

MATH 120 Section 7.2 Sets

Definitions: A set is any collection of objects. Each object in a set is called a member or element of the set. A set without any elements is called the empty or null set. A finite set is a set that has a finite number of elements. An infinite set is a set with an infinite number of elements.

Rule Method vs Listing Method for Sets

Example: 1) Complete the table.

Rule Method	Listing Method	Finite or Infinite?
$\{x \mid x \text{ is a weekend day}\}$	{Saturday, Sunday}	finite
$\{x \mid x^2 = 4\}$	$\{-2, 2\}$	finite
$\{x \mid x \text{ is an odd counting number}\}$	$\{1, 3, 5, 7, 9, \dots\}$	Infinite

*Read: "The set of x such that x is a weekend day."

Symbols & Notation

\in is an element of

$A \subset B$: Set A is a subset of set B means every element of A is an element of B .

$A = B$: Set A is equal to set B if every element of A is an element of B AND every element of B is an element of A , that is, $A \subset B$ AND $B \subset A$.

$\emptyset = \{ \}$ is the empty set. Note: The empty set is a subset of every set.

Examples: Let $A = \{-3, -1, 1, 3\}$, $B = \{3, -3, 1, -1\}$, $C = \{-3, -2, -1, 0, 1, 2, 3\}$. Determine if the following are true or false.

2) $3 \in A$ True	7) $A \subset C$ True
3) $0 \in A$ False	8) $C \subset A$ False
4) $A \subset B$ A is a subset of B True	9) $A \neq C$ True
5) $B \subset A$ True	10) $\emptyset \subset A$ True
6) $A = B$ True	11) $\emptyset \subset C$ True
	12) $\emptyset \in A$ False

Example: 13) List all subsets of the set {a, b, c}.

$\{\}, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}$
 $\{a, b, c\}$

Universal Set, Intersection & Union

U: The universal set is the set of all elements under consideration.

$A \cap B = \{x | x \in A \text{ and } x \in B\}$: A intersect B is a set of all elements in A AND B.

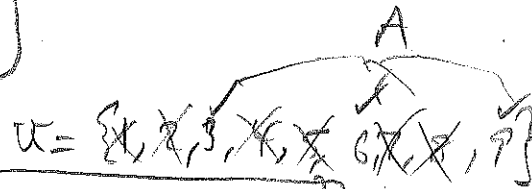
$A \cup B = \{x | x \in A \text{ or } x \in B\}$: A union B is a set of all elements in A OR B (or both).

$A' = \{x \notin A\}$: The complement of A is the set of elements in the universal set that are not in A.

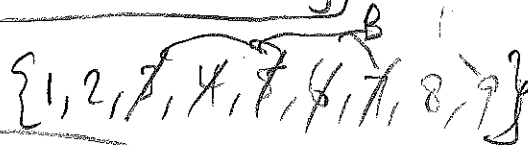
Examples: Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{3, 6, 9\}$ and $B = \{3, 4, 5, 6, 7\}$. Determine the following sets. Write using the listing method.

14) $A \cap B = \{3, 6\}$ A and B

15) $A \cup B = \{3, 4, 5, 6, 7, 9\}$ A OR B

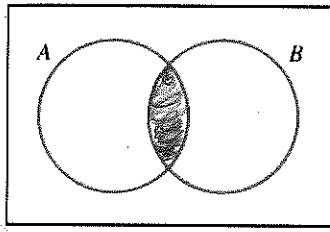


16) $A' = \text{Not } A = \{1, 2, 4, 5, 7, 8\}$

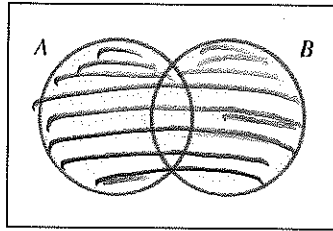


17) $B' = \text{Not } B = \{1, 2, 8, 9\}$

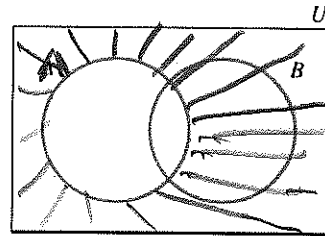
Venn Diagrams



$A \cap B$



$A \cup B$



A'

Examples: Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{3, 6, 9\}$ and $B = \{3, 4, 5, 6, 7\}$. Draw a Venn diagram and then answer the following:

18) $A \cap B = \{3, 6\}$

19) $A \cup B =$

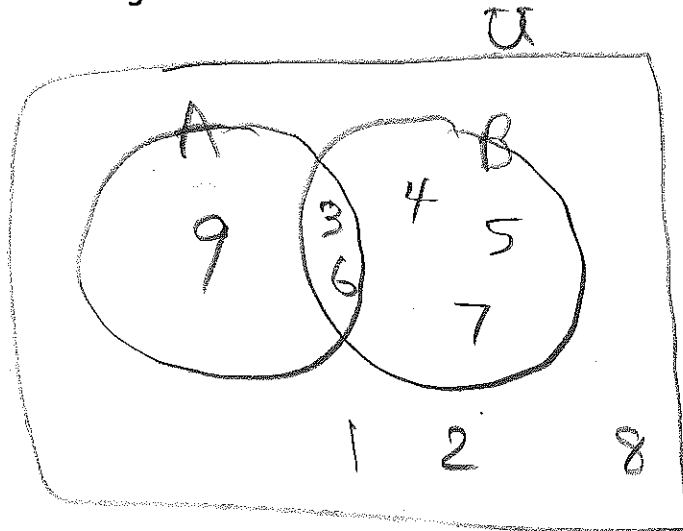
$\{3, 4, 5, 6, 7, 9\}$

20) $A' = \{1, 2, 4, 5, 7, 8\}$

21) $B' = \{1, 2, 8, 9\}$

22) $(A \cap B)' = \{1, 2, 4, 5, 7, 8, 9\}$

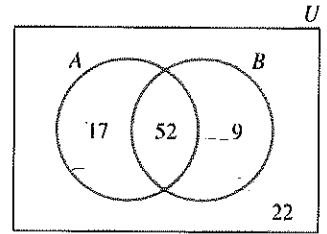
23) $(A \cup B)' = \{1, 2, 8\}$



Examples: Use the Venn Diagram to determine the indicated number of elements.

$$24) n(U) = 22 + 17 + 52 + 9 = 100$$

$$25) n(A \cap B) = \overset{\text{A intersect}}{52}$$



$$26) n(A) = 17 + 52 = 69$$

$$27) n(B) = 52 + 9 = 61$$

$$28) n(A \cup B) = 17 + 52 + 9 = 78$$

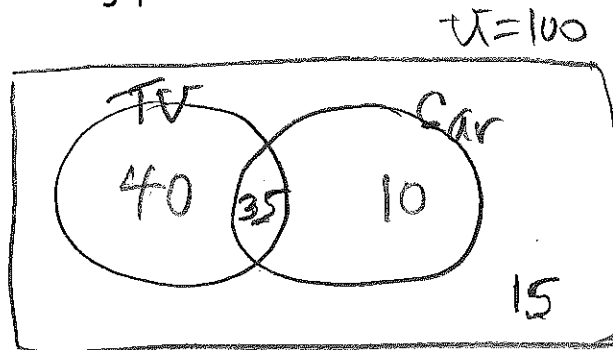
$$29) n(A') = 9 + 22 = 31$$

$$30) n(B') = 17 + 22 = 39$$

31) A survey was given to 100 randomly chosen students which included the following three questions and responses.

Do you own a TV?	Do you own a car?	Do you own a TV and a car?
75 said yes	45 said yes	35 said yes

Draw a Venn diagram and answer the following questions:



a) How many students do not own a TV?

$$10 + 15 = 25 \quad \text{OR} \quad 100 - 75 = 25$$

b) How many students do not own a car?

$$40 + 15 = 55 \quad \text{OR} \quad 100 - 45 = 55$$

c) How many students do not own a car or a TV?

$$15$$

d) How many students own a TV but not a car?

$$TV \cap \text{Car}' = 40 \quad \text{only TV}$$

e) How many students own a car but not a TV?

$$= 10 \quad \text{only Car}$$

f) How many students own either a TV or a car?

$$(TV \cup \text{Car}) = 40 + 35 + 10 = 85$$