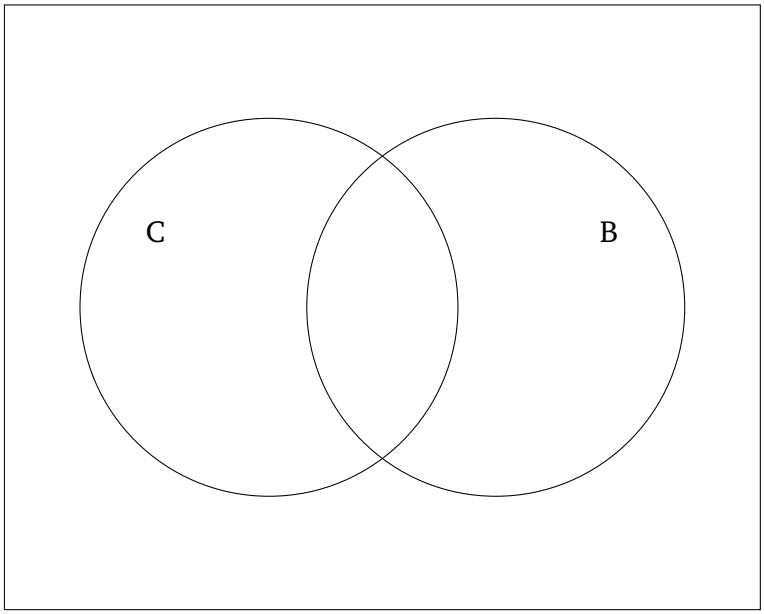
SET APPS

LAST NAME	FIRST NAME	DATE

1 (5 points)**.** A survey of 120 employees have shown that 84 of them commute by car, 35 commute by bike, and 28 use both modes of transportation.

(a) Fill out the Venn diagram below with cardinalities for each of the 4 subsets shown.



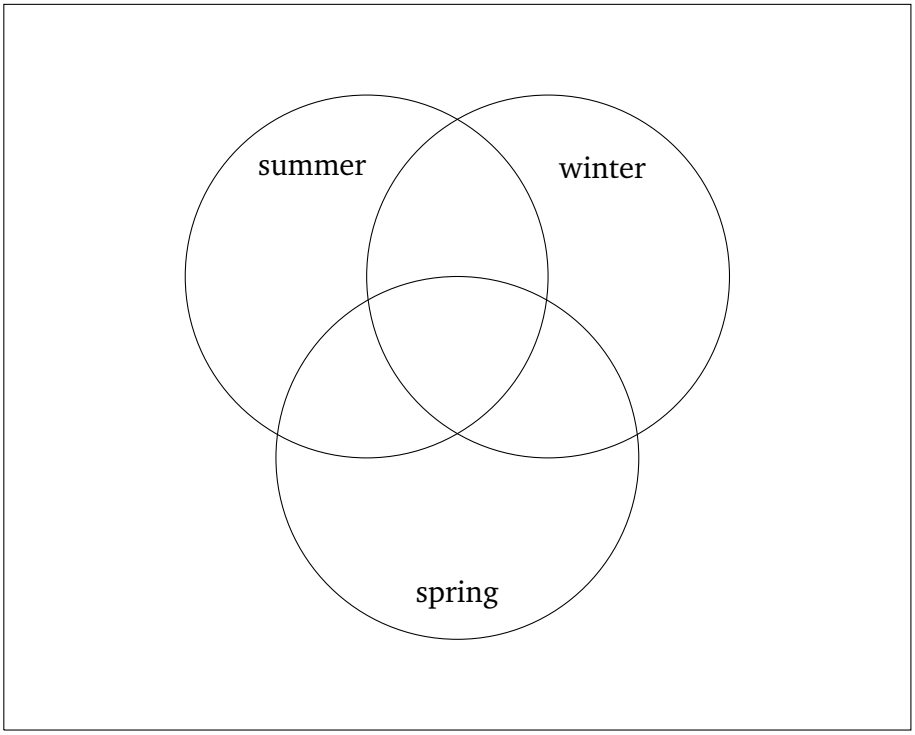
(b) How many employees are using the car but not the bike?

(c) How many employees are not using a car?

(d) How many employees are not using either form of transportation?

2 (10 points)**.** In a survey people were asked if they took a vacation in the summer, winter, or spring in the past year. The results were 73 took a vacation in the summer, 51 took a vacation in the winter, 27 took a vacation in the spring, and 2 had taken no vacation. Also, 10 had taken vacations at all three times, 33 had taken both a summer and a winter vacation, 18 had taken only a winter vacation, and 5 had taken both a summer and spring but not a winter vacation.

(a) Fill out the diagram below by stating the cardinality for each of the 8 mutually disjoint subsets.



(b) How many people had been surveyed?

(c) How many people had taken vacations at exactly two times of the year?

(d) How many people had taken vacations during both summer and winter but not spring?

(e) How many people had taken vacations during at most one time of the year?

3. In a class of 70 students, 45 students like to play soccer, 52 students like to play baseball. All the students like to play at least one of the two games.

(a) Using the addition formula for unions, find how many students like to play both soccer and baseball.

(b) How many students only play soccer?

4. A trading card game is played with a deck of 32 magical creature cards, where every creature can either breath fire or turn invisible or both. 20 of these creatures can breath fire, and 6 of the creatures have both powers.

(a) Using the addition formula for unions, find how many creatures can turn invisible.

(b) How many creatures have only one of the two powers?

Definition. A *partition* of a set X is a set P of subsets of X such that

(a) $\varnothing \notin P$,
(b) for any two distinct elements A and B of P, if $A \neq B$ then $A \cap B = \varnothing$,
(c) the union of all elements of P is X.

5. Create all possible partitions of integers $\mathbb{Z}$ using combinations of given sets as partition elements:

- $S = \{x \mid x \in \mathbb{Z} \text{ and } x \geq 7\}$
- E: even numbers
- A: integers whose rightmost digit is not a zero
- $\mathbb{Z}^+$: positive integers
- L: integers which are 6 or smaller
- P: prime numbers
- D: odd numbers
- $\{7\}$
- T: integer multiples of 10
- $\mathbb{Z}^-$: negative integers
- $\mathbb{Z}$
- G: integers which are higher than 7
- $\{0\}$
- N: non-negative integers

6. Find the cardinality of the set of all partitions of $\{1, 2, 3\}$.

7. Find the cardinality of the set of all partitions of $\{a, b, c, d\}$.

Problems With Answers.

Let $A = \{1,2,3,4,5\}$, $B = \{1,3,5\}$, $C = \{4,6\}$. Find the following cardinalities.

1. $|A|$

2. $|B|$

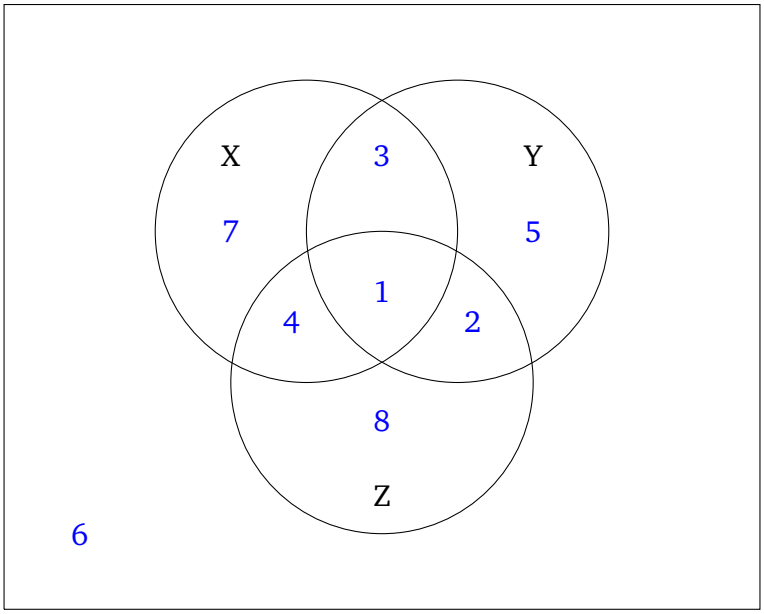
3. $|A \cup C|$

4. $|A \cap C|$

5. $|A - B|$

6. $|C - C|$

This diagram shows the cardinality of each of the eight mutually disjoint subsets of the universe.



Find the following cardinalities.

7. $|X \cap Z|$

8. $|Y \cup Z|$

9. $|(X \cap Y) - Z|$

10. $|(X - Y) \cap Z|$

11. If $|G| = 20$, $|H| = 30$, $|G \cap H| = 5$, find $|G \cup H|$.

12. If $|A| = 5$, $|B| = 8$, $|A \cap B| = 4$, find $|A \cup B|$.

Recall that $\mathscr{P}(X)$ is the set of all subsets of X. Find cardinalities of the following sets:

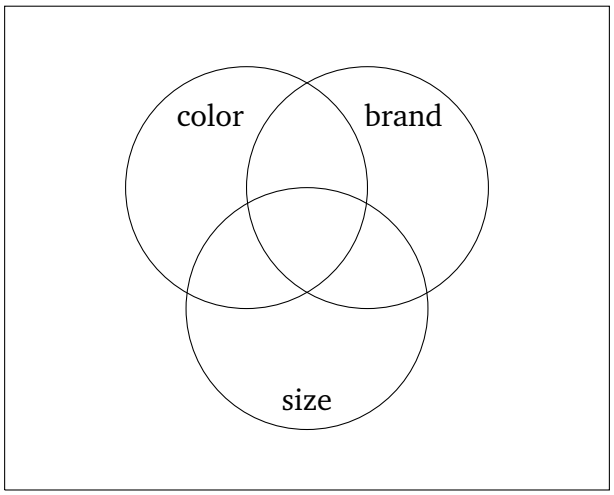
13. $\mathscr{P}(\{10, 20, 30, 40, 50, 60, 70, 80\})$

14. $\mathscr{P}(\varnothing)$

A survey asked buyers whether color, size, or brand influenced their choice of cell phone. The results are:

5 only said color
16 only said brand
42 said only color and brand
10 said all three
8 only said size
20 said only color and size
53 said only size and brand
20 said none of these

15. Complete the Venn diagram by stating the cardinality of each of the eight mutually disjoint subsets of the universe.



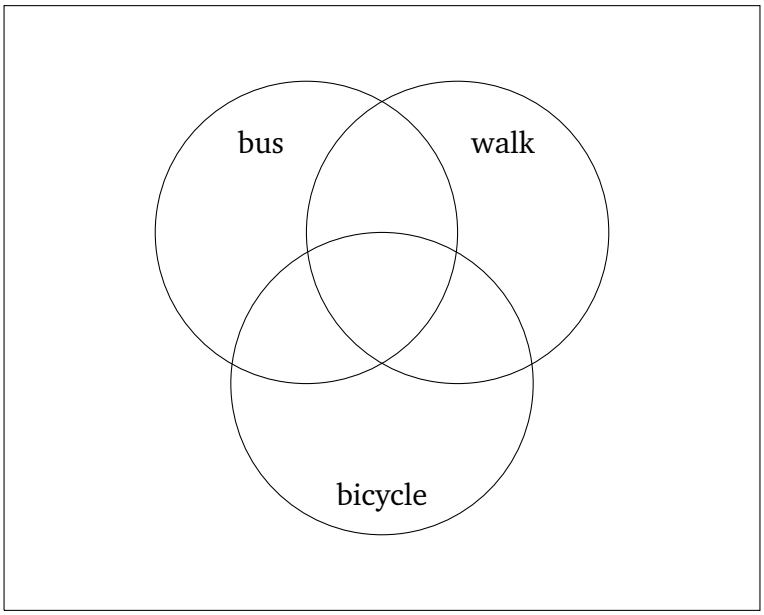
16. How many buyers were influenced by brand?

17. How many buyers were not influenced by color?

A survey asked 60 people what alternative transportation modes they use.

30 use the bus
25 walk
10 ride a bicycle and walk
2 use all three
20 ride a bicycle
5 use the bus and ride a bicycle
12 use the bus and walk

18. Complete the Venn diagram by stating the cardinality of each of the eight mutually disjoint subsets of the universe.



19. How many people only use bicycle?

20. How many people walk or use bus or both?

21. How many people walk and use a bicycle, but not the bus?

22. How many people use neither of the alternative transportation modes?

23. How any people do not use the bus?

ANSWERS.

1. 5

3. 6

5. 2

7. 5

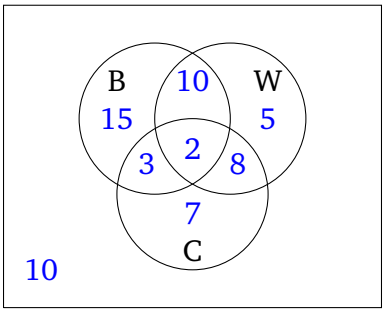
9. 3

11. 45

13. 256

16. 213

18. Let B, W, and C be the sets of people who use bus, walk, and cycle respectively.



20. 43

22. 10