SAT SELF ASSESSMENT TEST
(Based on latest CBSE Examination Pattern)

Time : 90 minutes
Max. Marks : 40

General instructions

1. This question paper has 5 Sections A, B, C, D and E.
2. Section A has 9 MCQs and 1 Assertion and Reason based question carrying 1 mark each.
3. Section B has 3 questions carrying 2 marks each.
4. Section C has 2 questions carrying 3 marks each.
5. Section D has 2 questions carrying 5 marks each.
6. Section E has 2 Case Study Based Questions of 4 marks each.
7. Draw neat figures wherever required. Take $\pi = \dfrac{22}{7}$ wherever required if not stated.

SECTION-A

Q 1. The empty set is represented by:

   (i) ϕ (ii) $\{\phi\}$ (iii) $\{\ \}$ (iv) $\{\{\ \}\}$

   (a) (i) and (ii)   (b) (i) and (iii)   (c) (ii) and (iii)   (d) (i) and (iv)

Q 2. Let $A = \{x : x \in \mathbb{Z} \text{ and } x^2 \le 4\}$ and $B = \{x : x \in \mathbb{Z} \text{ and } x^2 - 3x + 2 = 0\}$. Then:

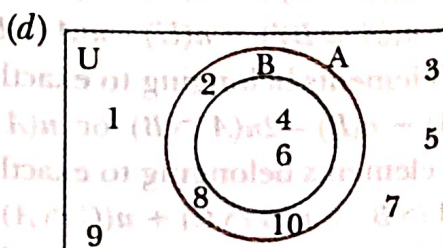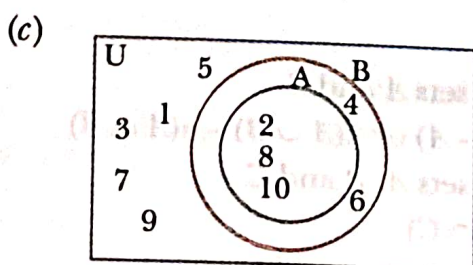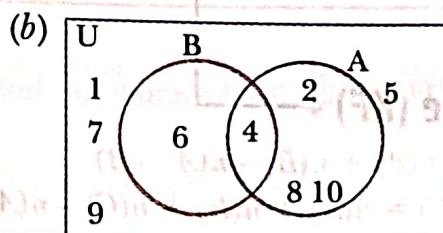   (a) $A = B$ (b) $A \ne B$ (c) $n(A) = n(B)$ (d) $A \subseteq B$
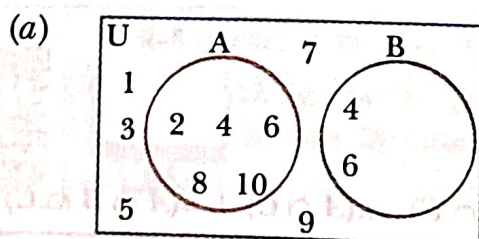
Q 3. If $A \subset B$ and $A \ne B$, then:

   (a) A is called a proper subset of B (b) A is called a super set of B

   (c) A is not a subset of B (d) B is a subset of A

Q 4. The set of negative real numbers is denoted by:

   (a) $(-\infty, 0)$ (b) $[-\infty, 0]$ (c) $(-\infty, 0]$ (d) $[-\infty, 0)$

                                                             [NCERT Exemplar]

Q 5. If $U = \{1, 2, 3, 4, ..., 10\}$ is the universal set of A and B where $A = \{2, 4, 6, 8, 10\}$ and $B = \{4, 6\}$. Then given, sets can be represented by Venn diagram as:

Q 6. The set $(A \cap B')' \cup (B \cap C)$ is equal to:

(a) $A' \cup B \cup C$ (b) $A' \cup B$ (c) $A' \cup C'$ (d) $A' \cap B$

Q 7. In a group of 800 people, 550 can speak Hindi and 450 can speak English. How many can speak both Hindi and English? (Assume that everyone speaks atleast one language.)

(a) 100   (b) 200   (c) 300   (d) 400

Q 8. Which of the following is not an empty set?

(a) A set of natural numbers less than 1.

(b) A set of natural numbers lying between 3 and 4.

(c) A set of integers between – 2 and – 3.

(d) $A = \{x : x^2 = 2 \; \forall \, x \in \mathbb{R}\}$

Q 9. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8\}, A = \{2, 4, 6\}$ and $B = \{3, 4, 5\}$ Which of the following are correct?

(i) $(A \cup B)' = \{1, 3, 5, 7, 8\}$ (ii) $(A \cup B)' = \{1, 7, 8\}$

(iii) $(A \cup B)' = \{2, 3, 4, 5, 6\}$ (iv) $A' \cap B' = \{1, 7, 8\}$

Choose the correct option from the following:

(a) (i) and (iv)   (b) (ii) only   (c) (ii) and (iv)   (d) (iii) only

The following question is Assertion and Reason based question. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to this question from the codes (a), (b), (c) and (d) as given below.

(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.

Q 10. Assertion (A) : The union of two disjoint sets is always a null set.

     Reason (R) : Disjoint sets have no common elements.

SECTION-B

Q 11. Express the set $D = \left\{x : x = \dfrac{n^2 - 1}{n^2 + 1}, n \in \mathbb{N} \text{ and } n < 4\right\}$ in roster form.

Q 12. Describe the following:

(i) "The set of vowels in the word MATHEMATICS" in roster form.

(ii) "The set of all odd natural numbers" in set-builder form.

Q 13. Write the following set as interval.

$$\{x : x \in \mathbb{R}, -12 \leq x \leq -10\}$$

Also, find the length of interval and represent on number line.

OR

Let $A = \{a, b, \{c, d\}, e\}$. Which of the following statements is/are true?

(i) $\{c, d\} \in A$ (ii) $\{\{c, d\}\} \subset A$

SECTION-C

Q 14. Examine whether the following statements are true or false.

    (i) $\{a, b\} \not\subset \{b, c, a\}$

    (ii) $\{a, e\} \subset \{x : x \text{ is a vowel in the English alphabet}\}$

    (iii) $\{a\} \in \{a, b, c\}$

    (iv) $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ is the universal set for the sets $\{1, 3, 5\}$ and $\{2, 4, 6\}$.

Q 15. Let $A = \{x : x \in \mathbb{N}\}$, $B = \{x : x = 2n, n \in \mathbb{N}\}$, $C = \{x : x = 2n - 1, n \in \mathbb{N}\}$ and $D = \{x : x \text{ is a prime number}\}$. Find:

    (i) $A \cap B$ (ii) $A \cap C$ (iii) $B \cap C$ (iv) $B \cap D$

OR

Let F_1 be the set of parallelograms, F_2 be the set of rectangles, F_3 be the set of rhombus and F_4 be the set of squares. Then, show that F_1 is the universal set of F_2, F_3 and F_4.

[NCERT Exemplar]

SECTION-D

Q 16. In a group of 100 people, 65 like to play Cricket, 40 like to play Tennis and 55 like to play Volleyball. All of them like to play at least one of the three games. If 25 like to play both Cricket and Tennis, 24 like to play both Tennis and Volleyball and 22 like to play both Cricket and Volleyball, then

    (i) How many like to play all the three games?

    (ii) How many like to play Cricket only?

    (iii) How many like to play Tennis only?

Represent above information in a Venn diagram.

Q 17. A college awarded 38 medals in Football, 15 in Basketball and 20 in Cricket. If these medals went to a total of 58 men and only three men got medals in all the three sports, then how many received medals in exactly two of the three sports?

OR

From the adjoining Venn diagram, determine the following sets.

    (i) $A \cup B$

    (ii) $A \cap B$

    (iii) $A - B$

    (iv) $(A \cap B)'$
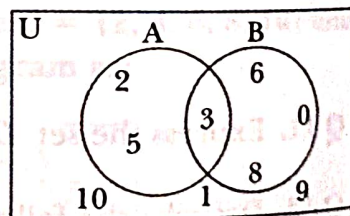
SECTION-E

Q 18. In a town of 10,000 families, it was found that 40% families go to shop A for their home needs groceries, 20% families go to the shop B and 10% families go to shop C. 5% families go to shops A and B, 3% go to B and C and 4% families go to A and C. 2% families go to all the three shops A, B and C.

Based on the given information, answer the following questions:

(i) Find the number of families which go to shop A only.

(ii) Find the number of families which don't visit/purchase from any of A, B and C.

(iii) Find the number of families that purchase from exactly one shop.

(iv) Find the number of families that buy from at least one of the shops A, B or C.

Q 19. In a survey of a town, it was found that the number of people buying only Hindustan Times (HT) is 80% of the number of people buying both the newspapers Hindustan Times and Times of India. The number of people buying only the Times of India is 60% less than the number who buy both. The number of people buying neither of these two is 22,000 less than the number of people in the town.

Based on the given information, answer the following questions:

(i) What is the number of people buying Hindustan Times?

(ii) What is the number of people buying Times of India?

(iii) What is the number of people buying both the newspapers?

(iv) What is the number of people buying exactly one of the two newspapers?

(v) What is the number of people buying only HT?

Q 1. An organization awarded 48 medals in event A, 25 in event B and 18 in event C. If these medals went to total 60 men and only five men got medals in all the three events, then how many received medals in exactly two of three events?

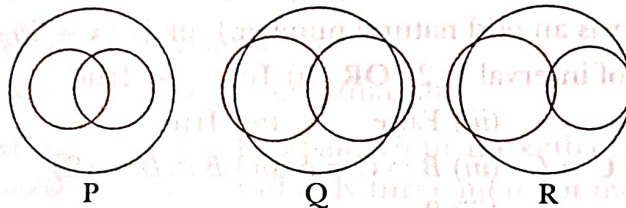(a) 10   (b) 9   (c) 21   (d) 15

Q 2. Let $S = \left\{ x \in [-6, 3] - \{-2, 2\} : \dfrac{|x+3|-1}{|x|-2} \geq 0 \right\}$ and $T = \{ x \in \mathbb{Z} : x^2 - 7|x| + 9 \leq 0 \}$.

Then the number of elements in $S \cap T$ is:

(a) 7   (b) 5   (c) 4   (d) 3

Q 3. In a school, there are three types of games to be played. Some of the students play two types of games, but none play all the three games. Which Venn diagrams can justify the above statement?

P   Q   R

(a) None of these   (b) P and Q (c) P and R (d) Q and R

Q 4. Consider the two sets : $A = \{ m \in \mathbb{R} :$ both the roots of $x^2 - (m+1)x + m + 4 = 0$ are real$\}$ and $B = [-3, 5)$. Which of the following is not true?

(a) $A - B = (-\infty, -3) \cup (5, \infty)$ (b) $A \cap B = \{-3\}$

(c) $B - A = (-3, 5)$ (d) $A \cup B = \mathbb{R}$

Q 5. A survey shows that 63% of the people in a city read newspaper A, whereas 76% read newspaper B. If x% of the people read both the newspapers, then a possible value of x can be

(a) 65   (b) 55   (c) 37   (d) 29

Q 6. Let A, B and C be sets such that $\phi \neq A \cap B \subseteq C$. Then which of the following statements is not true?

(a) $B \cap C \neq \phi$

(b) If $(A - C) \subseteq B$, then $A \subseteq B$

(c) $(C \cup A) \cap (C \cup B) = C$

(d) If $(A - B) \subseteq C$, then $A \subseteq C$

Q 7. Let $\bigcup_{i=1}^{50} X_i = \bigcup_{i=1}^{n} Y_i = T$, where each X_i contains 10 elements and Y_i contains 5 elements. If each element of the set T is an element of exactly 20 of sets X_i's and exactly 6 of sets, Y_i's, then n is equal to:

(a) 45   (b) 30   (c) 50   (d) 15

[JEE Mains 2020]

Q 8. Let $S = \{1, 2, 3, ..., 100\}$. The number of non-empty subsets A of S such that the product of elements in A is even, is:

(a) $2^{50}(2^{50}-1)$ (b) $2^{50}-1$ (c) $2^{50}+1$ (d) $2^{100}-1$

[JEE Mains 2019]

Q 9. In a certain town, 25% of the families own a phone and 15% own a car, 65% families own neither a phone nor a car and 2000 families own both a car and a phone. Consider the following three statements :

(i) 5% families own both a car and a phone.

(ii) 35% families own either a car or a phone.

(iii) 40,000 families live in the town.

Then:

(a) only (i) and (ii) are correct.   (b) only (i) and (iii) are correct.

(c) only (ii) and (iii) are correct.   (d) All (i), (ii) and (iii) are correct.

[JEE Mains 2015]

Q 10. If A, B and C are three sets such that $A \cap B = A \cap C$ and $A \cup B = A \cup C$, then:

(a) $A = C$ (b) $B = C$ (c) $A \cap B = \phi$ (d) $A = B$

[JEE Mains 2009]

Q 11. A survey shows that 73% of the persons working in an office like coffee, whereas 65% like tea. If x denotes the percentage of them, who like both coffee and tea, then x cannot be:

(a) 63   (b) 36   (c) 54   (d) 38

[JEE Mains 2020]

Q 12. In a college of 300 students, every student reads 5 newspapers and every newspaper is read by 60 students. The number of newspapers is:

(a) at least 30   (b) at most 20   (c) exactly 25   (d) none of these

[JEE Advanced 1998]

Q 13. The number of elements in the set $\{n \in \mathbb{N} : 10 \leq n \leq 100$ and $3^n - 3$ is a multiple of 7$\}$ is _____.

[JEE Mains 2023]

Q 14. Let $\gamma \in \mathbb{R}$ and let the equation E be $|x^2| - 2|x| + |\gamma - 3| = 0$.

Then, the largest element in the set $S = \{x + \gamma : x$ is an integer solution of $E\}$ is _____.

[JEE Mains 2023]

Q 15. Let $S = \{4, 6, 9\}$ and $T = \{9, 10, 11, ..., 1000\}$. If $A = \{a_1 + a_2 + ... + a_k : k \in \mathbb{N}, a_1, a_2, a_3, ..., a_k \in S\}$, then the sum of all the elements in the set $T - A$ is equal to _____.

[JEE Mains 2022]

Q 16. Let $A = \{1, 2, 3, 4, 5, 6, 7\}$. Define $B = \{T \subseteq A :$ either $1 \notin T$ or $2 \in T\}$ and $C = \{T \subseteq A :$ the sum of all the elements of T is a prime number$\}$. Then the number of elements in the set $B \cup C$ is _____. **[JEE Mains 2022]**

Q 17. If $A = \{x \in \mathbb{R} : |x - 2| > 1\}$, $B = \{x \in \mathbb{R} : \sqrt{x^2 - 3} > 1\}$, $C = \{x \in \mathbb{R} : |x - 4| \geq 2\}$ and v is the set of all integers, then the number of subsets of the set $(A \cap B \cap C)^c \cap \mathbb{Z}$ is _____. **[JEE Mains 2021]**

Q 18. The sum of all the elements in the set $\{n \in \{1, 2, \dots, 100\} \mid$ HCF of n and 2040 is 1$\}$ is equal to _____. **[JEE Mains 2021]**

Q 19. In a survey of 220 students of a higher secondary school, it was found that at least 125 and at most 130 students studied Mathematics; at least 85 and at most 95 studied Physics; at least 75 and at most 90 studied Chemistry; 30 studied both Physics and Chemistry; 50 studied both Chemistry and Mathematics; 40 studied both Mathematics and Physics and 10 studied none of these subjects. Let m and n respectively be the least and the most number of student who studied all the three subjects. Then $m + n$ is equal _____. **[JEE Mains 2024]**

Q 20. A group of 40 students appeared in an examination of 3 subjects — Mathematics, Physics and Chemistry. It was found that all students passed in at least one of the subjects, 20 students passed in Mathematics, 25 students passed in Physics, 16 students passed in Chemistry, atmost 11 students passed in both Mathematics and Physics, atmost 15 students passed in both Physics and Chemistry and atmost 15 students passed in both Mathematics and Chemistry. The maximum number of students passed in all the three subjects is _____. **[JEE Mains 2024]**