KENDRIYA VIDYALAYA SITAPUR I SHIFT

UT-1 (2023-24)

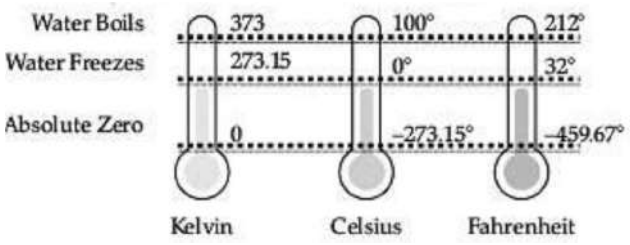
Class: XI Max. Marks: 40

Subject: -Mathematics Time: 90 minutes

General Instructions:

1. This question paper contains five sections – A, B, C, D and E. Each part is compulsory.
2. Section A has 8 multiple choice type questions of 1 mark each and 1 assertion reasoning question of 1 mark each.
3. Section B has 2 questions of 2 marks each.
4. Section C has 3 questions of 3 marks each,
5. Section D has 2 questions of 5 marks each
6. Section E has 2 case based questions of 4 marks each
7. There is an internal choice in some of the questions.

Q.NO	**Section A**	Marks
	Q (1-9) are multiple choice type questions. Select the correct option	
1	If A= {1,2,3,4},then number of proper subsets of A is (a) 16 (b) 15 (c) 14 (d) 10	1
2	Let A and B be 2 sets and U be the universal set, then $A' \cup ((A \cup B) \cap B')$ equals (a) ϕ (b) U (c) A (d) B	1
3	The domain and range of the function f given by f(x) = 2 – |x – 5| is (a) Domain = R+ , Range = (–∞, 1] (b) Domain = R, Range = (–∞, 2] (c) Domain = R, Range = (–∞, 2) (d) Domain = R+ , Range = (–∞, 2]	1
4	If A is the set of even natural number less than 8 and B is the set of prime number less than 7, then the number of relations from A to B is (a) 2^9 (b) 9 (c) 9^2 (d) 2^{9-1}	1
5	The large hand of a clock is 42 cm long. How much distance does its extremity move in 20 minutes? (a) 88 cm (b) 80 cm (c) 75 cm (d) 77 cm	1
6	The value of $i^n + i^{n+1} + i^{n+2} + i^{n+3}$ is (a)0 (b) 1 (c) -1 (d) 2	1
7	Modulus of $-1+i\sqrt{3}$ is a) 0 b) 1 c) 3 d) 2	1
8	If x is real number and $\|x\| < 3$, then (a) $-3 < -x < 3$ (b) $x > 3$ (c). $-3 \leq x \leq 3$ (d) $x \geq -3$	1
9	In the given question, 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. Assertion (A): The maximum value of sinx + cosx is 2 Reason (R): The maximum value of $\sin x$ *is* 1 and maximum value $\cos x$ *is* 1	1
	Section B	
10	For the sets $U = \{1,2,3,4,5,6,7,8,9\}$, $A = \{2,4,6,8\}$ and $B = \{2,3,5,7\}$, verify that $(A \cup B)' = A' \cap B'$.	2
11	Find the conjugate of $\left(\frac{1}{1+i} - \frac{i}{1-i}\right)$.	2

	Section C	
12	Find the domain and range of the function $f: R \to R_+$ defined by $f(x) = \sqrt{x^2 - 25}$.	3
13	Find the value of $\cot\left(\frac{\pi}{8}\right)$. Or Prove that $\frac{\sec 8x - 1}{\sec 4x - 1} = \frac{\tan 8x}{\tan 2x}$.	3
14	If z is a complex number such that $\lvert z\rvert = 1$, prove that $\left(\frac{z-1}{z+1}\right)$ is purely imaginary. or If $(\alpha + i\beta)^3 = x + iy$, then prove that: $\frac{x}{\alpha} - \frac{y}{\beta} = -2(\alpha^2 + \beta^2)$	3
	Section D	
15	Prove that $\sin^2 x + \sin^2\left(x + \frac{\pi}{3}\right) + \sin^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$. OR Prove that $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \frac{1}{16}$.	5
16	A manufacturer has 500 litres of a 12% solution of acid. How many litres of a 30% acid solution must be added to it so that acid content in the resulting mixture will be more than 15% but less than 18%?	5
	Section E (CASE BASED QUESTIONS)	
17	Let A, B be any two (non-empty) sets and R be a relation from A to B, then the inverse of relation R denoted by R^{-1} is a relation from B to A i.e. $R^{-1} \subset B \times A$. Also $R^{-1} = \{(b, a) : (a, b) \in R\}$, Clearly $(a, b) \in R \Leftrightarrow (b, a) \in R^{-1}$. If A = { 2 , 3, 4 , 5 } , B = {3 ,6 ,7 , 10 } and a relation R from A to B is defined as $R = \{(x, y) : x \text{ divides } y, x \in A, y \in B\}$ Based above information, answer the following questions : - 1. Write R as a set of ordered pairs 2. Write R^{-1} as a set of ordered pairs. 3. Write domain of R^{-1} 4. Write Range of R^{-1}	1x4= 4
18	Kelvin(K), degree Celsius(°C) and degree Fahrenheit(°F) are three units of temperature. The conversion formula for them is as follows: $F = \frac{9}{5}C + 32$ and $K = C + 273.15$  Based on the above information, answer the following questions. 1. To maintain the Celsius temperature of a system at least 5°C , what minimum Fahrenheit temperature should be maintained? 2. To maintain Kelvin temperature of a system maximum 100 K, what maximum Celsius temperature should be maintained? 3. Find the Celsius temperature (up to one place after the decimal) for which Kelvin and Fahrenheit temperatures are equal.	1+1+ 2