

Vikas Bharati Public School
Sample Paper (Session 2023-24)
Class: XI
Subject: Mathematics (041)

Time: 3 hrs.

M.M: 80

General Instructions:

- This question paper contains 5 sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
- Section A has 18 M.C. Q's and 2 Assertion- Reason based questions of 1 mark each.
- Section B has 5 very short answers type questions of 2 marks each.
- Section C has 6 short answer type questions of 3 marks each.
- Section D has 4 long answer type questions of 5 marks each.
- Section E has 3 case-based questions of 4 marks each with subparts
- This question paper contains 4 printed pages

Q No	SECTION A	Marks
1.	Which of the following is a null set ? (a) Integers in set [2,3] (b) Integers in set {2,3} (c) Integers in set (2,3) (d) Integers in set (2,3)	1
2.	Value(s) of θ , $\theta \in (0, 2\pi)$ for which the complex number $\frac{1+i \cos\theta}{1-2i \cos\theta}$ is purely real, is (a) $\frac{\pi}{4}, \frac{7\pi}{4}$ (b) $\frac{\pi}{2}, \frac{3\pi}{2}$ (c) $\frac{\pi}{2}$ only (d) π only	1
3.	For a G.P., if $a = 729$ and 7 th term is 64, then its common ratio is equal to : (a) $\frac{3}{2}$ (b) $\frac{2}{3}$ (c) $\frac{-2}{3}$ (d) $\pm \frac{2}{3}$	1
4.	Length of the latus rectum of the parabola with focus at (3,0) is (a) 3 (b) 12 (c) -12 (d) none of these	1
5.	Let $A = \{1,2\}$, $B = \{3,4\}$. Then the number of relations from A to B are (a) 4 (b) 8 (c) 16 (d) 32	1
6.	The number of 5 digit telephone numbers having atleast one of their digits repeated is : (a) 90000 (b) 100000 (c) 30240 (d) 69760	1
7.	If $A = \{1,2,3,4\}$, $B = \{3,5,6,7\}$ and $C = \{3,5,8\}$, then $(A \cap B) - (B \cap C) =$ {1,2} (b) {1} (c) {2} (d) \emptyset	1
8.	The equation of the line passing through (1,5) and perpendicular to the line $3x - 5y + 7 = 0$ is : (a) $5x + 3y - 2 = 0$ (b) $3x - 5y + 7 = 0$ (c) $3x - 5y + 6 = 0$ (d) $5x + 3y + 7 = 0$	1
9.	In a non leap year, probability of having 53 Tuesdays is : (a) $\frac{1}{5}$ (b) $\frac{4}{5}$ (c) $\frac{1}{7}$ (d) $\frac{5}{9}$	1

10.	$A = \{1,3,5, B\}$ and $B = \{2,4\}$, then (a) $4 \in A$ (b) $\{4\} \subset A$ (c) $B \subset A$ (d) none of these	1
11.	The value of $1 + i + i^2 + \dots + i^n$ is : (a) positive (b) negative (c) 0 (d) cannot be determined.	1
12.	If $(x + 1, y - 2) = (3,1)$, then the values of x and y are: (a) $x = -2, y = -3$ (c) $x = 2, y = -3$ (b) $x = -2, y = 3$ (d) $x = 2, y = 3$	1
13.	$\tan\left(\frac{-17\pi}{6}\right)$ equals to (a) $\frac{-1}{\sqrt{3}}$ (b) $\frac{1}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) $-\sqrt{3}$	1
14.	If $x + iy = (1 + i)(1 + 2i)(1 + 3i)$, then $x^2 + y^2 =$ (a) 0 (b) 1 (c) 100 (d) 5	1
15.	If $\tan\theta = 3$ and θ lies in third quadrant, then the value of $\sin\theta$ is : (a) $\frac{1}{\sqrt{10}}$ (b) $-\frac{1}{\sqrt{10}}$ (c) $\frac{3}{\sqrt{10}}$ (d) $\frac{-3}{\sqrt{10}}$	1
16.	Coordinates of the centre of given circle $x^2 + y^2 - 8x + 10y - 12 = 0$ are (a) (-4,5) (b) (4,-5) (c) (4,5) (d) none of these	1
17.	The degree measure of $\frac{11}{16}$ radian is (a) $39^{\circ}22'30''$ (b) $39^{\circ}22.3'$ (c) $39^{\circ}30'22''$ (d) 39°	1
18.	The value of $\frac{\tan 50^{\circ}}{\tan 230^{\circ}}$ is (a) 1 (b) 0 (c) -1 (d) can not be determined	1
19.	Assertion (A) : An angle of $\frac{11}{7}$ is equivalent to 90° Reason (R) : Angle in radian = Angle in degree $\times \frac{\pi}{180^{\circ}}$ (a) Both A and R are true and R is the correct explanation for A. (b) Both A and R are true and R is not the correct explanation for A. (c) A is true but R is false. (d) A is false but R is true.	1
20.	Assertion (A) : If $\cos x = -\frac{1}{3}$, then $\sin \frac{x}{2} = \frac{1}{\sqrt{3}}$, when $x \in$ II Quadrant Reason (R) : $\cos 2A = 1 - 2\sin^2 A$ (a) Both A and R are true and R is the correct explanation for A. (b) Both A and R are true and R is not the correct explanation for A. (c) A is true but R is false (d) A is false but R is true.	1
Section B		
21.	The perpendicular from the origin to the line $y = mx + c$ meets it at the point (-1, 2). Find the value of m and c .	2
OR		
	Find the equation of line passing through (1,2) and making angle 30° with y axis.	
22.	Find the domain and range of the function defined by $f(x) = \sqrt{(x - 1)}$	2

23.	In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that (1) The student opted for NCC or NSS (2) The student has opted neither NCC nor NSS	2
24.	Find the value of $\cos\left(\frac{3\pi}{2} - \theta\right)\cos(2\pi + \theta)[\cot\left(\frac{3\pi}{2} - \theta\right) + \cot(2\pi + \theta)]$	2
25.	Using Binomial theorem, find the value of 51^4 .	2
Section C		
26.	Determine the value of k for which $\lim_{x \rightarrow 3} f(x) = f(3)$ where $f(x) = \begin{cases} \frac{(x+3)^2 - 36}{x-3}, & x \neq 3 \\ k, & x = 3 \end{cases}$	3
27.	If the line $y = \sqrt{3}x + k$ touches the circle $x^2 + y^2 = 16$, then find the value of k.	3
OR		
	Find the equation of the circle having (1,-2) as its centre and passing through the intersection of the lines $3x + y = 14$ and $2x + 5y = 18$.	
28.	A straight line passes through the point P(1,2) and the portion of the line intercepted between the axes is bisected at this point, find its equation.	3
29.	Prove that $\cos 2x \cos \frac{x}{2} - \cos 3x \cos \frac{9x}{2} = \sin 5x \sin \frac{5x}{2}$	3
30.	(1) How many different words can be formed with the letters of the word HARYANA? (2) How many of these begin with H and end with N? (3) In how many of these H and N are together ?	3
OR		
	How many words, with or without meaning, each of 3 vowels and 2 consonants can be formed from the letters of the word INVOLUTE?	
31.	Out of 100 students, two sections of 40 and 60 are formed. If you and your friend are among the 100 students, what is the probability that (a) you both enter the same section? (b) you both enter the different sections?	3
Section D		
32.	(1) Differentiate the following function with respect to x, using first principle: $f(x) = \sin^2 x$ (2) Find the derivative of: (a) $(x + \cos x)(x - \tan x)$ and (b) $\frac{3x^2 - 5x + 2}{7x - 1}$ with respect to x.	3 + 2
33.	The mean of 5 observations is 4.4 and their variance is 8.24. If three of the observations are 1, 2 and 6, find the other two observations.	5
OR		
	Find the mean, variance and standard deviation of the following data :	

	Heights (in cms)	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	110-115	
	No. of children	3	4	7	7	15	9	6	6	3	
34.	A beam is supported at its ends by supports which are 12 meters apart. Since the load is concentrated at its centre, there is a deflection of 3 cm at the centre and the deflected beam is in the shape of a parabola. How far from the centre is the deflection 1 cm ?										5
	OR										
	Find the equation of the ellipse whose major axis is on the x axis and which passes through the points (4,3) and (6,2)										
35.	(1) Three vertices of a parallelogram ABCD are A(3, -1, 2), B(1, 2, -4) and C(-1, 1, 2). Find the coordinates of the fourth vertex. (2) Show that the ratio of the sum of first n terms of a G.P. to the sum of terms from (n+1) th to (2n) th term is $\frac{1}{r^n}$										2 + 3
	Section E (Case Based Questions)										
36.	In a survey of 200 students it was found that 120 had got grade 'A' in Mathematics , 90 had got grade 'A' in Physics, 40 had got grade 'A' in Mathematics and Physics. A class representative is chosen randomly from the above students. Based on the given information, answer the following questions: (i) Find the probability that the chosen class representative had got grade A in atleast one of the subject. (ii) Find the probability that the chosen class representative had got grade A in Mathematics but not Physics. (iii) Find the probability that the chosen class representative had got grade A in Physics but not Mathematics.										2 1 1
37.	A company produces certain items. The manager in the company used to make a data on daily basis about the cost and revenue of these items separately. The cost and revenue functions of a product are given by $C(x) = 20x + 4000$ and $R(x) = 60x + 2000$, respectively, where x is the number of items produced and sold. (i) How many items must be sold to realise some profit? (ii) If the cost and revenue function of a product are given by $C(x) = 2x + 400$ and $R(x) = 6x + 20$, respectively, where x is the number of items produced by the manufacturer. Then find the minimum number of items that the manufacturer must sell to realise some profit. (iii) Solve for x : $12x + 7 < -11$ OR Solve for x : $5x - 8 > 40$										1 1 2
38.	Evaluate the following limits: (i) $\lim_{x \rightarrow -1} \frac{x^{10} + x^5 + 1}{x - 1}$										1 1

$$(ii) \quad \lim_{x \rightarrow 1} \frac{(x-1)^2 + 3x^2}{(x^4+1)^2}$$

$$(iii) \quad \lim_{x \rightarrow 0} \frac{\sqrt{1+x^3} - \sqrt{1-x^3}}{x^2}$$

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