F Math 12

3.4 Application of Set Theory p. 179

Name _____

Date _____

Goal: Use sets to model and solve problems.

Example 1: Solving a puzzle using the Principle of Exclusion and Inclusion (p.180)

Use the following clues to answer the questions below:

- 28 children have a dog, a cat, or a bird.
- 13 children have a dog.
- 13 children have a cat.
- 13 children have a bird.
- 4 children have only a dog and a cat.
- 3 children have only a dog and a bird.
- 2 children have only a cat and a bird.
- No child has two of each type of pet.

a) How many children have a cat, a dog, and a bird?

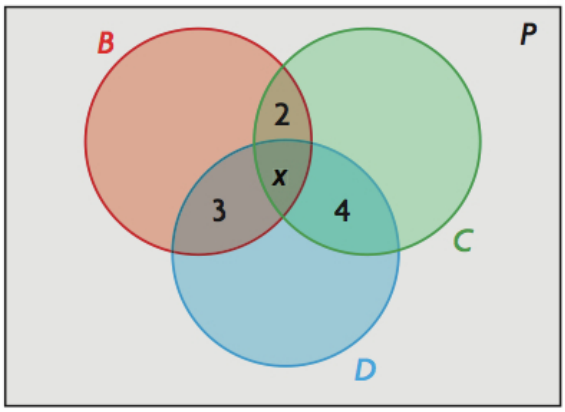
Define the sets and draw a Venn diagram.
Let *x* represent the number of children with a bird, a cat, and a dog.

P= {children with _____}

C= {children with a _____}

B= {children with a _____}

D= {children with a _____}



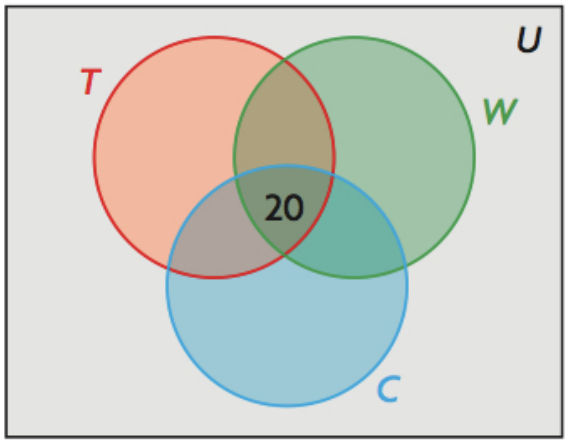
b) How many children have only one pet?

Example 3: Shannon's high school starts a campaign to encourage students to use "green" transportation for travelling to and from school. At the end of the first semester, Shannon's class surveys the 750 students in the school to see if the campaign is working. They obtain these results:

- 370 students use public transit.
- 100 students cycle and use public transit.
- 80 students walk and use public transit.
- 35 students walk and cycle.
- 20 students walk, cycle, and use public transit.
- 445 students cycle or use public transit.
- 265 students walk or cycle.

Complete the Venn Diagram to show how many students are using green transportation for travelling to and from school.

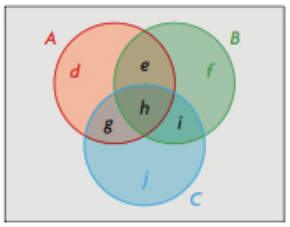
U={students who attend Shannon's school}
T= {students who use public transit}
W={students who walk}
C= {students who cycle}



In Summary

Key Ideas

- Set theory is useful for solving many types of problems, including Internet searches, database queries, data analyses, games, and puzzles.
- To represent three intersecting sets with a Venn diagram, use three intersecting circles. For example, in the following Venn diagram,



  - $A \cap B \cap C$ is represented by region h,
  - $A \cap B$ is represented by the union of regions e and h,
  - $A \cap C$ is represented by the union of regions g and h, and
  - $B \cap C$ is represented by the union of regions h and i.

  Each region of a Venn diagram contains elements that occur only in that particular region.
- You can use the Principle of Inclusion and Exclusion to determine the number of elements in the union of three sets:
  $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C)$

Need to Know

- You can use concepts related to sets to search for websites on the Internet:
  - Put an exact phrase in quotation marks.
  - Connect words or phrases with "and" to search for sites that contain both. The word "and" represents the intersection of two or more sets.
  - Connect words or phrases with "or" to search for sites that contain either one or the other, or both. The word "or" represents the union of two or more sets.
- When solving a puzzle or problem, it is often useful to visualize the problem. First identify which sets are defined by the context. Then identify how the sets overlap. Finally, identify regions of the overlaps that are of interest in the puzzle or problem. It is often advisable to consider how much is known about each region, and use the information about the region that is most known to deduce information about regions that are less well known. A systematic approach will result in answers that are easier to verify.

HW: 3.4 p. 191-194 # 2, 4, 6, 7, 9, 11, 12 & 13