , being a plant lover, decides to open a nursery and he buys a few plants and pots. He wants to place pots in such a way that the number of pots in the first row is 2, in the second row is 4 and in the third row is 8 and so on .....

Based on the above information, answer the following questions.

(i) The constant multiple by which the number of pots is increasing in every row .

(ii) The number of pots in the 8th row .

(iii) Total number of pots upto the 10th row

OR

The total number of rows formed , if Rahul wants to place 510 pots in total. (1+1+2)

Q38 Two friends Swati and Komal are playing cards. Swati asks Komal to choose any four cards from a pack of 52 cards. Based on this information, answer the following questions.

(i) In how many ways can the selected 4 cards belong to four different suits ?

(ii) In how many ways can she select two red cards and two black cards ? (2+2)