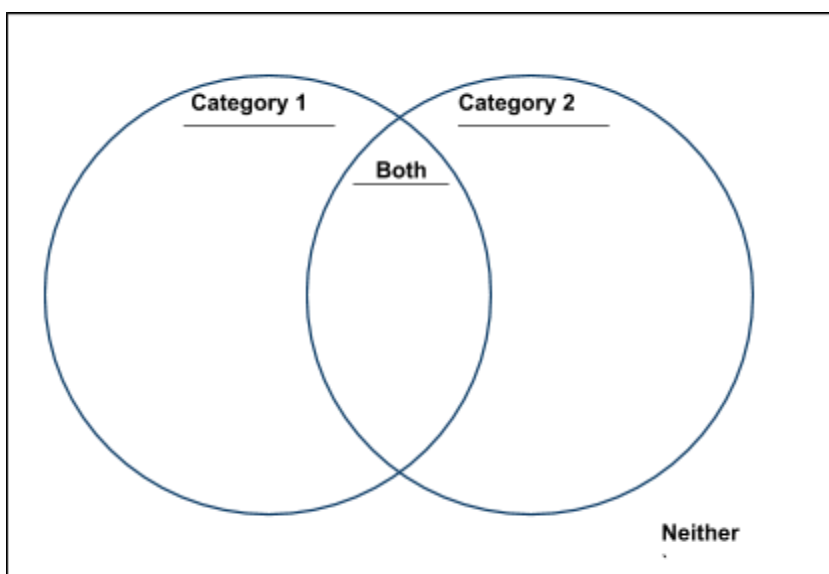# Venn Diagrams
UCLA Olga Radko Math Circle 11/8/2020

Introduction

Introduced in 1880 by John Venn, Venn diagrams have been a great way to visualize the relationship between a collection of sets. In a two-set Venn diagram, four regions are created from an outlining box and two overlapping circles.

For example, if Category 1 represents even numbers and Category 2 represents every multiple of 3, then we would have four regions:
   1) even numbers NOT a multiple of three,
   2) the overlapping region of numbers divisible by both 2 and 3 (multiples of 6),
   3) multiples of 3 that are NOT even, and
   4) all other numbers that are neither divisible by 2 or 3.

Steps for solving Venn Diagram Problems:
   1) Label each section of the Venn diagram
   2) Fill in the diagram with the given information.
   3) Determine the values of the missing spots
   4) Answer the question :)

Note: It gets confusing if the value in a circle represents ONLY that category or all values in that category, including the "both" section. The number represents what's only in that category (anything within the closest boundary. If you would like to keep track of the total value of the category including the "both", I recommend writing your labels "Category 1 = Total 1" and "Category 2 = Total 2".

Example 1: *In a class of 50 students, 18 take Chorus, 26 take Band, and 2 take both Chorus and Band. How many students in the class are not enrolled in either Chorus or Band?*
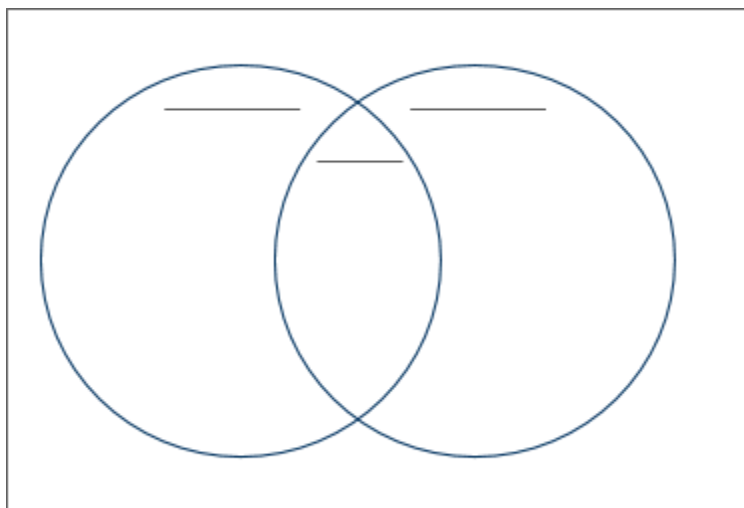
To solve this, let's follow the steps!

Band = 26   Chorus = 18   Neither

Both

26-2=24   2   18-2=16

50-16-24-2=8
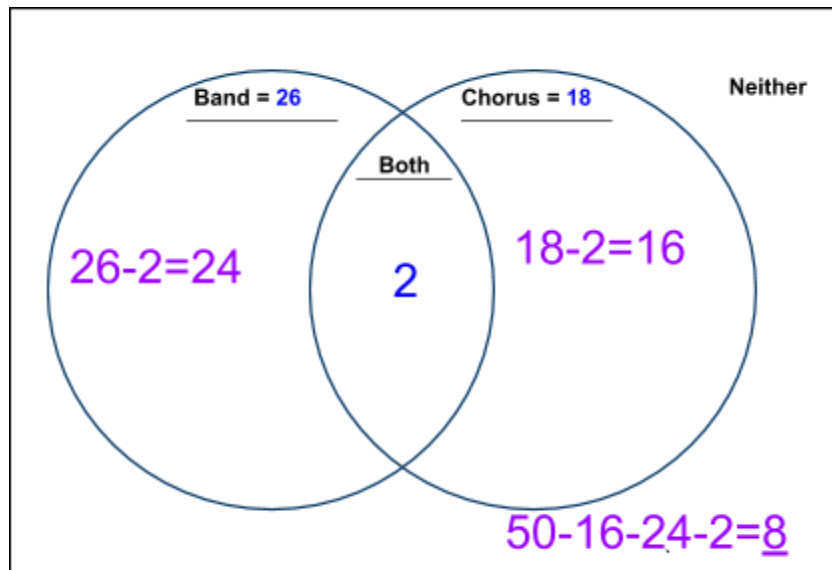
**Answer:** 8 students are not enrolled in either

Problem Set 1

1) In a school of 320 students, 85 students are in band, 200 students are on sports teams, and 60 students participate in both. How many students are NOT involved in either band or sports?

2) There are 26 students in Math Circle. After class, 11 students ate only chocolate chip cookies and 8 students ate only oatmeal cookies. If 5 students ate both types of cookies, *how many students did not eat any cookies*?
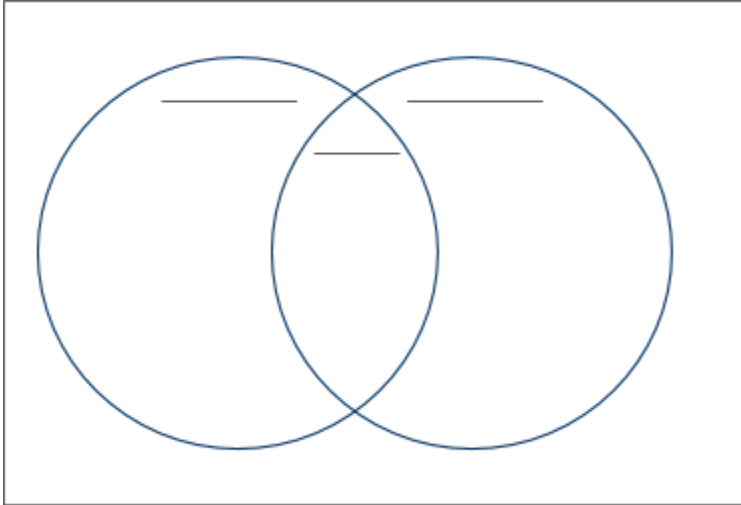
3) 50 students at Math Circle Elementary School either enroll in cooking or dance class or both. 14 of them take only cooking class, and 29 take only dance class. How many students take both classes?
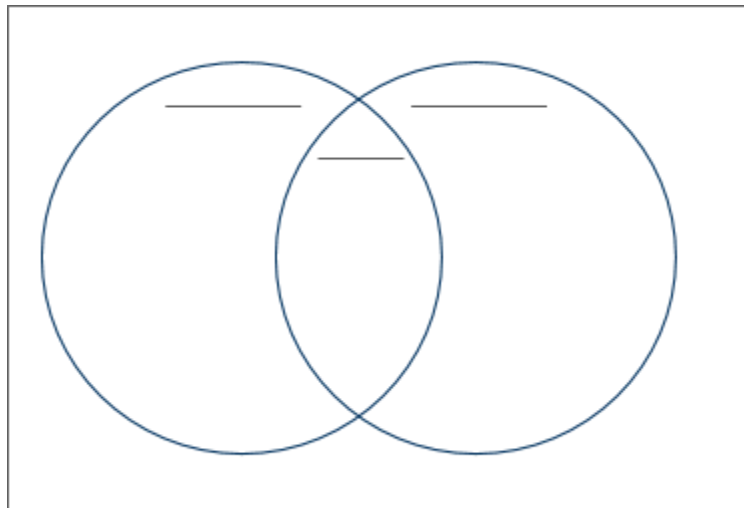
What if we have more than two categories?

No worries! We simply add another circle! However, there is a lot more information to keep track of! Be careful and make sure to keep track of all values correctly!

Category 1   Category 2

1 & 2

All three

1 & 3   2 & 3

Category 3

None
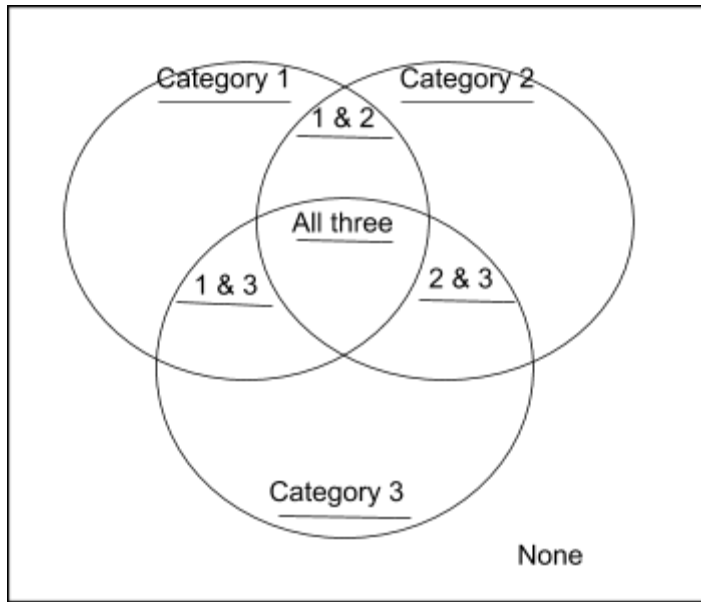
Problem Set 2

4) A veterinarian surveys 26 of her patrons. She discovers that 14 have dogs, 10 have cats, and 5 have fish. Additionally, 4 patrons have dogs and cats, 3 have dogs and fish, and 1 has a cat and fish. If no one has all three kinds of pets, how many patrons have none of these pets?
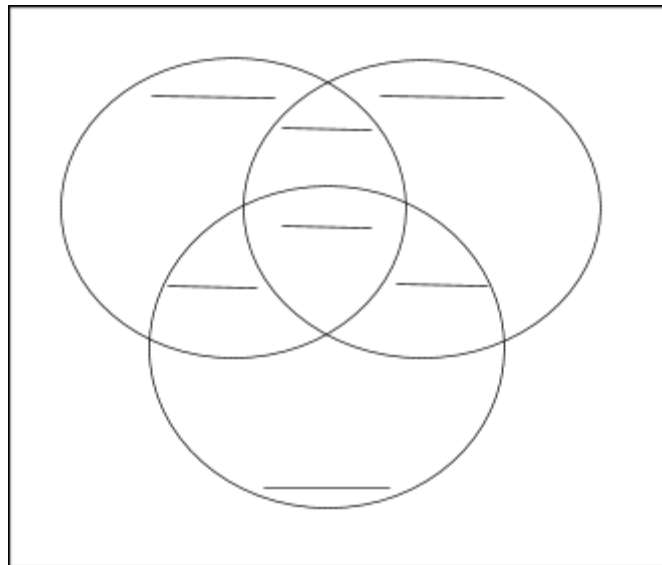
5) A guidance counselor is planning schedules for 30 students. 16 students say they want to take French, 16 want to take Spanish, and 11 want to take Latin. 5 say they want to take both French and Latin, and of these, 3 want to take Spanish as well. 5 want only Latin, and 8 want only Spanish. How many students want French only?
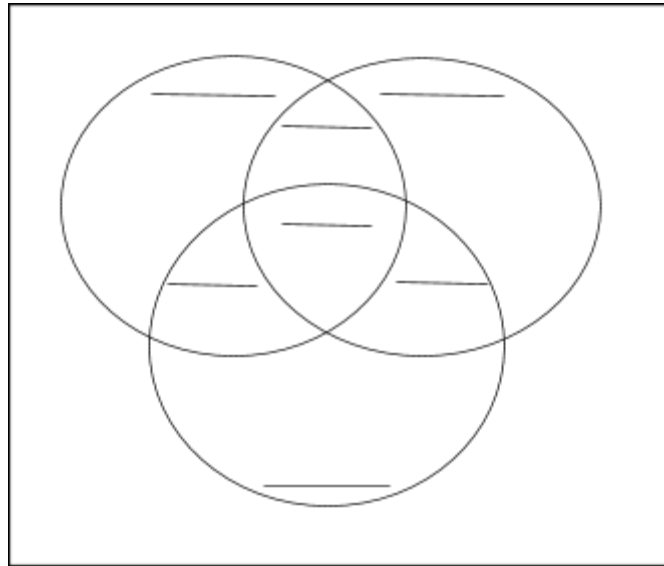
6) At Gavin's Good Dog Obedience School, dogs can learn to do three tricks: sit, stay, and roll over. Of the dogs at the school:

| A. 50 dogs can sit	B. 17 dogs can sit and stay	C. 29 dogs can stay
D. 12 dogs can stay and roll over	E. 34 dogs can roll over	F. 18 dogs can sit and roll over
G. 9 dogs can do all three	H. 9 dogs can do none	
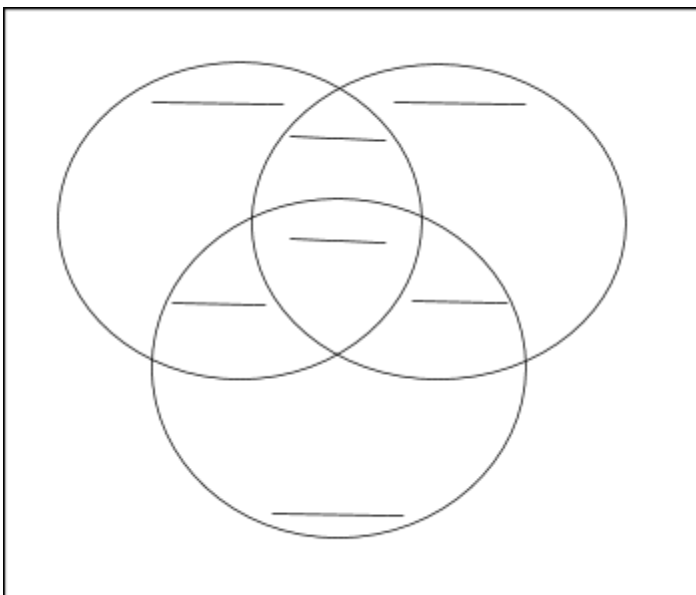
i) How many dogs are in the school?

ii) How many dogs can do exactly 2 tricks?

Challenge Problems

7) All 12 players of a Paul's basketball team are taking at least a biology or chemistry class. If 7 players are taking biology and 2 players are taking both sciences, how many players are taking chemistry?
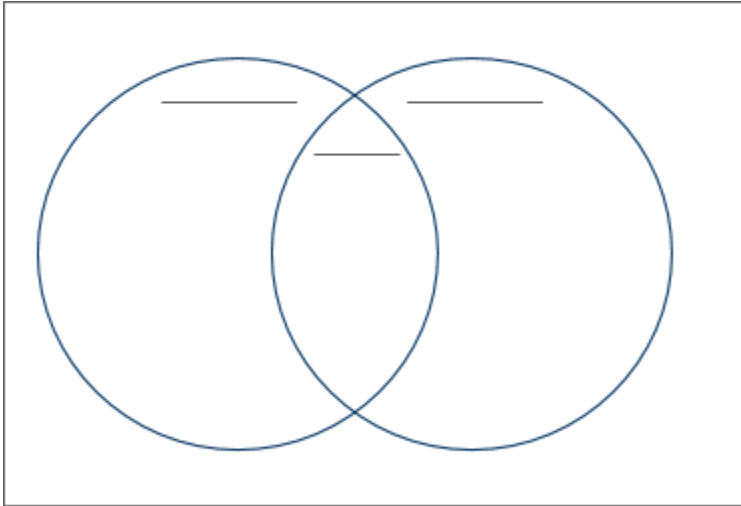
8) There are 30 students in Ashin's kindergarten class. If there are twice as many students with blond hair as with blue eyes, 6 students with blond hair and blue eyes, and 3 students with neither blond hair nor blue eyes, how many students have blue eyes?
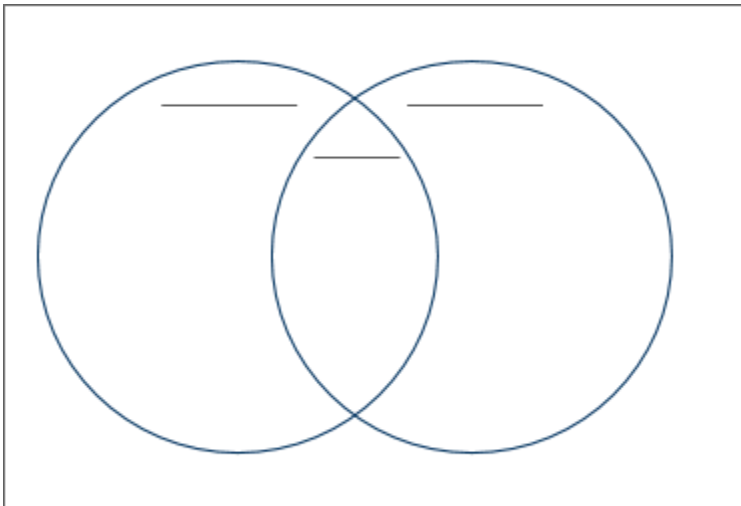
What if we have two sets of characteristics?

Extra Challenging Problems

9) There are 20 cars in front of UCLA's Math-Sciences building. All of the cars are red or white. 12 of them are red, 15 of them are 4-door, and 4 of them are 2-door and white. How many of the cars are 4-door and red?

10) US Blood Types. In the US, antigen A is present in 44% of the population and antigen B 15% (Blood type AB has both). The Rh factor is present in 84% of the population (+ means that Rh protein is present) . In addition, 7% of the population is type O-, 34% is type A+, 9% is type B+, and 1% is type AB-. (Note that you cannot be two different blood types). Each blood type represents what percentage of the population?

    a) O-
    b) O+
    c) A+
    d) A-
    e) B+
    f) B-
    g) AB+
    h) AB-