O.S.D.A.V. Public School Kaithal
July Test 2024-25
Class – XI **Set - B**
Subject – Core Maths

Time : 1 hr 30 min **M.M. 40**

Instructions :

All questions are compulsory. This question paper has 5 Sections. Section A has 10 questions of 1 mark each. Section B has 7 Questions of 2 marks each. Section C has 2 questions of 3 marks each. Section D has 2 questions of 5 mark each.

Section – A

Q1 In a circle of diameter 40 cm, the length of a chord is 20 cm. the length of minor arc of the chord is

a) $6.28\,\pi$ b) $6\,\pi$ c) 12π d) $\frac{20\,\pi}{3}$

Q2 Let A be a finite set having 9 elements, then the number of relations from set A to itself are:

a) 2^9 b) 2^{81} c) 81 d) 9

Q3 Let the set A = {x: x is a letter in the word " PERMUTATIONS " }, then the proper subsets of A is :

a) 2^{11} b) $2^{11} - 1$ c) 2^6 d) $2^6 - 1$

Q4 The range of the function f(x) $= x^2 + 4$, x ∈ R

a) (-∞,∞) b) [4,∞) c) (-∞,-4] d) (-∞, 0)

Q5 The domain of the function $\frac{1}{\sqrt{x-3}}$ is :

a) [3, ∞) b) [-3,3] c) (3, ∞) d) (-∞,3]

Q6 If cos x = $-\frac{5}{7}$, x lies in third quadrant , then cos $\frac{x}{2}$ is:

a) $-\frac{1}{\sqrt{7}}$ b) $\frac{1}{\sqrt{7}}$ c) $\frac{1}{7}$ d) $-\frac{1}{7}$

Q7 The value of $2sin^2\frac{\pi}{6} + cosec^2\frac{7\pi}{6}\ cos^2\frac{\pi}{3}$ is

a) $\frac{3}{2}$ b) 6 c) $\frac{1}{2}$ d) 2

Q8 The value of cosec $(-1410°)$ is

a) 1 b) 2 c) $\frac{1}{2}$ d) $\frac{1}{5}$

Q9 The radian measure of 65° is

a) $\frac{5\pi}{6}$ b) $\frac{22\pi}{36}$ c) $\frac{13\pi}{36}$ d) $\frac{35\pi}{9}$

Q10 The set builder form of the interval (-2, 16] is

a) $\{x : x \in R, -2 < x < 16\}$
b) $\{x : x \in R, -2 < x \leq 16\}$
c) $\{x : x \in R, -2 \leq x < 16\}$
d) $\{x : x \in Z, -2 \leq x < 16\}$

Section – B

Q 11 Show that

$\cot x \cot 2x - \cot 2x \cot 3x - \cot 3x \cot x = 1$

Q12 Define Modulus function. Write its domain and range. Also draw the graph of Modulus function.

Q13 If $A \subset B$ then prove that $A \cap B = A$.

Q14 Let A = {9, 10, 11, 12, 13} and let f: A → N be defined by f(n) = the highest prime factor of n. Find the range of f.

Q15 Prove that $\frac{\sin x - \sin 3x}{sin^2 x - cos^2 x} = 2 \sin x$

Q16 If A = {3, 5, 7, 9, 11}, B = {7, 9, 11, 13}, C = {11, 13, 15} and D = {15, 17}

Find i) $(A \cup B) \cap (B \cap C)$

ii) $(C - B) \cup (D - C)$

Q17 Convert 4 radians into its degree measure.

Section – C

Q18 Find the domain and range of $f(x) = \frac{x}{2 + x^2}$

Q19 Let A = {2, 4, 6, 8, 10}. Let R be the relation on A defined by

R = {(a, b): a, b ∈ A, b is exactly divisible by a}.

i) Write R in Roster form.
ii) Find the domain of R.
iii) Find the range of R.

Section – D

Q20 Prove that $\tan 4x = \frac{4 \tan x (1 - tan^2 x)}{1 - 6 tan^2 x + tan^4 x}$

Q21 If $\cos x = \frac{-1}{3}$, x lies in third quadrant, then find $\sin \frac{x}{2}$, $\cos \frac{x}{2}$, $\tan \frac{x}{2}$.

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Marking Scheme / Hints to Solution

Note :→ Any other relevant answers not given here in but given by the students could be suitably awarded.

Q.N.	Value Points / Key Points	Value point	Total Point
1	d) $\frac{2\pi}{3}$	1	
2	b) 2^{81}	1	
3	b) $2^{11}-1$	1	
4	b) $(4,\infty)$	1	
5	c) $(3,\infty)$	1	
6	a) $-\frac{1}{\sqrt{7}}$	1	
7	a) $3/2$	1	
8	b) 2	1	
9	c) $13\pi/36$	1	
10	b) $\{x : x \in R, -2 < x \leq 16\}$	1	

Section – B.

11

$3x = 2x + x$

$\cot 3x = \cot(2x+x)$

$\cot 3x = \frac{\cot 2x \cot x - 1}{\cot 2x + \cot x}$ $\frac{1}{2}$

$\Rightarrow \cot 3x(\cot 2x + \cot x) = \cot 2x \cot x - 1$ $\frac{1}{2}$

$\Rightarrow \cot 3x \cot 2x + \cot x \cot 3x = \cot 2x \cot x - 1$ $\frac{1}{2}$

$\Rightarrow \cot 2x \cot x - \cot 3x \cot 2x - \cot x \cot 3x = 1$ $\frac{1}{2}$ 2

12

Given $A \cap B = A$

To Prove $A \cap B \subset A$ (always) — (1) $\frac{1}{2}$

Now Let $x \in A$

and $A \subset B$

$\Rightarrow x \in B$

$\Rightarrow x \in A$ and $x \in B$ $1\frac{1}{2}$ 2

$\Rightarrow x \in A \cap B$

$A \subset A \cap B$ — (2)

From (1) and (2) $\Rightarrow A = A \cap B$

14 $A = \{9, 10, 11, 12, 13\}$

$f(n)$ = the highest prime factor of n

$\Rightarrow f(9) = 3,\ f(10) = 5,\ f(11) = 11,\ f(12) = 3$

$f(13) = 13$ — 1½

$\Rightarrow$ Range of $f = \{3, 5, 11, 13\}$ — ½ — 2

15 LHS $\dfrac{\sin x - \sin 3x}{\sin^2 x - \cos^2 x}$

$= \dfrac{2\cos 2x \sin(-x)}{-\cos 2x}$ — 1

$= \dfrac{+2\cos 2x \sin x}{+\cos 2x}$ — 1 — 2

$= 2\sin x = RHS$

16 $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$

$C = \{11, 13, 15\}$, $D = \{15, 17\}$

(i) $A \cup B = \{3, 5, 7, 9, 11, 13\}$

$B \cap C = \{11, 13\}$

$(A \cup B) \cap (B \cap C) = \{11, 13\}$ — 1

(ii) $C - B = \{15\}$

$D - C = \{17\}$

$(C - B) \cup (D - C) = \{15, 17\}$ — 1 — 2

17 4 radians $= \left(4 \times \dfrac{180}{\pi}\right)^\circ = \left(4 \times \dfrac{180}{22} \times 7\right)^\circ$ — ½

$= \left(\dfrac{2520}{11}\right)^\circ = 229^\circ \left(\dfrac{1}{11} \times 60\right)'$ — ½

$= 229^\circ\ 5'\left(\dfrac{5}{11} \times 60\right)''$ — ½

$= 229^\circ\ 5'\left(\dfrac{300}{11}\right)''$

$= 229^\circ\ 5'\ 27''$ — ½ — 2

Section-C

19 (i) $R = \{(2,2), (2,4), (2,6), (2,8), (2,10), (4,4), (4,8), (6,6), (8,8), (10,10)\}$ — 2

(ii) $D_R = \{2, 4, 6, 8, 10\}$ — $\frac{1}{2}$

(iii) $R_R = \{2, 4, 6, 8, 10\}$ — $\frac{1}{2}$ — 3

Section-D

20 $\tan 4x = \tan(2 \times 2x)$

$= \frac{2\tan 2x}{1 - \tan^2 2x}$ — 1

$= 2 \times \frac{2\tan x}{1-\tan^2 x} \Big/ 1 - \left(\frac{2\tan x}{1-\tan^2 x}\right)^2$ — 1

$= \frac{4\tan x}{1-\tan^2 x} \times \frac{(1-\tan^2 x)^2}{1 + \tan^4 x - 2\tan^2 x - 4\tan^2 x}$ — 1

$= \frac{4\tan x(1-\tan^2 x)}{1 + \tan^4 x - 6\tan^2 x} = RHS$ — 1 — 5

21 $\cos x = -\frac{1}{3}$, x lies in IIIrd quadrant

$180^\circ \le x \le 270^\circ$

So, $\frac{180^\circ}{2} \le \frac{x}{2} \le \frac{270^\circ}{2}$

$\Rightarrow 90^\circ \le \frac{x}{2} \le 135^\circ$

$\Rightarrow \frac{x}{2}$ lies in IInd quadrant (*) — 1

We know $\cos^2 \frac{x}{2} = \frac{1+\cos x}{2}$

$= \frac{1 - \frac{1}{3}}{2} = \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$ — 1

$\Rightarrow \cos \frac{x}{2} = \pm \frac{1}{\sqrt{3}}$

$\Rightarrow \boxed{\cos\frac{x}{2} = -\frac{1}{\sqrt{3}}}$ (Using ★) 1

Now $\sin^2\frac{x}{2} = \frac{1-\cos x}{2}$

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

$\Rightarrow \sin\frac{x}{2} = \pm\sqrt{\frac{2}{3}} = \pm\frac{\sqrt{6}}{3}$

$\Rightarrow \boxed{\sin\frac{x}{2} = \frac{\sqrt{6}}{3}}$ (Using ★) 1

$\Rightarrow \tan\frac{x}{2} = \frac{\sin\frac{x}{2}}{\cos\frac{x}{2}}$

$= \frac{\frac{\sqrt{6}}{3}}{\frac{-1}{\sqrt{3}}} = \frac{-\sqrt{6}}{3}\times\sqrt{3}$

$= -\frac{\sqrt{6}}{\sqrt{3}}$

$= -\sqrt{2}$

$\Rightarrow \boxed{\tan\frac{x}{2} = -\sqrt{2}}$ 1 (5)