INDIAN SCHOOL AL WADI AL KABIR

Assessment - 2 (2023-24)

SUB: Mathematics (041)

Date: 30/11/2023 Set 2 Time Allowed :3 hours

Class: XI Maximum Marks: 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 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.*
3. *Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.*
4. *Section C has 6 Short Answer (SA)-type questions of 3 marks each.*
5. *Section D has 4 Long Answer (LA)-type questions of 5 marks each.*
6. *Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.*

Q. No	SECTION A (MCQ)								Marks
1.	If A and B are disjoint sets and $n(A) = 3$ and $n(B) = 4$, then the number of subsets of $A \cup B =$ ___								1
	A	0	**B**	7	**C**	128	**D**	12	B
2.	$A = \{0, 1\}, B = \{x: x \in N, x \leq 2\}, C = \{x: x \in W, x^2 - x = 0\}, D = \{1, -1\}$, then ___and _____ are equal sets.								1
	A	A and C	**B**	A and B	**C**	B and C	**D**	A and D	A
3.	The sum of n terms of the series 5+55 + 555+….. = _____								1
	A	$\frac{5}{9}\left[\frac{10^n}{9} - n\right]$			**B**	$\frac{5}{9}\left[\frac{(10^n - 1)}{9} - 1\right]$			
	C	$\left[\frac{10^n}{9} - n\right]$			**D**	$\frac{5}{81}[10(10^n - 1) - 9n]$			D
4.	Which of the following relations are functions? i) {(1, 2), (2, 2), (3, 2), (4, 2)} ii) {(3, 5), (4, 7), (5, 8), (6, 10), (7,12)} iii) {(2, 1), (2, 2), (3, 1), (4, 2), (5, 2)} iv) {(5, 1), (5, 2), (5, 3), (5, 4)}								1
	A	*i and ii*	B	*ii and iv*	C	*i, ii, iii and iv*	D	*iv only*	A

5.	$If\ f(x) = \begin{cases} 3x-1,\ 0 \le x < 3 \\ 2x+1,\ 3 \le x < 5 \\ x^2-10,\ 5 \le x < 8 \end{cases}, x \in W, then\ f(0)+f(3)+f(5)$								1
	A	25	B	21	**C**	19	**D**	-10	B
6.	$If\ 2Sin\frac{7\pi}{6} - x\ cos\ \frac{2\pi}{3} = 0, then\ x = \_\_\_\_$								1
	A	-1	**B**	$\frac{2}{3}$	**C**	$\frac{1}{2}$	**D**	2	D
7.	If the coefficient of x^2 in the expansion of $(1+x)^m is\ 28, then\ m =$ _____								1
	A	4	**B**	6	**C**	8	**D**	10	C
8.	$\cot\frac{\pi}{8} = \_\_\_$								1
	A	$\sqrt{2}+1$	**B**	$\sqrt{2}-1$	**C**	$1-\sqrt{2}$	**D**	$\sqrt{2}+2$	A
9.	The equation of a circle with centre (0, 2) and radius 2 units is _____.								1
	A	$x^2+y^2=4$			**B**	$x^2+y^2-4y=0$			B
	C	$x^2+y^2-4x=0$			**D**	$x^2+y^2+4y=8$			
10.	$\|2x-1\| \le 3\ then$___								1
	A	$x \in \{1,2\}$	**B**	$x \in [-1,2]$	**C**	$x \in [1,2]$	**D**	$x \in (-1,2)$	B
11.	If AM and GM of two numbers are 10 and 6 respectively, then the numbers are								1
	A	12 and 3	B	10 *and* 10	**C**	12 *and* 8	**D**	18 *and* 2	D
12.	If $nC_2 = nC_8$, find nC_3=___								1
	A	10	**B**	45	**C**	120	**D**	720	C
13.	How many three-digit numbers are there will all digits distinct?								1
	A	999	**B**	648	**C**	899	**D**	729	B
14.	There are 10 points, out of these 3 points are collinear. The number of straight lines obtained from the points = _____								1
	A	43	**B**	42	**C**	45	**D**	90	A

15.	The nth term of the series $(2 \times 3) + (5 \times 9) + (8 \times 27) + (11 \times 81) + \cdots$ is:								1
	A	$2n(n+1)^2$	**B**	$3n(n+1)^n$	**C**	$(3n-1)3^n$	**D**	$(2n+1)(n+1)^n$	C
16.	$If\ \left(\frac{1-i}{1+i}\right)^{100} = a + ib\ then\ a^2 + b^2 = \_\_$								1
	A	0	B	4	C	16	D	1	D
17.	Which of the following represents the equation of a line whose sum of intercepts is 1 and product of intercepts is -6 ?								1
	A	$3x + 2y = 6$	**B**	$3x - 2y = 6$	**C**	$-3x + 2y = 6$	**D**	$3x + 2y = -6$	C
18.	The equation of the parabola with vertex (0, 0) passing through (5, 2) and symmetric with respect to y axis is _____								1
	A	$2x^2 = 25y$	**B**	$2y^2 = 25x$	**C**	$25x^2 = 2y$	**D**	$25y^2 = 2x$	A

ASSERTION-REASON BASED QUESTIONS

In the following questions (19 and 20), 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.

19.	(A) If A (3, 7) B (2, 5) and C(k,9) are collinear, k =4. (R) The slope of a line is the change in y coordinate with respect to the change in x coordinate.				1
	A	B	C	D	B
20.	A) $1 + i^2 + i^4 + i^6 + \ldots\ldots + i^{100} = 1$ R) $For\ any\ integer\ k,\ i^{4k} = 1\ and\ i^{4k+2} = -1.$				1
	A	B	C	D	A

SECTION B

21.	$\{-2,-1,0,1,2\} - \{1,2,3,4,5\} \cap \{1,2,3,4,5\} - \{2,3,5,7\} = \emptyset$ (½ x 4= 2)	2

22.	Find equation of a circle passing through origin and makes intercepts 8 and 6 on x axis and y axis respectively. Centre (4, 3) and radius =5 (1+1) Equation: $(x-4)^2+(y-3)^2=5^2$ OR Given that equation of a parabola is $x^2=16y$. Find the coordinates of the focus, axis of the parabola, the equation of the directrix and the length of the latus rectum. F(0, 4), Axis Y axis , Directrix y=-4, LR =16 (½ x 4= 2)	2
23.	Find n and r if $nP_r=120\ and\ nC_r=20$ (1+1) r= 3 n = 6 OR $nC_2-n=44\ \ Solving\ n=11$ (1+1)	2
24.	Write the multiplicative inverse of the complex number $\frac{(2-i)^2}{1+7i}$ $in\ standard\ form.$ $\frac{(2-i)^2}{1+7i}=\frac{(-3-4i)(1-7i)}{(1+7i)(1-7i)}=\frac{-25-25i}{50}=\frac{-1-i}{2}$ (½ x 4= 2)	2
25.	Evaluate mean deviation about mean: 4, 7, 8, 9, 10, 12, 13, 17. Mean = 10 (1+1) MD =3	2
	SECTION C	
26.	Given: For two finite sets A and B, $n(A-B)=20+x,\ n(B-A)=3x$ and $n(A\cap B)=x+5$. If n(A) = n(B), then the value of x and hence $n(A\cup B)$ X=20 (2+1) n(AUB) = 75	3
27.	$If\ tanA=\frac{p}{p-1}\ ,and\ tanB=\frac{1}{2p-1}\ then, prove\ A-B=\frac{\pi}{4}$ $\tan(A-B)=\frac{\frac{p}{p-1}-\frac{1}{2p-1}}{1+\frac{p}{p-1}.\frac{1}{2p-1}}=1$ Hence $A-B=\frac{\pi}{4}$ (1+1+1) **OR** $If\ tanA=-\frac{3}{4}, A\in IVth\ Quadrant\ then\ evaluate\ sin\frac{A}{2}\ and\ cos\frac{A}{2}.$ $CosA=\frac{4}{5}$ $sin\frac{A}{2}=\frac{1}{\sqrt{10}}\ and\ cos\frac{A}{2}=-\frac{3}{\sqrt{10}}$ (1+1+1)	3
28.	Solve the inequalities and represent the solution on a number line: $5(2x-7)-3(2x+3)\le 0;\ 2x+19\le 6x+47$ (1+1+1) Solving: $x\le 4\ \ and\ x\ge -7$ 	3
29.	Using binomial theorem prove that 6^n-5n-1 is divisible by 25 for n$\in N$. $6=1+5$ $6^n=(1+5)^n$ $6^n=1+5n+25k$ (1+1+1)	3
30.	Find r if $5\left(4_{P_r}\right)=6_{P_{(r-1)}}$ $\frac{5\times 4!}{(4-r)!}=\frac{6!}{(7-r)!}$ (1) Solving r= 4 (2)	3

31.	If the sum of two numbers is 6 times their geometric mean, prove that the numbers are in the ratio $3+2\sqrt{2} : 3-2\sqrt{2}$. (1+1+1)	3

$$a + b = 6\sqrt{ab}$$

$$\frac{(\sqrt{a})^2+(\sqrt{b})^2+2(\sqrt{a}\times\sqrt{b})}{(\sqrt{a})^2+(\sqrt{b})^2-2(\sqrt{a}\times\sqrt{b})} = \frac{4}{2}$$

$$\frac{(\sqrt{a}+\sqrt{b})^2}{(\sqrt{a}-\sqrt{b})^2} = \frac{2}{1}$$

$$\left(\frac{\sqrt{a}+\sqrt{b}}{\sqrt{a}-\sqrt{b}}\right)^2 = \frac{2}{1}$$

$$\frac{\sqrt{a}+\sqrt{b}}{\sqrt{a}-\sqrt{b}} = \frac{\sqrt{2}}{1}$$

$$\frac{a}{b} = \frac{(\sqrt{2}+1)^2}{(\sqrt{2}-1)^2}$$

$$\frac{a}{b} = \frac{(\sqrt{2})^2+(1)^2+2\sqrt{2}\times 1}{(\sqrt{2})^2+(1)^2-2\sqrt{2}\times 1}$$

$$\frac{a}{b} = \frac{2+1+2\sqrt{2}}{2+1-2\sqrt{2}}$$

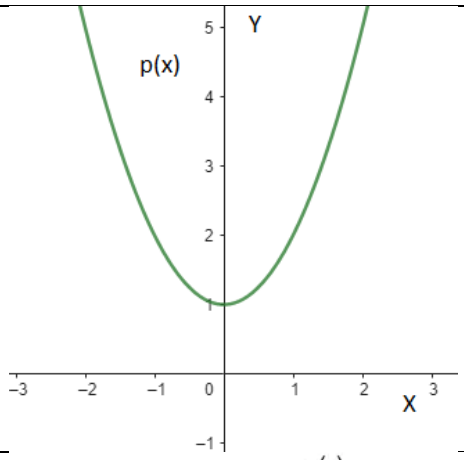
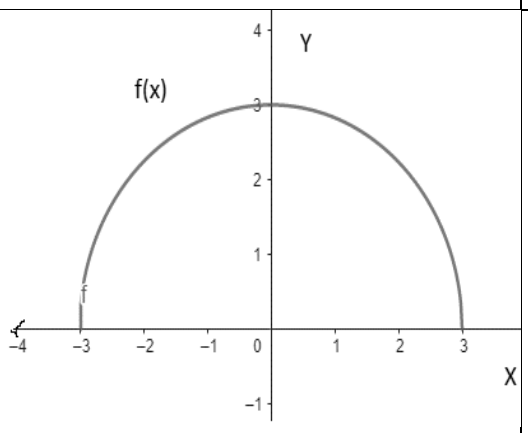
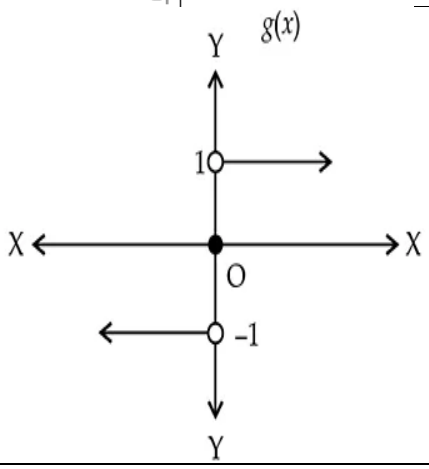
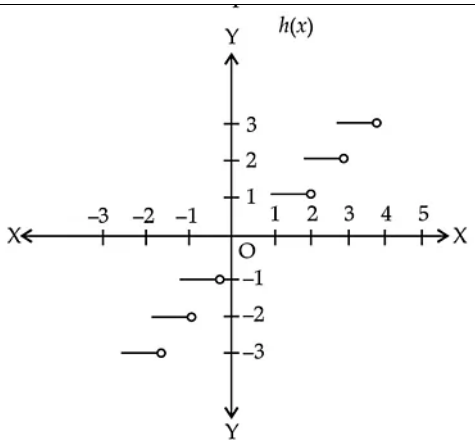
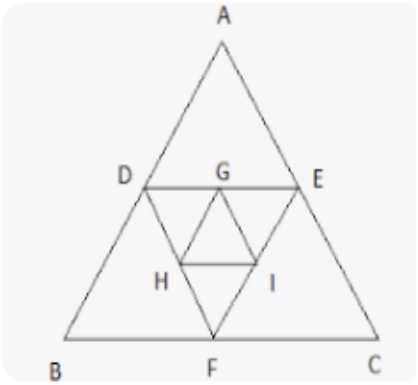
$$\frac{a}{b} = \frac{3+2\sqrt{2}}{3-2\sqrt{2}}$$

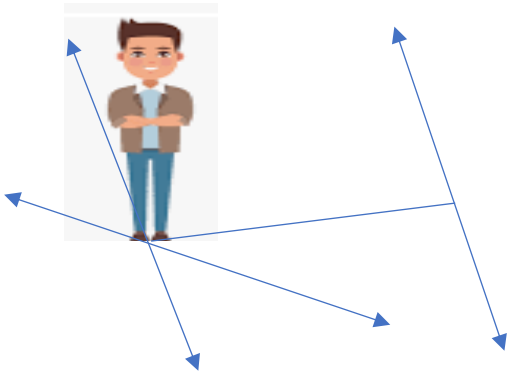
OR

Find three consecutive terms of a GP if the sum and product of these terms are $\frac{13}{3}$ and 1 $respectively.$

Terms $\frac{a}{r}, a, ar$

$a^3 = 1$ a= 1 r= 3 or 1/3 Terms 3, 1, 1/3 or 1/3, 1 , 3 (1+1+1)

	SECTION D- Case study-based Questions	
32.	There are four graphs p(x), f(x), g(x) and h(x) given below Based on the graph, answer the following questions:	4
	 	
	 	
	i) If $p(x) = x^2 + 1$ *then write the domain and range of* $p(x)$. R to $[1, \infty)$ ii) If f(x) = $\sqrt{9 - x^2}$ *write domain and range of* $f(x)$ $[-3, 3]$*to* $[0, 3]$ iii) a) Identify the function g(x). Also write domain and range of g(x). Signum function R to {-1, 0, 1} OR b) $h(2.5) + h(-2.5) + h(2)$ = 2+-3+2= 1 (1+1+2)	
33	The side of an equilateral triangle is 20 cm. The midpoints of the sides are joined to form another triangle. The process is continued as shown in the figure. Based on the given information answer the following: i) Find the length of side of fifth triangle so obtained. 1.25 ii) Write the sides of triangle in order to form a sequence and verify that the sequence is a GP. 20, 10, 5, … iii) (a) Find the sum of perimeters of first 7 triangles. $\frac{495}{4} cm$ OR	

	(b) If the process of making triangles continued indefinitely, what will be the sum of areas of all triangles.$200\sqrt{3}\,cm^2$ (1+1+2)		
34	A person standing at the junction (crossing) of two straight paths represented by the equations $2x - 3y - 5 = 0$ *and* $3x + 4y - 16 = 0$ wants to reach the path whose equation is 6x - 7y + 8 = 0 in the least time. Based on the above information, answer the following: i) Find coordinates of the point where the person is standing. (1, 4) ii) Find equation of the path that he should follow. $y - 1 = -\frac{7}{6}(x - 4)$ (2+2)		
	SECTION E		
.	$Prove: cos^2(x) + cos^2\left(x + \frac{\pi}{3}\right) + cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$ $LHS = 1 + \frac{\cos 2x}{2} + \frac{1 + \cos\left(2x + \frac{2\pi}{3}\right)}{2} + \frac{1 + \cos\left(2x - \frac{2\pi}{3}\right)}{2}$ $\frac{1}{2}[1 + 1 + 1 + \cos 2x + \cos\left(2x + \frac{2\pi}{3}\right) + \cos\left(2x - \frac{2\pi}{3}\right)]$ $= \frac{1}{2}[3 + \cos 2x + 2\cos 2x.\cos\frac{2\pi}{3}]$ $= \frac{1}{2}[3 + \cos 2x + 2\cos 2x(-\cos\frac{\pi}{3})]$ $= \frac{1}{2}[3 + \cos 2x - \cos x]$ $= \frac{3}{2}$ $= RHS$ (2+1+1+1) OR Prove: $\frac{(1+cos4x)}{cotx-tanx} = \frac{1}{2}sin4x$		5

$$L.H.S. = \frac{1+\cos 4x}{\cot x - \tan x}$$
$$= \frac{2\cos^2 2x}{\frac{\cos x}{\sin x} - \frac{\sin x}{\cos x}}$$
$$= \frac{2\cos^2 2x \cos x \sin x}{\cos^2 x - \sin^2 x}$$
$$= \frac{2\sin x \cos x \cdot \cos^2 2x}{\cos 2x}$$
$$= \sin 2x \cos 2x$$
$$= \frac{1}{2}(2\sin 2x \cos 2x)$$
$$= \frac{1}{2}\sin 4x = R.H.S.$$

(2+1+1+1)

36. Find the mean, variance and standard deviation using short cut method — 5

Class	30-40	40-50	50-60	60-70	70-80	80-90	90-100	
f	3	7	12	15	8	3	2	50
U	-3	-2	-1	0	1	2	3	
fu	-9	-14	-12	0	8	6	6	-15
fu^2	27	18	12	0	8	12	18	105

$Mean = 62 \quad Variance = 201 \; SD = \sqrt{201}$ (2+1+1+1)

37. $(x+1)^6 + (x-1)^6 = x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1 + x^6 - 6x^5 + 15x^4 - 20x^3 + 15x^2 - 6x + 1$ — 5

$= 2(x^6 + 15x^4 + 15x^2 + 1)$

$(\sqrt{2}+1)^6 + (\sqrt{2}-1)^6 = 198$. (3+2)

38. Find the image of the point P (3, 4) with respect to the line $2x + y - 5 = 0$. — 5

Slope of given line = -2
Slope of line through P = 1/2
Equation through P x+2y=-5
Foot of perpendicular (1, 3) Image (-1, 2) (1+1+1+2)

OR

Given: The vertices of ΔABC are $A(0,4), B(3,2) and\ C(-3,-3)$.

i) area of ΔABC = 11
ii) Find the equation of median AD. D(2, -1) and Equation 5x+2y -8=0
iii) Find the equation of line passing through the point A. and parallel to BC. BC equation 3x-y-7=0 and distance $=\frac{11}{\sqrt{10}}$ (1+2+2)

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