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## GRADE 11-MATHEMATICS WORKSHEET –SETS

### Don't forget:-

- A set is a **well-defined collection** of objects. It can be represented in three ways. **Statement form, Roster form** and **Set Builder form**.
- A set which doesn't contain any element is called **Empty set**.
- A set which consists of a definite number of elements is called **Finite set**. Otherwise the set is called **Infinite set**.
- Two sets A and B are said to be **Equal** if they have exactly the **same elements**.
- A set **A** is said to be subset of a set **B**, if every element of **A** is also an element of **B** and we write  $A \subset B$ .
- The collection of all subsets of a set **A** is called the **Power set of A**. It is denoted by  $P(A)$ .
- If A is a set with  $n(A) = m$ , then  $n[P(A)] = 2^m$ .
- Union of two sets A and B defined as  $A \cup B = \{x / x \in A \text{ or } x \in B\}$ .
- $A \cap B = \{x / x \in A \text{ and } x \in B\}$
- $A - B = \{x / x \in A \text{ and } x \notin B\}$
- If U is the universal set, then  $A' = \{x / x \in U \text{ and } x \notin A\}$ .
- **De Morgan's Law:-**  $(A \cup B)' = A' \cap B'$  and  $(A \cap B)' = A' \cup B'$ .
- If A and B are finite sets, such that  $A \cap B \neq \phi$ , then  $n(A \cup B) = n(A) + n(B) - n(A \cap B)$ .
- If A and B are finite sets, such that  $A \cap B = \phi$ , then  $n(A \cup B) = n(A) + n(B)$ .

1. Consider the sets A and B given by,  $A = \{x : x \text{ is a prime number } < 10\}$

$$B = \{x : x \text{ is a natural number which divides } 12\}$$

- Write A and B in Roster form
- Find  $A \cup B$  and  $B - A$ .
- Verify that  $(A \cup B) - A = B - A$ .

2. Consider  $A = \{x : x \text{ is a natural number, } 2 \leq x \leq 6\}$

$$B = \{x : x \text{ is a prime number, } x \leq 7\}, \quad C = \{x : x^2 - 5x + 6 = 0\}$$

- Write A, B, C in the roster form.
- Verify that  $(A \cup B) \cup C = A \cup (B \cup C)$ .



3. If  $A = \{1\}$ ,  $B = \{\{1\}, 2\}$ ,  $C = \{\{1\}, 3\}$  and  $U = \{\{1\}, \{2\}, \{3\}, 1, 2, 3\}$ , then find
- $A \cap B$
  - $B \cap C$
  - $n[(A \cap B)^c \cup (B \cap C)^c]$
4. 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 3 men got medals in all three sports. How many received medals in exactly two of the three sports?
5. 27 out of 50 boys in a class play football, 16 play basketball and 18 are on the track teams. 8 play football and basketball, 3 are on the basketball and track teams, 7 are on the football and track teams, 3 are on all teams. How many are on no team? How many play only basketball? How many are on the basketball and track teams but not on the football team?
6. Let  $U = \{x / 1 \leq x \leq 10, x \in N\}$ ,  $A = \{x / x = 2n, 1 \leq n \leq 5, n \in N\}$ , and  $B = \{x / x = 2n, 1 < n < 3, n \in N\}$
- Find  $A$  and  $A^c$ .
  - Find  $(A \cup B)$  and  $(A \cup B)^c$ .
  - Verify  $(A \cup B)^c = A^c \cap B^c$ .
7. Consider two sets  
 $A =$  Set of letters in word 'CAPITAL'.  
 $B =$  Set of letters in the word 'CAPSULE'.
- Express  $A$  and  $B$  in tabular form.
  - Is  $A=B$ ? Justify your answer.
8. If  $A = \{1, 2, 3, 4\}$ ,  $B = \{3, 4, 5, 6\}$  &  $C = \{5, 6, 7, 8\}$   
Find 1.  $(A \cup C)$  2.  $B \cap (A \cup C)$ .
9. If  $X$  and  $Y$  are two sets such that  $X$  has 40 elements,  $X \cup Y$  has 60 elements,  $X \cap Y$  has 10 elements. How many elements  $Y$  has?
10. Consider the set  $A = \{x : x \text{ is a letter of the word 'BALL'}\}$
- Write  $A$  in roster form.
  - How many subsets has set  $A$ .
  - Write the power set of  $A$ .
11. In a survey of 100 people it was found that 45 people read newspaper  $A$ , 50 read newspaper  $B$ , 39 read newspaper  $C$ , 18 read both  $A$  and  $B$ , 22 read  $B$  &  $C$  and 20 read  $A$  &  $C$ , 8 read all three.
- Draw the Venn diagram to represent the above data.
  - How many people don't read any of the newspapers?
  - How many read exactly one newspaper?
  - How many read newspapers  $A$  &  $B$  but not  $C$ .
12. If  $X$  and  $Y$  are two subsets such that  $n(X \cup Y) = 50$ ,  $n(X) = 28$  and  $n(Y) = 32$ , find  $n(X \cap Y)$ .
13. In a survey of 600 students in a school 150 students were found to be taking tea and 225 taking coffee, 100 were taking both tea and coffee.
- Represent these data by using Venn diagram.
  - How many students were taking neither tea nor coffee.



14. In a group of athletic team in a school 21 are in the basketball team, 26 in the hockey team and 29 in the football team. If 14 play hockey and basketball, 12 play football and basketball, 15 play hockey and football and 8 play all the three games, find the following
- How many players are there?
  - How many play football only?
15. Consider the set  $A = \{1,2,3\}$
- Write all subsets of  $A$
  - How many elements are there in its power set  $P(A)$ .
  - Write the power set  $P(A)$ .
16. If  $A$  and  $B$  are two sets such that  $n(A) = 115$ ,  $n(B) = 326$ ,  $n(A - B) = 47$ , then write  $n(A \cup B)$ .
17. Let  $A = \{x : x \in N, x \text{ is a multiple of } 3\}$  and  $B = \{x : x \in N, x \text{ is a multiple of } 5\}$ . Write  $A \cap B$ .
18. Let  $A = \{a, b, c, d\}$ ,  $B = \{a, b, c\}$  and  $C = \{b, d\}$ . Find all sets  $X$  such that :
- $X \subset B$  and  $X \subset C$
  - $X \subset A$  and  $X \not\subset B$ .
19. Let  $A$ ,  $B$  and  $C$  be three sets. If  $A \in B$  and  $B \subset C$ , is it true that  $A \subset C$ ? If not give an example.
20. Write the following subsets of  $R$  as intervals:
- $\{x : x \in R, -4 < x \leq 6\}$
  - $\{x : x \in R, -12 < x < -10\}$
  - $\{x : x \in R, 3 \leq x \leq 4\}$
21. Write the following intervals in the set-builder form:
- $(-7, 0)$
  - $[6, 12]$
  - $(6, 12)$
  - $[-20, 3)$ .
22. For any two sets  $A$  and  $B$ , prove that  $A \cup B = A \cap B \Leftrightarrow A = B$ .
23. Let  $A$ ,  $B$  and  $C$  be the sets such that  $A \cup B = A \cup C$  and  $A \cap B = A \cap C$ . Show that  $B = C$ .
24. Let  $A$  and  $B$  be sets, if  $A \cap X = B \cap X = \phi$  and  $A \cup X = B \cup X$  for some sets  $X$ , prove that  $A = B$ .
25. For any two sets  $A$  and  $B$ , prove that  $P(A) = P(B) \Rightarrow A = B$ .
26. For any two sets  $A$  and  $B$ , prove that  $P(A \cap B) = P(A) \cap P(B)$ .
27. Let  $A$ ,  $B$  and  $C$  be three sets such that  $A \cup B = C$  and  $A \cap B = \phi$ . Then, prove that  $A = C - B$ .
28. There are 40 students in a chemistry class and 60 students in a physics class. Find the number of students which are either in physics or chemistry class in the following cases:
- The two classes meet at the same hour.
  - The two classes meet at different hours and 20 students are enrolled in both the subject.
29. In a survey of 700 students in a college, 180 were listed as drinking Limca, 275 as drinking Miranda and 95 were listed as both drinking Limca as well as Miranda. Find how many students were drinking neither Limca nor Miranda.
30. Let  $U = \{1,2,3,4,5,6,7,8,9\}$ ,  $A = \{1,2,3,4\}$ ,  $B = \{2,4,6,8\}$  and  $C = \{3,4,5,6\}$ . Find
- $A'$
  - $B'$
  - $(A \cap C)'$
  - $(A \cup B)'$
  - $(A)'$
  - $(B - C)'$ .
31. Write all possible subsets of  $\{a, b, c\}$



32. Which of the following sets are equal?

(i)  $A = \{1, 2, 3\}$ ;

(ii)  $B = \{x \in R : x^2 - 2x + 1 = 0\}$ ;

(iii)  $C = \{1, 2, 2, 3\}$ ;

(iv)  $D = \{x \in R : x^3 - 6x^2 + 11x - 6 = 0\}$ ;

33. In a survey of 25 students, it was found that 15 had taken Mathematics, 12 had taken Physics and 11 had taken Chemistry, 5 had taken Mathematics and Chemistry, 9 had taken Mathematics and Physics, 4 had taken Physics and Chemistry and 3 had taken all the three subjects. Find the number of students that had

(i) Only Chemistry.

(ii) Only Mathematics.

(iii) Only Physics.

(iv) Physics and Chemistry but not Mathematics.

(v) Mathematics and Physics but not Chemistry.

(vi) Only one of the subjects.

(vii) At least one of the three subjects.

(viii) None of the subjects.

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