I. Use the numerals in the Venn diagrams to give the cardinality of each set:

1.

\[
\begin{array}{c}
A \\
2 \ 4 \ 6 \\
B \\
8 \ U
\end{array}
\]

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

2.

\[
\begin{array}{c}
A \\
5 \ 8 \\
B \\
13 \ U
\end{array}
\]

a. \( A' \cup B' \)
b. \( A' \cap B \)
c. \( (A' \cap B)' \)
d. \( U \)

3.

\[
\begin{array}{c}
A \\
1 \ 2 \ 6 \\
B \\
9 \ 12 \\
C \\
8 \ U
\end{array}
\]

a. \( A \cap B \cap C \)
b. \( A \cap B \cap C' \)
c. \( A \cap B' \cap C \)
d. \( A' \cap B \cap C \)
e. \( A \cap B' \cap C' \)
f. \( A' \cap B \cap C' \)
g. \( A' \cap B' \cap C \)
h. \( A' \cap B' \cap C' \)
4.

II. Make use of an appropriate formula:

1. Find \( n(A \cup B) \) if \( n(A) = 5 \), \( n(B) = 6 \), and \( n(A \cap B) = 3 \)
2. Find \( n(A \cap B) \) if \( n(A) = 7 \), \( n(B) = 14 \), and \( n(A \cup B) = 18 \)
3. Find \( n(A) \) if \( n(B) = 9 \), \( n(A \cup B) = 14 \), and \( n(A \cap B) = 2 \)
4. Find \( n(B) \) if \( n(A) = 19 \), \( n(A \cup B) = 34 \), and \( n(A \cap B) = 7 \)

III. Draw a Venn diagram and use the information to fill in the number of elements in each region:

1. \( n(A) = 12 \), \( n(B) = 7 \), \( n(A \cap B) = 5 \), \( n(U) = 17 \)
2. \( n(A) = 20 \), \( n(A \cup B) = 35 \), \( n(A - B) = 9 \), \( n(A' \cap B') = 21 \)
3. \( n(A) = 25 \), \( n(B) = 31 \), \( n(C) = 34 \), \( n(A \cap B) = 8 \), \( n(A \cap C) = 10 \), \( n(B \cap C) = 14 \), \( n(A \cap B \cap C) = 3 \), \( n(U) = 70 \)
4. \( n(A \cup B \cup C) = 52 \), \( n(A \cap B \cap C') = 8 \), \( n(A \cap B' \cap C) = 11 \), \( n(A' \cap B \cap C) = 1 \), \( n(A' \cup B' \cup C') = 47 \), \( n(A) = 34 \), \( n(B) = 31 \), \( n(U) = 54 \)
5. \( n(A \cap B \cap C) = 11, \ n(A \cap B) = 17, \ n(A \cap C') = 11, \ n(B \cap C') = 18, \ n(A) = 25, \ n(B) = 30, \ n(A \cup B \cup C) = 42, \ n(U) = 45 \)

6. \( n(U) = 45, \ n(C) = 20, \ n(A) = 20, \ n(A \cap B \cap C) = 1, \ n(A \cup B \cup C=38, \ nB\cap C=7, \ n(A \cup B)'=10 \)

7. \( n(U) = 55, \ n(A \cup B \cup C)' = 5, \ n(A \cap B \cap C) = 3, \ n(A' \cap B' \cap C) = 10, \ n(A \cap C) = 10, \ n(C) = 27, n(A \cup C)' = 8, \ n(B \cap C) = 37 \)

IV. **Use Venn diagrams to answer each question:**

1. At the Cerullo Learning Assistance Center there are 150 tutors.
   
   100 tutor Math
   
   75 tutor English
   
   55 tutor both subjects

   a. How many are Math tutors only?
   b. How many are English tutors only?
   c. How many tutors do not tutor Math or English?

2. An English professor surveyed his class of 20 students to see which of the following sentences was correct. “The sun comes up everyday” or “The sun comes up every day.”

   10 students thought “everyday” was correct and “every day” was wrong
   
   2 students thought both were correct
   
   1 student did not answer

   a. How many students thought that “everyday” was correct?
   b. How many students thought that “every day” was correct?
   c. How many students thought that only “every day” was correct?

3. 100 people were surveyed to determine what kind of movies they liked.

   77 liked comedies
   84 liked action movies
   30 liked horror movies
   67 liked comedies and action movies
25 liked action movies and horror movies
22 liked comedies and horror movies
20 liked all three

a. How many liked only comedies?
b. How many liked only action movies?
c. How many liked horror or action movies?
d. How many did not like any of the three?

4. College seniors were surveyed to determine what type of alcohol they preferred.

27 liked beer and wine but not mixed drinks
48 liked wine and mixed drinks but not beer
83 like mixed drinks but not beer
114 liked beer and wine
167 liked beer
182 liked mixed drinks
177 liked wine
31 did not like any

a. How many liked beer and mixed drinks?
b. How many liked mixed drinks and wine?
c. How many liked all three?
d. How many people were surveyed?
e. How many only liked beer?

5. 500 high school athletes were asked what sports they played.

320 played soccer
250 played basketball
297 played baseball
194 played soccer and basketball
150 played basketball and baseball
80 played soccer and baseball but not basketball
115 played all three sports

a. How many did not play any of the sports?
b. How many played only one sport?
c. How many played only two sports?
d. How many played at least two sports?
e. How many played a sport that starts with the letter B?
f. How many played soccer or baseball?

6. People were asked what tourist destinations they would like to visit.

   3 people wanted to go to the Empire State Building only
   26 people wanted to go to Disneyland only
   15 people wanted to go to the Grand Canyon only
   72 people did not want to go to the Grand Canyon
   103 people did not want to the Empire State Building
   66 people did not want to go to Disneyland
   31 people did not want to go to any destination
   150 people were surveyed

   a. How many people wanted to go to Disneyland and the Grand Canyon?
b. How many people wanted to go to all three destinations?
c. How many wanted to go to Disneyland?
d. How many wanted to visit exactly two destinations?
e. How many wanted to go to the Empire State Building?
SOLUTIONS

I.

1. 
   a. 4
   b. 12
   c. 2
   d. 8

2.
   a. 27
   b. 13
   c. 22
   d. 35

3.
   a. 9
   b. 2
   c. 3
   d. 12
   e. 1
   f. 6
   g. 8
   h. 7

4.
   a. 20
   b. 31
   c. 30
   d. 21
   e. 49
   f. 54
   g. 14
   h. 23

II.

1. 8
2. 3
3. 7
4. 22

III.

1.

\[ \begin{array}{c}
A & B \\
7 & 5 & 2 \\
3 & U \\
\end{array} \]

2.

\[ \begin{array}{c}
A & B \\
9 & 11 & 15 \\
21 & U \\
\end{array} \]
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3.

4.

5.

6.

7.
IV.
1. a. 45  
b. 20  
c. 30  
2. a. 12  
b. 9  
c. 7  
3. a. 8  
b. 12  
c. 89  
d. 3  
4. a. 99  
b. 135  
c. 87  
5. a. 57  
b. 134  
c. 194  
d. 309  
e. 397  
f. 422  
6. a. 46  
b. 15  
c. 84  
d. 60  
e. 47