Surveys and Cardinal Numbers Applications

Problems involving sets of people (or other objects) sometimes require analyzing known information about certain subsets to obtain cardinal numbers of other subsets. The "known information" is often obtained by administering a survey.

In addition to just being fun, we can also use **Venn diagrams** to solve problems. When doing so, the key is to work from the "inside out," meaning we **start by** putting information in the regions of the diagram that represent the **intersections of sets.**

Example 1) In a group of 100 customers at Big Red's Pizza, 80 of them ordered mushrooms on their pizza and 72 of them ordered pepperoni. 60 customers ordered both mushrooms and pepperoni on their pizza.

- a) How many customers ordered mushrooms but no pepperoni?
- b) How many customers ordered pepperoni but no mushrooms?
- c) How many customers ordered neither of these two toppings?

Solution:
Create a Venn diagram with two sets. To do this, first draw two intersecting circles inside a rectangle

Example 2: At Dan's Automotive Shop, 50 cars were inspected. 23 of the cars needed new brakes, 34 needed new exhaust systems, and 6 cars needed neither repair.
a) How many cars needed both repairs?
b)How many cars needed new brakes, but not a new exhaust system?

Example 3: Make and label a Venn diagram for the following data where A, B, and C are subsets of the universe of people who were surveyed about the type of meat they like to eat. Let **A represent the people who like steak**, **B is the set who like chicken**,

$$n(U) = 350$$
$$n(A) = 150$$
$$n(B) = 195$$
$$n(A \cap B) = 100$$

- a) How many eat steak only?
- b) How many eat chicken only
- c) How many eat neither steak or chicken?
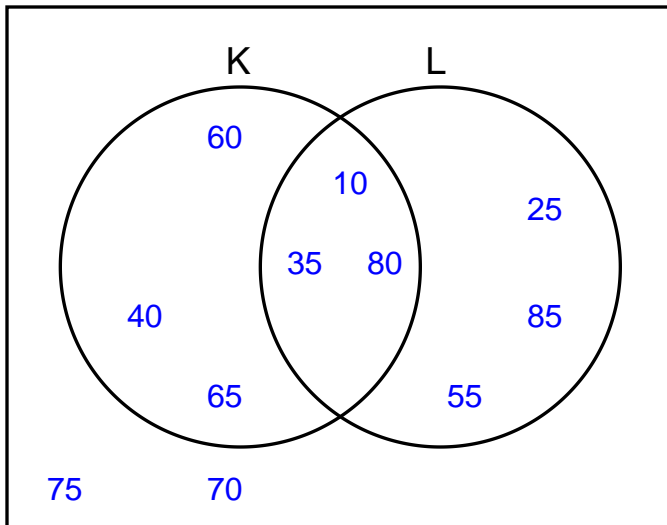- d) How many steak or chicken?

Name : _____   Score : _____

Teacher : _____   Date : _____
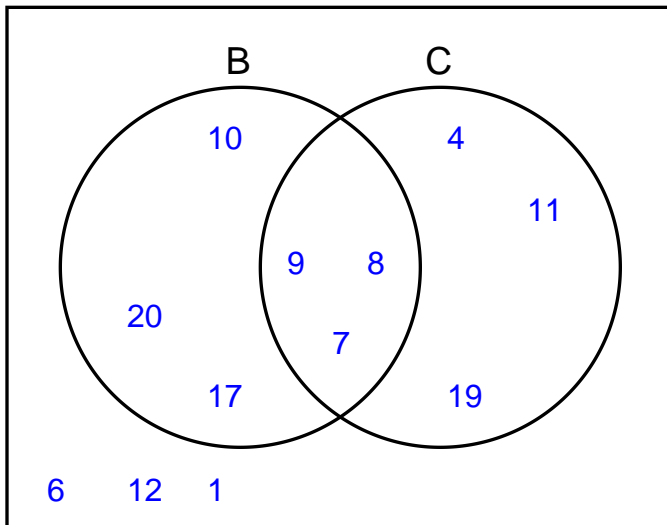
Solve the Problems Using the Venn Diagrams

1)

K   L

60

10
                    25
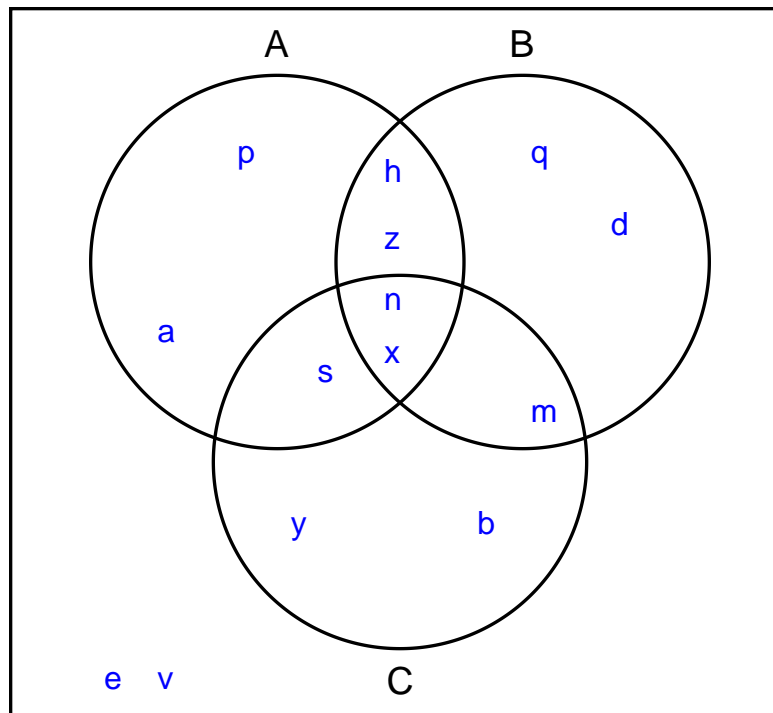35   80
40   85

65   55

75   70

L'	= _____
K' ∩ L'	= _____
K ∩ L	= _____
L' - K	= _____

2)

B   C

10   4

11
9   8
20
7
17   19

6   12   1

C - B	= _____
(B ∩ C)'	= _____
C - B'	= _____
(C - B)'	= _____

3)

L   M

t   v

x
r   n
c
a   h
q

k   d   p

L - M	= _____
L ∩ M'	= _____
M - L	= _____
M'	= _____

2

Solve the Problems Using the Venn Diagrams

Name : _____   Score : _____

Teacher : _____   Date : _____

1) (A U C) - B   = _____

2) B - (A U C)   = _____

3) A U B U C   = _____

4) (B U C)∩A   = _____

5) C - (A∩B)   = _____

6) (A U B) - C   = _____

7) B U (C - A)   = _____

8) (A U C)∩B   = _____

9) A∩B∩C   = _____

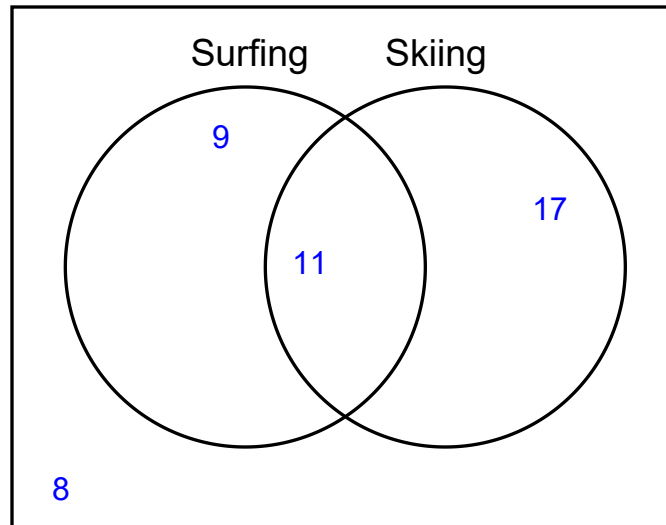10) A U (B - C)   = _____

Name : _____   Score : _____

Teacher : _____   Date : _____

Answer the Questions Based on the Venn Diagram

1) How many students like Surfing or Skiing ? _____

2) How many students like Surfing ? _____

3) How many students only like Surfing ? _____

4) How many students do not like either Surfing or Skiing ? _____

5) How many students only like Skiing ? _____

6) How many students do not like Surfing ? _____

7) How many students do not like Skiing ? _____

8) How many students like Skiing ? _____

9) How many students like both Surfing and Skiing ? _____

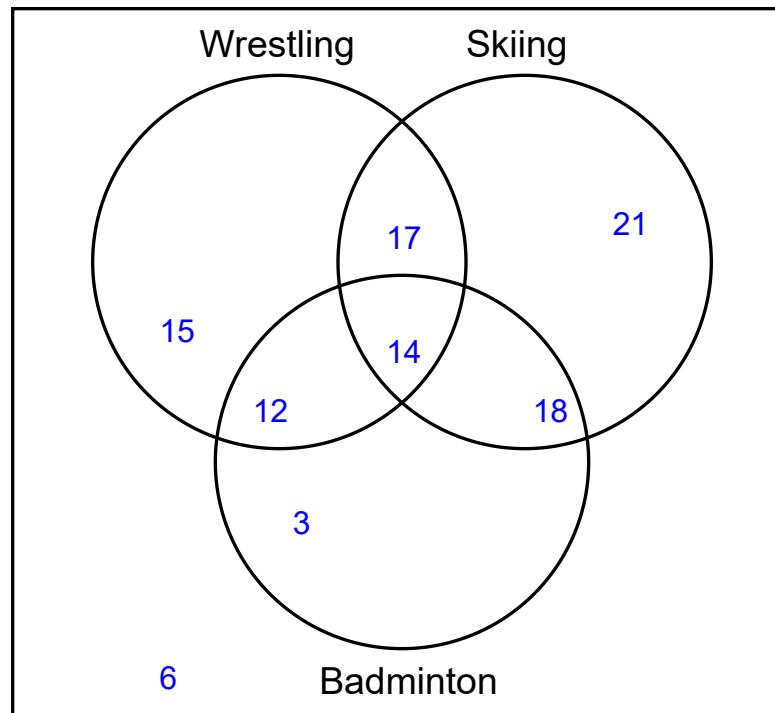10) How many students do not like both Surfing and Skiing ? _____

Venn Diagrams

Answer the Questions Based on the Venn Diagram

1) How many students do not like either Wrestling or Skiing ? ____

2) How many students only like Badminton ? ____

3) How many students only like Wrestling ? ____

4) How many students do not like either Skiing or Badminton ? ____

5) How many students only like Skiing ? ____

6) How many students like both Skiing and Badminton but not Wrestling ? ____

7) How many students do not like both Skiing and Badminton ? ____

8) How many students like Wrestling or Skiing but not Badminton ? ____

9) How many students like Wrestling or Badminton ? ____

10) How many students like both Wrestling, Skiing, and Badminton ? ____

Venn Diagrams

Example 4: A survey of a 160 students at CSUS showed that,

41 like Rock & Roll	48 like Jazz
37 like Classics	15 like both Rock & Roll and Jazz
11 like both Jazz and Classics	18 like both Rock & Roll and Classics
7 like all three subjects	

Fill in the number of elements in each region.

Find the number of students who:

1. like none of these subjects   1) _____

2. like Jazz only   2) _____

3. like Jazz or Classics, but not both   3) _____

4. don't like Jazz.   4) _____

5. like Classics or Rock but not both   5) _____

6. like Jazz or Rock but not both   6) _____

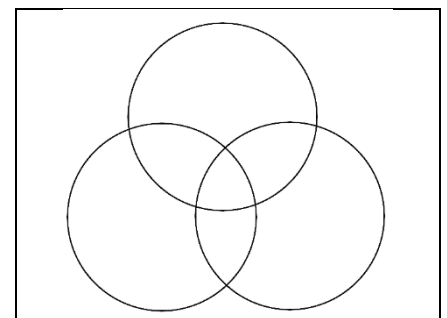7. like Classics only   7) _____
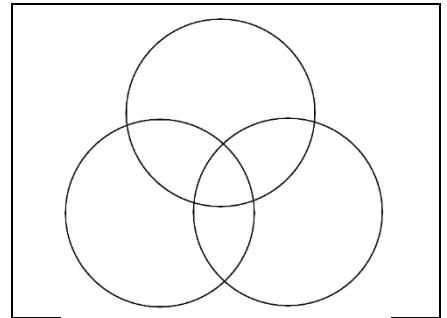
8. like none of those   8) _____

Example 4: A survey of 85 students asked them about the subjects they liked to study. Thirty -five students liked math, 37 liked history, and 26 liked physics. Twenty liked math and history, 14 liked math and physics, and 3 liked history and physics. Two students liked all three subjects.

a) How many of these students like math or physics?
b) How many of these students didn't like any of the three subjects?
c) How many of these students liked math and history but not physics?
d) How many of these students liked math and physics but not history?
e) How many of these students liked physics or history?

6

Make and label a Venn diagram for the following data where A, B, and C are subsets of the universe of people who were surveyed about the type of meat they like to eat. Let **A represent the people who like steak**, **B is the set who like chicken**, and **C is the set who like pork**.

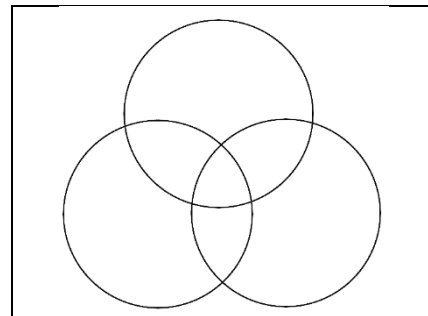$$n(U) = 350$$
$$n(A) = 150$$
$$n(B) = 195$$

$$n(C) = 170$$
$$n(A \cap B) = 99$$
$$n(B \cap C) = 103$$
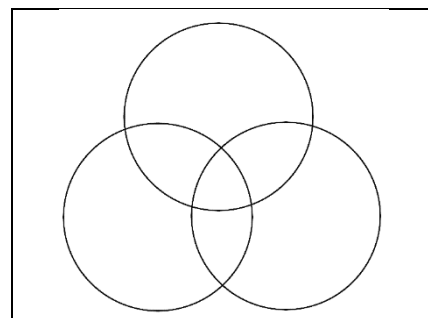$$n(A \cap C) = 62$$
$$n(A \cap B \cap C) = 56$$

e) How many eat steak only?
f) How many eat chicken only
g) How many eat pork only?
h) How many steak or chicken but not pork?
i) How many eat steak or pork but not chicken?
j) How many eat chicken or pork but not steak?

B) Draw an appropriate Venn diagram and use the information given to fill in the number of elements in each region.

$$n(A) = 57, \qquad\qquad n(A \cap B) = 35 \quad ,n(A \cup B) = 81,$$
$$n(A \cap B \cap C) = 15, \qquad n(A \cap C) = 21$$
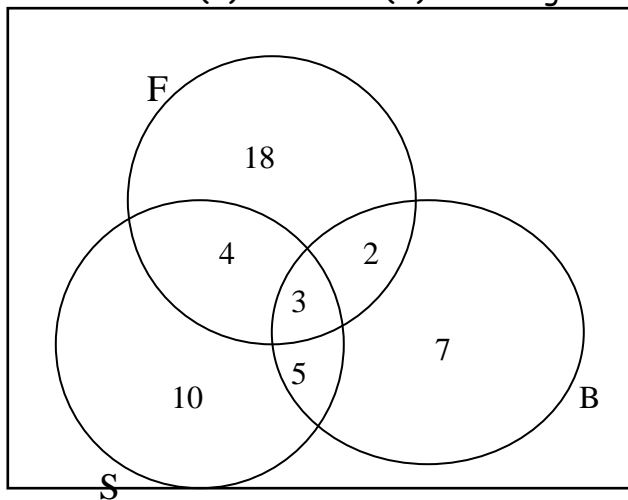
$$,n(B \cap C) = 25, \qquad n(C) = 49, and \qquad n\left(B'\right) = 52.$$

1. $n\left(A'\right) = ?$

2. $n\left(B'\right) = ?$

3. $n\left(C'\right) = ?$

4. $n\left(A' \cap C'\right) = ?$

5. $n\left(A' \cup C'\right) = ?$

6. $n\left(A' \cap B' \cap C'\right) = ?$

7. $n\left(A - C\right) = ?$

8. $n\left(A' - C\right) = ?$

9. $n\left(A' - C'\right) = ?$

10. $n\left(A - C'\right) = ?$

7

Venn Diagrams Worksheet
Math 1

1. A group of 60 students were asked if they played fieldhockey (F), basketball (B) or soccer (S). The diagram below displays the results.

What percent of the group play:
   a) field hockey & basketball?
   b) field hockey or basketball?
   c) field hockey & soccer?
   d) neither of the three sports?
   e) only 1 sport?

2. A survey was done to see how many people visit the beach, go camping or go to the waterslides during the summer months. It was found that 35% went camping, 57% went to the beach and 20% went to the waterslides. 15% went camping & to the beach, 8% went to the beach & to the waterslides, 5% went camping & to the waterslides and 3% went to all three. Draw a Venn diagram to display the information and find the percent of the survey population that:

   a) went to the beach or went to the slides.
   b) went camping or went to the beach.
   c) only went to one of the three locations.
   d) did none of the three activities.

3. The Venn diagram displays the results of a survey of 100 families regarding technology in their homes. Computer (C), VCR (V) and fax machine (F).
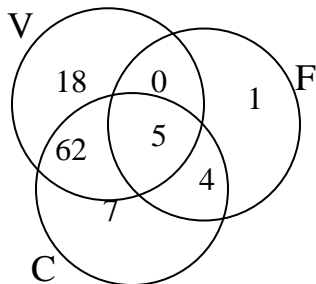
How many families have:
    a) a computer at home?   b) all three machines?
    b) none of the machines in their home?   c) no fax machine?
    c) a computer and a VCR?   d) a VCR or a computer?

4. Each member of a sports club plays at least one of soccer, rugby or tennis. The following is known: 43 members play tennis, 11 play tennis & rugby, 7 play tennis & soccer, 6 play soccer & rugby, 84 play rugby or tennis, 68 play soccer or rugby and 4 play all three sports. How many members does the club have?

5.   Of the 28 students in a class, 12 have a part time job, 22 have a part time job or do regular volunteer work, and 4 of the students have a part time job and do regular volunteer work.

       a) Display the data in a Venn Diagram.
       b) How many of the students do not have a part time job or do not volunteer regularly?

6. Given the Venn Diagram below with set A and set B determine the following:
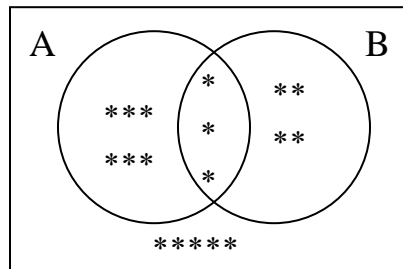
    a) $P(A)$
    b) $P(B)$
    c) $P(A\,and\,B)$
    d) $P(A\,or\,B)$
    e) $P(A')$
    f) $P(B')$
    g) $P(A'\,or\,B)$
    h) $P(A\,and\,B')$

Answers:
1. a) 8.33%   **b)** 65%   **c)** 11.67%   **d)** 18.33%   **e)** 58.33%
2. a) 69%   **b)** 77%   **c)** 65%   **d)** 13%
3. a) 78%   **b)** 5%   **c)** 3% **d)** 90%   **e)** 67%   **f)** 96%
4. 97
5. 24

6. a) $\dfrac{9}{18}$ b) $\dfrac{7}{18}$ c) $\dfrac{3}{18}$ d) $\dfrac{13}{18}$ e) $\dfrac{9}{18}$ f) $\dfrac{11}{18}$ g) $\dfrac{12}{18}$ h) $\dfrac{6}{18}$