

Section 1.3: Intersection and Union of Two Sets

****Handout:** Venn Diagram Definitions**

Venn diagrams can help develop formulas to determine the number of elements in certain sets.

What formula may be used to determine $n(A \setminus B)$?

Example 1:

R is the set of positive odd numbers less than 10. S is the set of multiples of 3 between 4 and 20. T is the set of prime numbers less than 12.

$$R = \{ \quad \quad \quad \} \quad S = \{ \quad \quad \quad \} \quad T = \{ \quad \quad \quad \}$$

Note: 1 is NOT a prime number!

a) List the elements of :

i. $R \cup S$

ii. $R \cap S$

b) What does it mean to write $x \in (R \cap T)$? List all possible values of x?

c) Is it true that $S \cap T$ is the empty set? Explain.

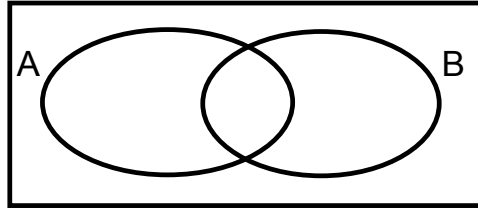


Example 2:

Given the following sets: Set A = {2, 3, 6, 8, 9}

Set B = {4, 5, 6, 7, 9}

a) Complete the Venn Diagram.



b) What is $n(A) + n(B)$?

c) What is the number of elements in A union B, $n(A \cup B)$?

d) Which elements were added twice?

e) How can you compensate for this overcounting?

f) Predict a formula for $n(A \cup B)$.

g) When will $n(A \cup B) = n(A) + n(B)$?



Principle of Inclusion and Exclusion

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

Note: When the sets are disjoint

$$n(A \cup B) = n(A) + n(B)$$

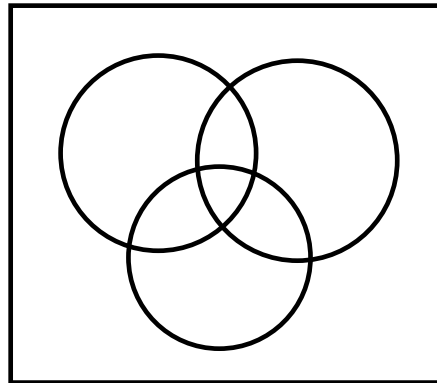
NOTE:

- We will be working with three sets as well. There is a formula available but due to the complexity it is best to use the Venn Diagram.
- When working with the Venn Diagram, it is best to fill in the center first, then the two set intersections before filling in the remaining pieces!

Example 3:

There are 36 students who study science.

- 14 study Physics,
- 18 study Chemistry,
- 24 study Biology,
- 5 study Physics and Chemistry,
- 8 study Physics and Biology,
- 10 study biology and Chemistry,
- 3 study all three subjects.



- Determine the number of students who study Physics and Biology only.
- Determine the number of students who study at least two subjects.
- Determine the number of students who study Biology only.



Example 4:

A group of 30 students are surveyed to find out which of the three sports, soccer (S), basketball (B), or volleyball (V), they play. The results are as follows:

3 children do not play any of the three sports

2 children play all three sports

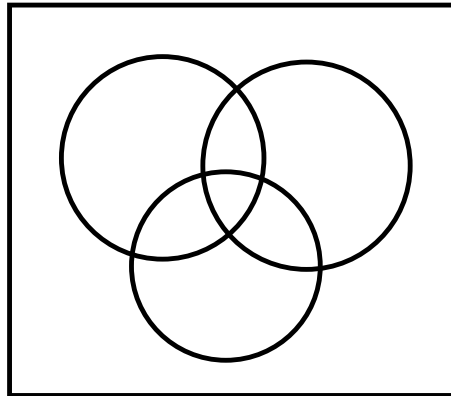
6 play volleyball and basketball

3 play soccer and basketball

6 play soccer and volleyball

16 play basketball

12 play volleyball



Use a Venn Diagram to answer the following questions:

- a) How many students play soccer only?

- b) How many students play soccer but not basketball?

- c) How many students play volleyball but not basketball?



Example 5: (Ex. 4 p. 29)

Morgan surveyed the 30 students in her math class about their eating habits.

- 18 of these students eat breakfast
- 5 of the 18 students also eat a healthy lunch
- 3 students do not eat breakfast and do not eat a healthy lunch.

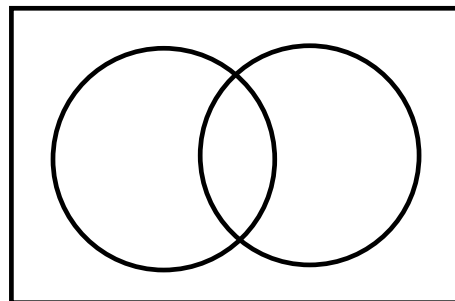
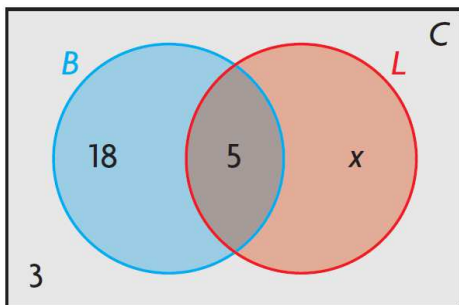
How many students eat a healthy lunch?

Tyler solved the problem but made an error.

What error did Tyler make?

Determine the correct solution.

Correct solution:



$$18 + 5 + x = 27$$

$$x = 4$$

$$n(L) = 5 + 4 = 9$$

Practice Questions:

p. 32 - 34, #1, 3, 8, 10, 15, 16

p. 38, #1, 2, 4 - 7 + matching worksheet