OSDAV Public School, Kaithal

Half yearly Exams (2024-25)

SET- A

Class : XI

Subject : Applied Maths

Time: 3 Hrs .   **M.M. : 80**

General Instructions:-

1   **All questions are compulsory.**
2   **This question paper has 5 Sections. Section A has 20 questions of 1 mark each which includes 18 M.C.Q.'s and 2 Assertion Reasons Section B has 5 Questions of 2 marks each. Section C has 6 questions of 3 marks each. Section D has 4 questions of 5 mark each and Section E has 3 case study based question of 4 marks each.**

Q.N.	Questions	Marks
1	If P = {u, v, w} and Q = {1, 2, 3, 4} and R is a relation from set P to set Q then number of relations from set P to set Q are a) 12 b) 7 c) 2^7 d) 2^{12}	1
2	If $^nP_4 : {}^{n-1}P_3 = 9: 1$ then n is a) 9 b) 8 c) 10 d) 1	1
3	If $log_{27} x = \frac{4}{3}$ then value of x is a) 81 b) 9 c) 64 d) 256	1
4	The first and last term of A. P. are 1 and 11. If the sum of its terms is 36, then the number of terms will be a) 5 b) 6 c) 7 d) 8	1
5	If $^nC_7 = {}^nC_5$ then n is a) 20 b) 12 c) 6 d) 30	1
6	If in certain code, HARYANA is written as 8197151, then DELHI is written as a) 45389 b) 45634 c) 45337 d) 45568	1
7	If A = { 4, 5, 8, 12} and B = { 5, 6, 7, 8, 9} then A - B is a) {5} b) { 6, 7, 9} c) { 5,8} d) { 4, 12}	1
8	Pick the odd one out in the series: 64, 38, 132, 324 a) 64 b) 38 c) 132 d) 324	1
9	Which of the following binary number is equivalent to decimal number 35? a) $(10010110)_2$ c) $(10001010)_2$ b) $(100000)_2$ d) $(100011)_2$	1

10	The two arithmetic means between the numbers 1 and 64 are a) 1 and 64 b) 4 and 16 c) 23 and 43 d) 8 and 16	1
11	The number of ways in which 5 boys and 3 girls can be arranged so that no two girls may sit together, is a) 1440 b) 14400 c) 5! d) ^6_3P	1
12	Ramesh told Amit, 'Yesterday I defeated the only brother of the daughter of my grandmother.' Whom did Ramesh defeated ? a) Brother b) Uncle c) Father d) Nephew	1
13	If 5 # 9 @ 7 = 52 and 3 @ 9 # 2 = - 89, then the value of 7 # 6 @ 9 is a) 67 b) 68 c) 66 d) 65	1
14	Find the odd one out: 19, 26, 33, 46, 59, 74, 91 a) 26 b) 33 c) 74 d) 59	1
15	If Z = 52 and ACT = 48, then what will be the code for 'BAT'. a) 46 b) 50 c) 54 d) 45	1

16	If M % N means M is the son of N, M @ N means M is the sister of N, M $ N means M is the father of N, then which of the following indicates that C is the granddaughter of E?
	
	    a) C % B $ F $ E c) B $ F $ E % C
	    b) C @ B % F % E d) E % B $ F $ C
		1

17	The domain of the function $f(x) = \frac{x^2+3x+5}{x^2-5x+4}$ is a) $\{1, 4\}$ b) $(1, 4)$ c) $R - \{1, 4\}$ d) $R - (1, 4)$	1
18	The sum of an infinite G.P. is 4 and its first term is 2 then the common ratio of the G.P. is a) 1/2 b) 2/3 c) 1/3 d) -1/2	1

	Assertion Reason Based Questions:
	
	Choose according to these options in Q 19 and 20
	
	  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 the correct explanation of A.**
	  c) **A is true and R is false.**
	  d) **A is false and R is true.**	

19	Assertion (A) : If the numbers $\frac{-3}{11}$, k , $\frac{-11}{3}$ are in G.P. then k = $\pm$ 1 Reason (R) : If a_1, a_2, a_3 are in G. P. then $\frac{a_2}{a_1} = \frac{a_3}{a_2}$	1

20	**Assertion (A):** $\lim\limits_{x \to 0} \frac{(x+2)^3 - 8}{x} = 12$ **Reason (R) :** $\lim\limits_{x \to a} \frac{x^n - a^n}{x - a} = n\, a^{n-1}$	1
	Section – B	
21	Convert 142.125 into its binary representation.	2
22	Check which of the following conclusions can be logically drawn from given statements. Statements: All the cars are cycles. Some cycles are scooters. Conclusion: i) All the cars are scooters. ii) Some cars are scooters.. iii) Some scooters are cycles. iv) Some cycles are cars	2
23	How many words each of 3 vowels and 2 consonants can be formed from the letter of word COMBINE	2
24	Evaluate: $\lim\limits_{x \to 4} \frac{x^3 - 64}{x^2 - 16}$	2
25	Let A be the set of first ten natural numbers and let R be a relation on A defined by R= $\{(x, y): x \in A, y \in A$ and $x + 2y = 10\}$. (i) Write R in its roster form. (ii) Write domain and range of R.	2
	Section – C	
26	Find the domain and range of the function : $f(x) = \sqrt{x - 3}$	3
27	If $m = a^{\frac{1}{3}} + a^{\frac{-1}{3}}$, prove that $m^3 - 3m = a + \frac{1}{a}$	3
28	If the ratio of sum of n terms of two A. P.'s is $(14 - 4n) : (3n + 5)$ then find the ratio of their 9th terms.	3
29	In a survey of 100 persons it was found that 28 read magazine A, 30 read magazine B, 42 read magazine C, 8 read magazine A and B, 10 read magazine A and C, 5 read magazine B and C and 3 read all the three magazines. Find i) How many read none of the three magazines. ii) How many read magazine C only. iii) How many read A and B but not C.	3
30	$f(x) = $ $\{\, 2x + 3, \quad$ if $\ x \le 2$ $x + 3k$, if $\ x > 2\ \}$ If $\lim\limits_{x \to 2} f(x)$ exists then find the value of k.	3
31	Let f = $\{(1, 1), (2, 3), (0, -1), (-1, -3)\}$ be a linear function defined as $f(x) = ax + b$ from Z to Z. Find f(x).	3

	Section – D	
32	If $a^x = b^y = c^z = d^w$, show that log_a(bcd) = x$(\frac{1}{y} + \frac{1}{z} + \frac{1}{w})$	5
33	Discuss the continuity of the function at x = 1 $$f(x) = \begin{cases} x^2 + 2, if \ x > 1 \\ 3 \quad , if \ x < 1 \\ 2x + 1, if \ x = 1 \end{cases}$$	5
34	If $_{r+1}^{22}P \ : \ _{r+2}^{20}P = 11 : 52$, find r	5
35	Find the sum of given series to n terms: 1 + 11+ 111+ 1111+ …………..	5
	Section – E	

36	Mr. X planned to make a committee of 3 members from 9 boys and 4 girls. In how many ways can this be done when the committee consists of
	
	   i) Atleast 3 girls
	   ii) Atmost 2 girls
		4

37	Raman took a loan of ₹ 1,00,000 from a branch of SBI, but could not repay the amount on time due to some reason which result in accumulation of interest and the outstanding amount in his name accrued to ₹ 1,18,000. Raman now decides to repay the outstanding amount of ₹ 1,18,000 by paying every month, starting with first instalment of ₹ 1000 and increasing the instalment by ₹ 100 every month. Based on the above information answer the following questions.
	
	   i) What is the first term and common difference of the A.P. formed by the sequence of instalments?
	   ii) In how many months the loan will be cleared?
	   iii) What will be the amount paid by Raman in 30th instalment ?
		4

38	Ram, Keshav, Madhav and Pulkit are four friends and they have one card in their hands on which one number is written. The number numbers on their cards are 7, 85, 3 and 432 respectively. Now answer the following:
	
	   i) Insert 3 arithmetic mean's between 7 and 85.
	   ii) Insert 3 geometric mean's between 3 and 432.
		4

Half Yearly Exams (2024-25) Set-A

Subject → Applied maths

Class – XI

Marking Scheme / Hints to Solⁿ

Note:→ Any relevant answer not mentioned here in but done by students will be suitably awarded.

Q. No	Value Points / Key Points	Value Point	Total Print
1	d) 2^{12}		1
2	a) 9		1
3	a) 81		1
4	b) 6		1
5	b) 12		1
6	a) 45389		1
7	d) {4,12}		1
8	c) 132		1
9	d) $(100011)_2$		1
10	d) 8 and 16		1
11	b) 14400		1
12	c) Father		1
13	a) 67		1
14	b) 33		1
15	a) 46		1
16	b) $E @ B \% F \chi E$		1
17	c) $R - \{1,4\}$		1
18	a) 1/2		1
19	a) Both are true and R is correct explanation of A		1
20	a)		1

(21)

	142	R
2	142	0
2	71	1
2	35	1
2	17	1
2	8	0
2	4	0
2	2	0
2	1	1
	0	1

Decimal Part	Product	Binary
0.125×2	0.250	0
0.250×2	0.500	0
0.500×2	1.000	1

$1+1$ 2

$\therefore 142.125 = 10001110.001$

(22) iii) and iv are true   2   2

(23) Total no. of possible ways $= {}^3C_3 \times {}^4C_2 \times 5 \cdot 6$ $1+1$ 2

$= 720$

(24) $\lim\limits_{x \to 4} \dfrac{x^3 - 64}{x^2 - 16} \times \dfrac{x - 4}{x - 4}$ 1

$\dfrac{\lim\limits_{x \to 4} \dfrac{x^3 - 4^3}{x - 4}}{\lim\limits_{x \to 4} \dfrac{x^2 - 4^2}{x - 4}} = \dfrac{3 \times 4^2}{2 \times 4} = 6$ 1   2

(25) $R = \{(2,4), (4,3), (6,2), (8,1)\}$ 1

Domain $= \{2, 4, 6, 8\}$ $\frac{1}{2}$

Range $= \{4, 3, 2, 1\}$ $\frac{1}{2}$ 2

(26) $f(x) = \sqrt{x - 3}$

for $f(x)$ to exists on real line $\frac{1}{2}$

$x - 3 \geq 0 \Rightarrow x \geq 3$

$\Rightarrow x \in [3, \infty)$ 1

$\Rightarrow D_f = [3, \infty)$

Range $y = \sqrt{x - 3}$

$y^2 = x - 3$ $\frac{1}{2}$

$\Rightarrow x = y^2 + 3$

$x \geq 3 \Rightarrow y^2 + 3 \geq 0$ 1

$\Rightarrow y \in [0, \infty)$ $y^2 \geq 0$ Range $= [0, \infty)$

27

$$m = a^{\frac{1}{3}} + a^{-\frac{1}{3}}$$

$$m^3 = a + a^{-1} + 3\left(a^{\frac{1}{3}} + a^{-\frac{1}{3}}\right)$$

$$m^3 = a + \frac{1}{a} + 3m$$

$$m^3 - 3m = a + \frac{1}{a} \qquad \text{Hence Proved}$$

1	
1	
1	3

28

Let Ist term and common difference and sum of first AP. $= a, d, S_n$

Let for second AP. $= a', d', S_n'$

So, $\dfrac{S_n}{S_n'} = \dfrac{14-4n}{3n+5}$

$$\Rightarrow \frac{\frac{n}{2}\left[2a + (n-1)d\right]}{\frac{n}{2}\left[2a' + (n-1)d'\right]} = \frac{14-4n}{3n+5}$$

$$\Rightarrow \frac{2\left[a + \left(\frac{n-1}{2}\right)d\right]}{2\left[a' + \frac{(n-1)}{2}d'\right]} = \frac{14-4n}{3n+5}$$

Put $n = 17$

$$\Rightarrow \frac{a + 8d}{a' + 8d'} = \frac{-54}{56}$$

$$\Rightarrow \frac{a_9}{a_9'} = \frac{-27}{28}$$

$\frac{1}{2}$	
$\frac{1}{2}$	
$1\frac{1}{2}$	3
$\frac{1}{2}$	

29

(i) 20

(ii) 30   (Using Venn Diagrams)

(iii) 5

1	
1	
1	

30

L.H.L.

$$\lim_{x \to 2^-} 2x+3$$
$$\lim_{h \to 0} 2(2-h)+3$$
$$7$$

R.H.L.

$$\lim_{x \to 2^+} x+3k$$
$$\lim_{h \to 0} 2+h+3k$$
$$= 2+3k$$

$$\Rightarrow 2+3k = 7$$
$$\Rightarrow 3k = 5$$
$$k = 5/3$$

$1+1$	
1	3

(31)

$f(x) = ax + b$

$f(1) = 1 \qquad a + b = 1$

$f(2) = 3 \qquad 2a + b = 3$

On solving $a = 2, \ b = -1$

So, $f(x) = 2x - 1$

(32)

$a^x = b^y = c^z = d^w = K$

$\Rightarrow a = K^{\frac{1}{x}}, \quad b = K^{\frac{1}{y}}, \quad c = K^{\frac{1}{z}}, \quad d = K^{\frac{1}{w}}$

$\Rightarrow \log a = \frac{1}{x} \log K, \quad \log b = \frac{1}{y} \log K, \quad \log c = \frac{1}{z} \log K$

$\Rightarrow \frac{1}{x} = \frac{\log a}{\log K} = \log_K a$

$\Rightarrow \frac{1}{y} = \frac{\log b}{\log K} = \log_K b$

$\Rightarrow \frac{1}{z} = \frac{\log c}{\log K} = \log_K c$

$\Rightarrow \frac{1}{w} = \frac{\log d}{\log K} = \log_K d$

R.H.S $\quad x\left(\frac{1}{y} + \frac{1}{z} + \frac{1}{w}\right)$

$= \frac{1}{\log_K a}\left(\log_K b + \log_K c + \log_K d\right)$

$= \frac{\log_K (bcd)}{\log_K a}$

$= \frac{\frac{\log bcd}{\log K}}{\frac{\log a}{\log K}} = \frac{\log bcd}{\log a}$

$= \log_a bcd$

$= L.H.S$

(33)

L.H.L. $\to 3$

R.H.L. $= \lim_{x \to 1^+} x^2 + 2$

$= \lim_{h \to 0} (1+h)^2 + 2$

$= 3$

$f(1) = 2x + 1 = 2 \times 1 + 1 = 3$

$\Rightarrow f(x)$ is continuous at $x = 1$

(34) $^{22}P_{\lambda+1} : {}^{20}P_{\lambda+2} = 11 : 52$

$$\frac{22!}{(22-(\lambda+1))!} \times \frac{(20-\lambda-2)!}{20!} = \frac{11}{52}$$

On solving

$$(21-\lambda)(20-\lambda)(19-\lambda) = 14 \times 13 \times 12$$

On Comparing

$$\boxed{\lambda = 7}$$

	1
Full Sol" 4	5

(35) $\frac{1}{9} \times 9 \left(1 + 11 + 111 + 1111 + \underline{\quad} \; n \text{ terms} \right)$

$\frac{1}{9} \left(9 + 99 + 999 + \underline{\quad} \; n \text{ terms} \right)$

$\frac{1}{9} \left((10-1) + (100-1) + (1000-1) + \underline{\quad} n \text{ terms} \right)$

$\frac{1}{9} \left(\left(10 + 10^2 + 10^3 + \underline{\quad} \right) - n \right)$

$\frac{1}{9} \left(\frac{10(10^n - 1)}{10 - 1} - n \right)$

$\frac{1}{9} \left(\frac{10(10^n - 1)}{9} \right) - \frac{n}{9}$

1	
1	
1	
1	
1	5

(36) (i) atleast 3 girls $= {}^9C_0 \times {}^4C_3$

$= 4$

(ii) atmost 2 girls $\rightarrow$ 0.G 3B + 1G 2B + 2G 1B

$= {}^9C_3 \times {}^4C_0 + {}^9C_2 \times {}^4C_1 + {}^9C_1 \times {}^4C_2$

$= 84 + 144 + 54$

$= 282$

1	
3	4

(37) 1000, 1100, 1200, $\underline{\quad}$

1) Ist term $= 1000$, Common difference $= 100$

ii) $S_n = 118000 = \frac{n}{2} \left[2a + (n-1)d \right]$

On Solving $n^2 + 17n - 236 = 0$

$\Rightarrow n = -59,$ $\boxed{n = 40}$ Ans

(Not Possible)

1	
2	

(iii) $a_{30} = a + 29d$

$\qquad = 3900$

(98) i) $7, A_1, A_2, A_3, 85$

$\qquad a = 7, \qquad a_4 = a + 3d = 85$

$\qquad\qquad\qquad\qquad d = \dfrac{39}{2}$

$\qquad A_1 = a + d = 7 + \dfrac{39}{2} = 26.5$

$\qquad A_2 = a + 2d = 46$

$\qquad A_3 = a + 3d = 65.5$

(ii) $\qquad 3, G_1, G_2, G_3, 432$

$\qquad\qquad a = 3$

$\qquad\qquad a_4 = ar^3 = 432$

$\qquad\qquad\qquad r = 2\sqrt{3}$

$\qquad\qquad G_1 = ar = 3 \times 2\sqrt{3} = 6\sqrt{3}$

$\qquad\qquad G_2 = ar^2 = 3 \times 2\sqrt{3} \times 2\sqrt{3}$

$\qquad\qquad\qquad\qquad = 36$

$\qquad\qquad G_3 = ar^3 = 3 \times 2 \times 2 \times 2 \times \sqrt{3} \times \sqrt{3} \times \sqrt{3}$

$\qquad\qquad\qquad\qquad = 72\sqrt{3}$

1

4

2

2 4

OSDAV Public School, Kaithal

Half yearly Exams (2024-25)

SET- B

Class : XI

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General Instructions:-

1   **All questions are compulsory.**
2   **This question paper has 5 Sections. Section A has 20 questions of 1 mark each which includes 18 M.C.Q.'s and 2 Assertion Reasons Section B has 5 Questions of 2 marks each. Section C has 6 questions of 3 marks each. Section D has 4 questions of 5 mark each and Section E has 3 case study based question of 4 marks each.**

Q.N.	Questions	Marks
1	The sum of an infinite G.P. is 8 and its first term is 3 then the common ratio of the G.P. is a) 8/5 b) 5/8 c) 8/3 d) -1/2	1
2	If $^{10}_rP = 2\,^9_rP$ then r is a) 5 b) 8 c) 10 d) 1	1
3	If $log_{25} x = 0$ then value of x is a) 81 b) 9 c) 1 d) 256	1
4	The 5th term of A. P. is 10 and 10th term is zero then its first term will be a) 5 b) -2 c) 7 d) 18	1
5	If $^n_8C = ^n_9C$ then n is a) 20 b) 17 c) 6 d) 30	1
6	If in certain code, FRIEND is written as FPIBNZ, then PATRON is written as a) PYTOOJ b) PTOOJY c) POOJYT d) PYJOOT	1
7	If A = { 4, 5, 8, 12} and B = { 5, 6, 7, 8, 9} then B - A is a) {5} b) { 6, 7, 9} c) { 5,8} d) { 4, 12}	1
8	Pick the odd one out in the series: 7, 13, 19, 25, 29, 37, 43 a) 43 b) 7 c) 19 d) 29	1
9	Which of the following binary number is equivalent to decimal number 76? a) $(1001100)_2$ c) $(10001010)_2$ b) $(100000)_2$ d) $(100011)_2$	1
10	The two geometric means between the numbers 1 and 64 are a) 1 and 64 b) 4 and 16 c) 23 and 43 d) 8 and 16	1

11	The number of ways in which 4 boys and 2 girls can be arranged so that no two girls may sit together, is a) 480 b) 400 c) 6! d) ^4_2P	1
12	Pointing to Rohan, Ruchi says, "I am the daughter of the only son of his grandfather." How is Ruchi related to Rohan? a) Sister b) Cousin c) Mother d) Niece	1
13	If 3 # 6 @ 9 = 45 and 9 # 8 @7 = 105, then the value of 5 @ 6 # 3 is a) 67 b) 68 c) 66 d) 65	1
14	Find the odd one out: 253, 136, 352, 460, 324, 631, 244 a) 631 b) 136 c) 324 d) 244	1
15	If E = 5 and READ = 7, then what will be the code for 'DEAR'. a) 7 b) 17 c) 28 d) 5	1

16	If M % N means M is the son of N, M @ N means M is the sister of N, M $ N means M is the father of N, then which of the following indicates that C is the granddaughter of E?
	
	    a) C % B $ F $ E c) B $ F $ E % C
	    b) C @ B % F % E d) E % B $ F $ C
		1

17	The domain of the function $f(x) = \frac{x^2+2x+1}{x^2-8x+12}$ is a) {2, 6} b) (2, 6) c) R – {2, 6} d) R – (2, 6)	1
18	If P = {9,10} and Q = {1, 2, 3, 4} and R is a relation from set P to set Q then number of relations from set P to set Q are If P = {9,10} and Q = {1, 2, 3, 4} and R is a relation from set P to set Q then number of relations from set P to set Q are 12 b) 7 c) 2^8 d) 2^{12}	1

	Assertion Reason Based Questions:
	
	Choose according to these options in Q 19 and 20
	
	    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 the correct explanation of A.**
	    c) **A is true and R is false.**
	    d) **A is false and R is true.**	

19	**Assertion (A) :** If the numbers $\frac{-3}{11}$, k , $\frac{-11}{3}$ are in G.P. then k = ± 1 **Reason (R) :** If a_1, a_2, a_3 are in G. P. then $\frac{a_1}{a_3} = \frac{a_2}{a_3}$	1
20	**Assertion (A):** $\lim\limits_{x \to 0} \frac{(x+2)^3-8}{x} = 12$	1

	Reason (R) : $\lim\limits_{x \to a} \dfrac{x^n - a^n}{x - a} = n\, a^{n-1}$		
	Section – B		
21	Convert 59.8125 into its binary representation.		2

22	Check which of the following conclusions can be logically drawn from given statements.
	
	Statements: All the cars are cycles. Some cycles are scooters.
	
	Conclusion:
	
	    i) All the cars are scooters.
	    ii) Some cars are scooters..
	    iii) Some scooters are cycles.
	    iv) Some cycles are cars
			2

23	How many words each of 3 vowels and 2 consonants can be formed from the letter of word DAUGHTER		2
24	Evaluate: $\lim\limits_{x \to 1} \dfrac{x^{15} - 1}{x^{10} - 1}$		2

25	Let A be the set of first fourteen natural numbers and let R be a relation on A defined by R= $\{(x, y): x \in A, y \in A$ and $3x - y = 0\}$.
	
	    (i) Write R in its roster form.
	    (ii) Write domain and range of R.
			2

	Section – C		
26	Let f = $\{(1, 1), (2, 3), (0, -1), (-1, -3)\}$ be a linear function defined as $f(x) = ax + b$ from Z to Z. Find f(x).		3
27	If pqr = 1, show that $\dfrac{1}{1+p+q^{-1}} + \dfrac{1}{1+q+r^{-1}} + \dfrac{1}{1+r+p^{-1}} = 1$		3
28	Find three numbers in G.P. whose sum is 19 and whose product is 216.		3

29	In a group of athletic teams in a school, 21 are in the basketball team; 26 in the hockey team and 29 in the football team. If 14 play hockey and basketball; 12 play football and basketball; 15 play hockey and football and 8 play all the three games. Find
	
	    i) How many players are there in all.
	    ii) How many play football only.
			3

30	Evaluate the limit if it exist: $\lim\limits_{x \to 2} \dfrac{|x-2|}{x-2}$		3
31	Find the domain and range of the function : $f(x) = \sqrt{5 - x}$		3
	Section – D		
32	If $a^2 + b^2 = 7ab$, prove that $2 \log(a - b) = \log 5 + \log a + \log b$		5

33	Find the value of k so that given function is continuous at x = 0	5
	$f(x) = \{ \begin{array}{l} 2x^2 + k, \ if \ x \geq 0 \\ -2x^2 + k, if \ x < 0 \end{array} \}$	
34	If $_{r+1}^{10}P : _{r}^{11}P = 30 : 11,$ find r	5
35	Find the sum of given series to n terms:	5
	$5 + 55 + 555 + 5555 + \ldots\ldots\ldots..$	
	Section – E	
36	Ram, Keshav, Madhav and Pulkit are four friends and they have one card in their hands on which one number is written. The number numbers on their cards are 7, 85, 3 and 432 respectively. Now answer the following: i) Insert 3 arithmetic mean's between 7 and 85. ii) Insert 3 geometric mean's between 3 and 432.	4
37	Raman took a loan of ₹ 1,00,000 from a branch of SBI, but could not repay the amount on time due to some reason which result in accumulation of interest and the outstanding amount in his name accrued to ₹ 1,18,000. Raman now decides to repay the outstanding amount of ₹ 1,18,000 by paying every month, starting with first instalment of ₹ 1000 and increasing the instalment by ₹ 100 every month. Based on the above information answer the following questions. i) What is the first term and common difference of the A.P. formed by the sequence of instalments? ii) In how many months the loan will be cleared? iii) What will be the amount paid by Raman in 30th instalment ?	4
38	Mr. X planned to make a committee of 3 members from 9 boys and 4 girls. In how many ways can this be done when the committee consists of i) Atleast 3 girls ii) Atmost 2 girls	4

Half Yearly Exams 2024-25   Set-B
Subject → Applied maths
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Marking Scheme / Hints to Solution

Note :→ Any relevant answer not mentioned here in but done by students is suitably awarded.

1	b) $5/8$
2	a) 5
3	c) 1
4	d) 18
5	b) 17
6	a) PY T00J
7	b) $\{6,7,9\}$
8	29
9	a) $\left(100\,\|\,100\right)_2$
10	b) 4 and 16
11	a) 480
12	a) Sister
13	b) 68
14	c) 324
15	a) 7
16	b) $C @ B \% F \% E$
17	c) $R - \{2,6\}$
18	c) 2^8
19	c) A is true and R is false
20	a) Both are true and R is correct explanation of A

(21)

2	59	R
2	29	1
2	14	1
2	7	0
2	3	1
2	1	1
2	0	1

Decimal Part	Product	Binary
0.8125×2	1.6250	1
0.625×2	1.250	1
0.25×2	0.50	0
0.50×2	1.00	1

$$59.8125 = (111011.1101)$$

(22) iii) and iv) are true.

(23) No. of ways $= 3_{P_2} \times 5_{C_2} \times 3_{C_3} \times 5!$

$$= \frac{5!}{2! \, 3!} \times \frac{3!}{3! \times 0!} \times 120$$

$$= \frac{5 \times 4}{2} \times 120 = 1200$$

(24) $\lim_{x \to 1} \dfrac{x^{15} - 1}{x^{10} - 1} \times \dfrac{x - 1}{x - 1}$

$$= \frac{15 (1)^{14}}{10 (1)^{9}} = \frac{3}{2}$$

(25) $R = \{(1,3), (2,6), (3,9), (4,12)\}$

Domain $= \{1, 2, 3, 4\}$

Range $= \{3, 6, 9, 12\}$

(26) Same as set A

(27) LHS. $\dfrac{1}{1 + p + \frac{1}{q}} + \dfrac{1}{1 + q + \frac{1}{r}} + \dfrac{1}{1 + r + \frac{1}{p}}$ $\qquad pq = \frac{1}{r}$

$$\frac{q}{q + pq + 1} + \frac{r}{1 + rq + 1} + \frac{p}{p + pr + 1}$$

$$\frac{q}{q + pq + 1} + \frac{\frac{1}{pq}}{\frac{1}{pq} + \frac{1}{pq}q + 1} + \frac{p}{p + pr \cdot \frac{1}{pr} + 1}$$

$$\frac{q}{q + pq + 1} + \frac{1}{1 + q + pq} + \frac{pq}{pq + 1 + q}$$

$$\frac{q + 1 + pq}{q + 1 + pq} = 1 = RHS$$

(28) Let no. are $\frac{a}{r}, a, ar$

$\Rightarrow \frac{a}{r} \times a \times ar = 216$

$a^3 = 216$

$a = 6$

$\frac{a}{r} + a + ar = 19$

$\frac{6}{r} + 6 + 6r = 19$

$6 + 6r + 6r^2 = 19r$

$6r^2 - 13r + 6 = 0$

$6r^2 - 9r - 4r + 6 = 0$

$3r(2r - 3) - 2(2r - 3) = 0$

$r = \frac{2}{3}, \frac{3}{2}$

$\Rightarrow$ No. = Ist $\frac{6}{2} \times 3 = 9$

IInd = 6

IIIrd $= 6 \times \frac{2}{3} = 4$

(29) i) 43

ii) 10 (Using Venn Diagram)

(30) LHL $\rightarrow \lim\limits_{x \to 2^-} \frac{|x-2|}{x-2} = \lim\limits_{h \to 0} \frac{|2-h-2|}{2-h-2}$

RHL $\rightarrow \lim\limits_{x \to 2^+} \frac{|x-2|}{x-2} = \frac{[2+h-2]}{2+h-2} = 1$

So, limit does not exist

(31) $f(x) = \sqrt{5-x}$

for $f(x)$ to exist on real line

$5 - x \geq 0$

$5 \geq x \qquad \Rightarrow \qquad x \in (-\infty, 5]$

$D_f = (-\infty, 5]$

Range $y = \sqrt{5-x}$

$y^2 = 5 - x$

$x = 5 - y^2$

$x \leq 5 \qquad \Rightarrow \qquad 5 - y^2 \leq 5$

$5 - 5 \leq y^2$

$y^2 \geq 0 \qquad \Rightarrow \qquad y \geq 0 \qquad y \in [0, \infty)$

(32)

$a^2 + b^2 = 7ab$

$a^2 + b^2 - 2ab = 7ab - 2ab$

$(a-b)^2 = 5ab$

Take log on both sides

$2 \log(a-b) = \log(5ab)$

$= \log 5 + \log a + \log b$

(33)

LHL $\lim\limits_{x \to 0^-} (-2n^2 + k)$

$\lim\limits_{h \to 0} -2(0-h)^2 + k$

$= k$

RHL $\lim\limits_{x \to 0^+} 2x^2 + k$

$\lim\limits_{h \to 0} 2(0+h)^2 + k = k$

$f(e) = 2n^2 + k = 2(0)^2 + k = k$

so, k can be real number

(34)

$\dfrac{^{10}P_{\lambda+1}}{^{11}P_{\lambda}} = \dfrac{30}{11}$

$\dfrac{10!}{(10-\lambda-1)!} \times \dfrac{(11-\lambda)!}{11!} = \dfrac{30}{11}$

on solving

$(11-\lambda)(10-\lambda) = 6 \times 5$

$11 - \lambda = 6$

$\lambda = 5$

(35)

$5 + 55 + 555 + \underline{\quad}$

$9 \times \dfrac{5}{9}(1 + 11 + 111 + \underline{\quad})$

$\dfrac{5}{9} [9 + 99 + \underline{\quad}]$

$\dfrac{5}{9}((10-1) + (10^2-1) + \underline{\quad})$

$$= \frac{5}{9} \left((10 + 10^2 + \cdots) - n \right)$$

$$= \frac{5}{9} \left(\frac{10(10^n - 1)}{9} - n \right)$$

$$= \frac{5 \times 10(10^n - 1)}{81} - \frac{5n}{9}$$

$$= \frac{50(10^n - 1)}{81} - \frac{5n}{9}$$
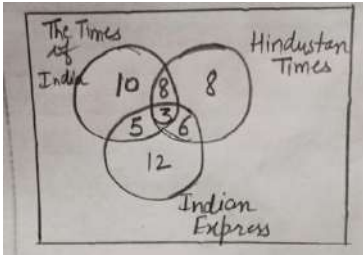
OSDAV Public School, Kaithal

Half yearly Exams (2024-25)

SET- A

Class : XI

Subject : Core Maths(Additional)

Time: 3 Hrs .   M.M. : 80

General Instructions:-

1   **All questions are compulsory.**
2   **This question paper has 5 Sections. Section A has 20 questions of 1 mark each which includes 18 M.C.Q.'s and 2 Assertion Reasons Section B has 5 Questions of 2 marks each. Section C has 6 questions of 3 marks each. Section D has 4 questions of 5 mark each and Section E has 3 case study based question of 4 marks each.**

Q.N.	Questions	Marks
1	If U = { 1, 2, 3, ………. , 12} , A = { 8, 9, 10, 11} and B = { 1, 2, 3, 4, 5, 7, 8, 9} then B' - A' is a) { 1, 2, 3, 4, 5, 7} b) { 6, 8, 9, 10, 11, 12} c) {10, 11} d) ∅	1
2	If $3\ ^{n}_{4}P = 5\ ^{n-1}_{4}P$, n > 4 then the value of n is a) -3 b) 10 c) 5 d) 3	1
3	A $\cap A'$ = ____ a) A b) ∅ c) A' d) U	1
4	The coefficient of x^5 in the expansion of $(x^2 + \frac{3}{x})^4$ is a) 12 b) 54 c) 108 d) 81	1
5	In a circle of diameter 30 cm, the length of chord is 15 cm , then the length of minor arc of the chord is a) $\frac{20\pi}{3}$ b) $\frac{15\pi}{3}$ c) $\frac{20\pi}{4}$ d) $\frac{15\pi}{4}$	1
6	If A = {1, 8, 27, 64, 125} then the number of subsets of A are a) 32 b) 16 c) 31 d) 5	1
7	Which of the following relations are functions : a) {(5,7), (6, 8), (7,8), (7, 9)} c) { (5, 1), (5,2)} b) { (5,7), (6,7), (7,7), (8,7)} d) { (7,8), (8,9), (8, 10)}	1
8	The solution of the inequality : 5x – 3 < 7 , when x is a natural number is a) {1} b) {1, 2} c) (1,2) d) no solution	1
9	If z = 2 + 2i then the value of $|z - 1|$ is a) $\sqrt{3}$ b) $\sqrt{8}$ c) $\sqrt{5}$ d) $\sqrt{2}$	1

| 10 | The conjugate of $\frac{7}{7+i}$ is

a) $\frac{49-7i}{50}$ b) $\frac{57}{7+i}$ c) $\frac{49+7i}{50}$ d) $\frac{-7}{7+i}$ | 1 |
|---|---|---|
| 11 | The value of $2sin^2 \frac{\pi}{6} + cosec^2 \frac{7\pi}{6} \, cos^2 \frac{\pi}{3}$ is

a) $\frac{1}{2}$ b) $\frac{3}{2}$ c) $-\frac{1}{2}$ d) $-\frac{3}{2}$ | 1 |
| 12 | The value of tan 15° is

a) $2 - \sqrt{3}$ b) $2 + \sqrt{3}$ c) $2 - \sqrt{2}$ d) $2\sqrt{3}$ | 1 |
| 13 | The number of terms in the expansion of $(x^2 + 2x + 1)^{40}$ is

a) 41   b) 80   c) 41   d) 81 | 1 |
| 14 | The solution of the inequality :   -8x + 6 ≤ -2 , for x∈ R is

a) $[1, \infty)$ b) $(1, \infty)$ c) N   d) {1} | 1 |
| 15 | Let R be a relation " less than" from A = {1, 2, 3, 4, 5} to B = { 1, 4, 5} then the

    domain of this relation is

a) { 4, 5}   b) {1, 2, 3, 4}   c) { 5}   d) { 1, 2, 3, 4, 5} | 1 |
| 16 | The multiplicative inverse of 2 - 3i is

a) $2 + 3i$ b) $\frac{1}{2+3i}$ c) $\frac{2+3i}{13}$ d) $\frac{5+2i}{3}$ | 1 |
| 17 | Let A = {1, 8, 27, 64, 125} , B = {1, 2, 3, 4, 5, 6} and R be the relation ' is cube of' from A to B. Then range of R is

a){(1,1), (8, 2), (27, 3), (64, 4), (125, 5)}   c) {1, 8, 27, 64, 125}

b) {1, 2, 3, 4, 5, 6}   d) {1, 2, 3, 4, 5} | 1 |
| 18 | If tan x = 3 then tan 3x is equal to

a) 9   b) $\frac{9}{13}$ c) $\frac{-9}{13}$ d) -9 | 1 |
| | **Assertion Reason Based Questions:**

Choose according to these options in Q 19 and 20

  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 the correct explanation of A.**
  c) **A is true and R is false.**
  d) **A is false and R is true.** | |
| 19 | **Assertion (A):** The value of $i^2 + i^4 + i^6 +$ ………….. $+ i^{20}$ is 1

    Reason (R) : i^{4n} = 1, n∈ Z | 1 |
| 20 | **Assertion (A):** The number of non-empty subsets of the set {1, 3, 5, 7, 9) is 31.

    Reason (R) : The number of proper subsets of the set A when n(A) = k is $2^k - 1$ | 1 |

	Section – B	
21	Prove that $cos^2 2x$ - $cos^2 6x$ = sin 4x sin 8x	2
22	The figure shows a relation from a set X to a set Y. Write the above relation in Roster form. Is the above relation a function? Give reason in support of your answer.	2
23	Draw the graph of constant function. Also find the domain and range of constant function.	2
24	Expand $(\frac{2}{x} - \frac{x}{2})^5$ using binomial theorem.	2
25	In how many ways a committee of 7 has to be formed from 9 boys and 4 girls, when the committee consists of exactly 3 girls.	2
	Section – C	
26	Expand using binomial theorem $(\sqrt{3} + \sqrt{2})^4$ - $(\sqrt{3} - \sqrt{2})^4$	3
27	Prove that cos 6x = $32 \, cos^6 x - 48 \, cos^4 x + 18 \, cos^2 x - 1$	3
28	Solve the inequalities and represent the solution on number line for real value of x: 3x – 7 > 2(x - 6) and 6 – x > 11 – 2x	3
29	How many words with or without meaning , can be formed using all the letters of the word EQUATION at a time so that vowels and consonants occur together?	3
30	If $\frac{(x+i)^2}{2x^2+1}$ = u + iv, then show that $\frac{(x^2+1)^2}{(2x^2+1)^2} = u^2 + v^2$	3
31	The sum of first three terms of a G.P. is $\frac{39}{10}$ and their product is 1. Find the common ratio and terms.	3
	Section – D	
32	In an examination, a question paper consists of 12 questions divided into two parts i.e. Part I and Part II, containing 5 and 7 questions, respectively. A student is required to attempt 8 questions in all, selecting at least 3 from each part. In how many ways can a student select the questions?	5

33	The ratio of A.M. and G.M. of two positive numbers a and b, is m : n. Show that $$a: b = (m + \sqrt{m^2 - n^2}) : (m - \sqrt{m^2 - n^2})$$	5
34	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 $\sin x = \frac{1}{4}$, x lies in second quadrant, then find $\sin \frac{x}{2}$, $\cos \frac{x}{2}$, $\tan \frac{x}{2}$.	5
35	Find the domain and range of the function $\frac{x^2}{1+x^2}$	5

Section – E

36	Mr. Kumar buys bank's cash certificates every year of value exceeding the last year purchase by ₹ 25. After 20 years he finds that the total value of the certificates purchase by him is ₹ 7250. (i) Find the value of certificates purchased by him in first year. (ii) Find the value of certificates purchased by him in the 13th year. (iii) Find the total value of certificates purchased by him after 13 years.	4
37	A survey is conducted by Ram and his friends about how many people read different editions of newspaper in his society of 60 people. People in his society ate reading these three newspapers mainly that are **The Times of India, Hindustan Times and Indian Express.** He created a Venn diagram to understand the choices of people as shown below: i) How many people read only Indian Express? ii) How many people read none of these three newspapers? iii) How many people read Hindustan Times and The Times of India but not Indian Express?	4
38	There are 10 friends A, B, C, D, E, F, G, H, I, J. They are supposed to sit in a line. Find the number of ways: i) If sitting arrangement starts with A and ends with J. ii) If A, B, C, D, E will sit together and F, G, H, I, J will sit together.	4

Note :→ Any other relevant answer not given here in but given by the students are suitably awarded

Q.No.	Value Points / Key Points Section-A	Marks allotted to each Key Point	Total Points
1	c) $\{10, 11\}$		1
2	b) 10		1
3	b) ϕ		1
4	a) 12		1
5	b) $\dfrac{15\pi}{3}$		1
6	a) 32		1
7	b) $\{(5,7), (6,7), (7,7), (8,7)\}$		1
8	a) $\{1\}$		1
9	c) $\sqrt{5}$		1
10	c) $\dfrac{49+7i}{50}$		1
11	b) $\dfrac{3}{2}$		1
12	a) $2-\sqrt{3}$		1
13	d) 81		1
14	a) $[1, \infty)$		1
15	b) $\{1, 2, 3, 4\}$		1
16	c) $\dfrac{2+3i}{13}$		1
17	d) $\{1, 2, 3, 4, 5\}$		1
18	b) $\dfrac{9}{13}$		1
19	d) A is false and R is true		1
20	b) Both A and R are true and R is not the correct explanation of A		1

Section - B

Q21

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

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

$= -2\sin 4x \cdot \sin(-2x) \cdot 2\cos 4x \cdot \cos(-2x)$

$= (2\sin 4x \cos 4x)(2\sin 2x \cos 2x)$

$= \sin 8x \sin 4x = $ R.H.S

½

1

½   2

Q22

$R = \{(5,4), (7,9), (9,8), (12,7), (6,0)\}$

Yes, the above relation is function as every element of x has unique image in Y.

1

1   2

Q23

$f(x) = c$ where $c \in R$

$D_f = R$ and $R_f = \{c\}$

1+1   2

$f(x) = c, c > 0$

$f(x) = -c$

Q24
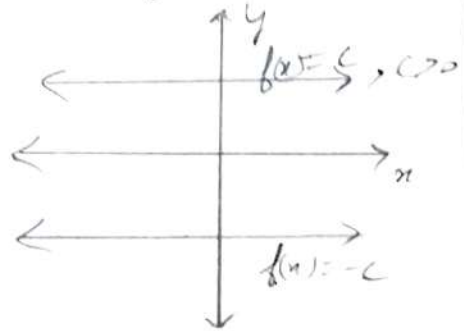
$\left(\frac{2}{x} - \frac{x}{2}\right)^5$

$= 5c_0\left(\frac{2}{x}\right)^5 + 5c_1\left(\frac{2}{x}\right)^4\left(-\frac{x}{2}\right) + 5c_2\left(\frac{2}{x}\right)^3\left(-\frac{x}{2}\right)^2 + 5c_3\left(\frac{2}{x}\right)^2\left(-\frac{x}{2}\right)^3$

$+ 5c_4\left(\frac{2}{x}\right)\left(-\frac{x}{2}\right)^4 + 5c_5\left(-\frac{x}{2}\right)^5$

1

$= \frac{32}{x^5} - \frac{40}{x^3} + \frac{20}{x} - 5x + \frac{5}{8}x^3 - \frac{x^5}{32}$

1   2

Q25

No. of boys = 9,   No. of girls = 4

No. of ways to form a committee of 7 which consists of exactly 3 girls $= {}^9C_4 \times {}^4C_3$

1

$= \frac{9!}{4!5!} \times \frac{4!}{3!1!}$

$= \frac{9 \times 8 \times 7 \times 6}{3 \times 2 \times 1} = 504$

1   2

Section - C

Q26

$(\sqrt{3} + \sqrt{2})^4 - (\sqrt{3} - \sqrt{2})^4$

$[(a+b)^4 - (a-b)^4 = (4c_0 a^4 + 4c_1 a^3 b + 4c_2 a^2 b^2 + 4c_3 ab^3 + 4c_4 b^4)$

$- (4c_0 a^4 - 4c_1 a^3 b + 4c_2 a^2 b^2 - 4c_3 ab^3 + 4c_4 b^4)$

$= 2(4c_1 a^3 b + 4c_3 ab^3)$

$= 2(4a^3 b + 4ab^3) = 8a^3 b + 8ab^3$

1+1

Take $a = \sqrt{3}$, $b = \sqrt{2}$

$\Rightarrow (\sqrt{3}+\sqrt{2})^4 - (\sqrt{3}-\sqrt{2})^4 = 8 \times (\sqrt{3})^3 \sqrt{2} + 8(\sqrt{3})(\sqrt{2})^3$

$= 8 \times 3\sqrt{6} + 8 \times 2\sqrt{6}$

$= 24\sqrt{6} + 16\sqrt{6} = \boxed{40\sqrt{6}}$

1   3

Q27

L·H·S $\cos 6n = \cos(2 \times 3n)$

$= 2\cos^2 3n - 1$

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

$= 2(16\cos^6 n + 9\cos^2 n - 24\cos^4 n) - 1$
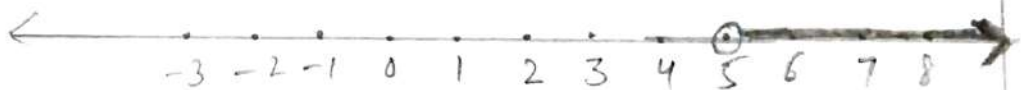
$= 32\cos^6 n + 18\cos^2 n - 48\cos^4 n - 1$

$= R·H·S·$

$\frac{1}{2}$

1

1

$\frac{1}{2}$ 3

Q28

$3x - 7 > 2(x-6)$	$6-x > 11 - 2n$
$3x - 2n > -12 + 7$	$6 - 11 > -2n + n$
$n > -5$	$-5 > -n$
$\Rightarrow x \in (-5, \infty)$	$-x < -5$
	$\Rightarrow n > 5$
	$\Rightarrow n \in (5, \infty)$

$\Rightarrow \quad x \in (5, \infty)$

1+1

1   3

Q29

EQUATION

No. of words formed using all the letters of the word EQUATION so that vowels and consonants occur together are

$\boxed{E \, U \, A \, I \, O} \; \boxed{Q \, T \, N}$

$= 2! \times 5! \times 3! = 2 \times 120 \times 6$

$= 1440$

2

1   3

Q30

$\dfrac{(x+i)^2}{2x^2+1} = u + iv$

$\dfrac{x^2 - 1 + 2xi}{2x^2 + 1} = u + iv$

Comparing real and imaginary part

$u = \dfrac{x^2-1}{2x^2+1}$, $v = \dfrac{2x}{2x^2+1}$

Now $u^2 + v^2 = \left(\dfrac{x^2-1}{2x^2+1}\right)^2 + \left(\dfrac{2x}{2x^2+1}\right)^2$

$= \dfrac{x^4 + 1 - 2x^2 + 4x^2}{(2x^2+1)^2} = \dfrac{x^4 + 2x^2 + 1}{(2x^2+1)^2} = \dfrac{(x^2+1)^2}{(2x^2+1)^2}$

Hence Proved.

1

2   3

Q31)

Let us suppose that first three terms of G.P. are $\frac{a}{r}$, a, ar

A.T.Q.

$$\frac{a}{r} + a + ar = \frac{39}{10} \qquad \text{and} \quad \frac{a}{r} \times a \times ar = 1$$

$$\Rightarrow a^3 = 1$$

Now put $a = 1$

$$\Rightarrow a^3 - 1 = 0$$

$$\Rightarrow \frac{1}{r} + 1 + r = \frac{39}{10}$$

$$\Rightarrow (a-1)(a^2 + 1 + a) = 0$$

$$\Rightarrow \frac{1 + r + r^2}{r} = \frac{39}{10}$$

$$\Rightarrow a - 1 = 0 \quad \Big| \quad a^2 + a + 1 = 0$$

$$\Rightarrow \boxed{a = 1} \quad \Big| \quad D = \sqrt{1 - 4}$$

$$= \sqrt{-3}$$

$$\Rightarrow 10 + 10r + 10r^2 = 39r$$

$$D < 0$$

$$\Rightarrow 10r^2 - 29r + 10 = 0$$

No real values of (a)

$$\Rightarrow \frac{1}{r} + r = \frac{39}{10} - 1$$

$$\Rightarrow \frac{1}{r} + r = \frac{29}{10}$$

$$\Rightarrow \frac{1 + r^2}{r} = \frac{29}{10}$$

$$\Rightarrow 10r^2 - 29r + 10 = 0$$

$$\Rightarrow 10r^2 - 25r - 4r + 10 = 0$$

$$\Rightarrow 5r(2r - 5) - 2(2r - 5) = 0$$

$$\Rightarrow (2r - 5)(5r - 2) = 0$$

$$\Rightarrow r = \frac{5}{2}, \frac{2}{5}$$

So, Three terms are $\frac{1}{\frac{5}{2}}$, 1, $\frac{5}{2}$

$$= \frac{2}{5}, 1, \frac{5}{2}$$

$$\left. \text{or } \frac{5}{2}, 1, \frac{2}{5} \right\} \text{ Ans}$$

Section - D.

Q32

No. of questions in Part I = 5
No. of questions in Part II = 7
No. of ways of selecting 8 questions such that Student has to select at least 3 questions from each part are →

① 3 Ques from Part I and 5 Questions from Part 2
② 4 Q ,,,,, ,,,,, ,, 4 ,,,,,,,,,,,,,,,
③ 5 Q ,,,,,,,,,,, and 3 ,,,,,,,,,,,,,

So, No. of Ways = $^5C_3 \times {}^7C_5 + {}^5C_4 \times {}^7C_4 + {}^5C_5 \times {}^7C_3$

$$= \frac{5!}{3!2!} \times \frac{7!}{5! \times 2!} + \frac{5 \times 7!}{4!3!} + 1 \times \frac{7!}{3!4!}$$

$$= \frac{7 \times 6 \times 5 \times 4}{2 \times 2} + \frac{5 \times 7 \times 6 \times 5}{3 \times 2} + \frac{7 \times 6 \times 5}{3 \times 2}$$

$$= 210 + 175 + 35$$

$$= 420 \text{ ways}$$

Q33

A.M. of two numbers a and b = $\frac{a+b}{2}$

G.M. of two members a and b = $\sqrt{ab}$

A.T.Q

$$\frac{a+b}{2\sqrt{ab}} = \frac{m}{n}$$

T.P. $\Rightarrow$ $a = \frac{m + \sqrt{m^2 - n^2}}{b} \quad \frac{m - \sqrt{m^2 - n^2}}{}$

Apply C and D rule

$$\frac{a+b+2\sqrt{ab}}{a+b-2\sqrt{ab}} = \frac{m+n}{m-n}$$

$$\Rightarrow \frac{(\sqrt{a}+\sqrt{b})^2}{(\sqrt{a}-\sqrt{b})^2} = \frac{m+n}{m-n}$$

$$\Rightarrow \frac{\sqrt{a}+\sqrt{b}}{\sqrt{a}-\sqrt{b}} = \sqrt{\frac{m+n}{m-n}}$$

Again Apply C and D rule

$$\Rightarrow \frac{\sqrt{a}+\sqrt{b}+\sqrt{a}-\sqrt{b}}{\sqrt{a}+\sqrt{b}-\sqrt{a}+\sqrt{b}} = \frac{\sqrt{m+n}+\sqrt{m-n}}{\sqrt{m+n}-\sqrt{m-n}}$$

$$\Rightarrow \frac{2\sqrt{a}}{2\sqrt{b}} = \frac{\sqrt{m+n} + \sqrt{m-n}}{\sqrt{m+n} - \sqrt{m-n}}$$

$\Rightarrow$ Squaring both sides

$$\Rightarrow \frac{a}{b} = \frac{m+n+m-n+2\sqrt{m^2-n^2}}{m+n-m+n-2\sqrt{m^2-n^2}}$$

$$\Rightarrow \frac{a}{b} = \frac{m+\sqrt{m^2-n^2}}{m-\sqrt{m^2-n^2}}$$

Hence Proved

Q34

LHS $2\cos\frac{\pi}{13}\cos\frac{9\pi}{13} + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$

$$= 2\cos\frac{\pi}{13}\cos\frac{9\pi}{13} + 2\cos\frac{4\pi}{13}\cdot\cos\left(\frac{-\pi}{13}\right)$$

$$= 2\cos\frac{\pi}{13}\left(\cos\frac{9\pi}{13} + \cos\frac{4\pi}{13}\right)$$

$$= 2\cos\frac{\pi}{13}\left(2\cos\frac{\pi}{2}\cdot\cos\frac{5\pi}{26}\right)$$

$$= 2\cos\frac{\pi}{13}\left(2\times 0\times\cos\frac{5\pi}{26}\right)$$

$$= 0 = R\cdot h\cdot s$$

Q35

$$f(x) = \frac{x^2}{1+x^2}$$

As $f(x)$ exists for all real values of x

So, Domain of $f(x) = R$

for Range of $f(x) \rightarrow$

Let $y = \frac{x^2}{1+x^2}$

$$\Rightarrow y(1+x^2) = x^2$$

$$\Rightarrow y + yx^2 = x^2$$

$$\Rightarrow x^2(y-1) = -y$$

$$\Rightarrow x^2 = \frac{-y}{y-1}$$

$$\Rightarrow x^2 = \frac{y}{1-y}$$

As $x^2 \geq 0$ always so, $\frac{y}{1-y} \geq 0$

→ Case I

$y \geq 0$ and $1 - y > 0$

$y \geq 0$ and $1 > y$

⇒ $y \in [0, 1)$

or   Case II

$y \leq 0$ and $1 - y < 0$

$y \leq 0$ and $1 < y$

No solution

$1 + 1$

⇒ $y \in [0, 1) \cup \phi$

⇒ $y \in [0, 1)$

So, Range of $f(x) = [0, 1)$

$\frac{1}{2}$ 5

Section-E

Q36   Value of certificates that will increase every
year $= ₹25 = d$

Total value of certificates after 20 years $= ₹7250$

i)   The value of certificates purchased by
him in first year $= a = ?$

$$S_{20} = 7250$$

$$\frac{20}{2} \{2a + 19d\} = 7250$$

$$10 \{2a + 19 \times 25\} = 7250$$

$$2a + 475 = 725$$

$$2a = 725 - 475$$

$$2a = 250$$

$$\boxed{a = 125} \quad Ans$$

2

(ii) $a_{13} = a + 12d = 125 + 12 \times 25$
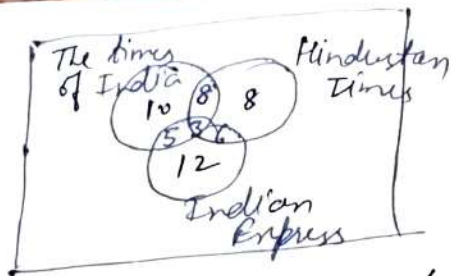$$= 125 + 300$$
$$= 425$$

1

iii) $S_{13} = \frac{13}{2} [2 \times 125 + 12 \times 25]$
$$= \frac{13}{2} [250 + 300]$$
$$= \frac{13}{2} \times 550$$
$$= 13 \times 275$$
$$= 3575 \quad Ans$$

1   4

Q37

The Times of India   Hindustan Times
10 8 8
5 3 6
12
Indian Express

i)   No. of people who read only Indian Express   1

$$= 12$$

(ii)   No. of people who read none of newspaper   2

$$= \text{Total people} - \text{No. of people who read atleast one}$$

$$= 60 - (10 + 8 + 8 + 5 + 3 + 6 + 12)$$

$$= 60 - (52)$$

$$= 8$$

(iii)   No. of people who read H.T and The Times but   1   4
not Indian Express = 8

Q38

       A   I

(i)   No. of ways $= 1 \times 8! \times 1 = 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$$= 8 \times 42 \times 120$$

$$= 960 \times 42$$

$$= 40320$$ 2

(ii) $\boxed{ABCDE}$ $\boxed{FGHIJ}$

$$2! \times 5! \times 5! = 2 \times 120 \times 120 = 2 \times 14400$$

$$= 28800$$ 2   4