1   Introduction

In mathematics, drawing pictures often helps especially when we are given a large set of values and asked to compare. **Venn diagrams** allow us to untangle and visualize data, making common applications like addition and subtraction easier.
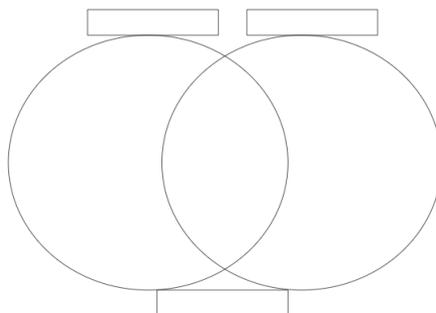
Figure 1: Venn Diagram

Label the diagram with "**A**", "**B**", and "**A and B**" as shown.

2   Warm-up

In a classroom with 10 students, everyone plays at least one sport after school. The school offers the option of volleyball and basketball. 7 students play volleyball and 3 play both sports. How many students play basketball? (*Hint: Think of which piece of given information is the easiest to start with.*)

To solve, first draw a Venn diagram and label it. Place the known data into the corresponding sections. Now, fill in the missing value given the total.

3   Try It Yourself

1. A school took a survey to see students' preferred transportation methods to and from school. The statistic showed that 22 students walk, 17 bike, and 12 use both. How many students did they survey in total?

2. A student was curious to see what her peers did over winter break. She asked her 30 classmates and found that 19 of them vacationed in Lake Tahoe and 17 went to Disneyland, and 8 lucky kids did both.

   Add up all the values in your diagram. Is it the same as the total? If not, why did you fall short?

In Venn Diagrams, we must look at A, B, both but also consider **neither A nor B**. This number is denoted outside the Venn diagram and should be accounted for in the total.
How many students did only one activity over break? How many did none?

3. In genetics, there are dominant and recessive alleles. The alleles come in pairs, one from the mother and the other from the father. Let's denote the dominant allele for big ears as B and the recessive as b. BB and Bb result in big ears while one must receive both recessive alleles (bb) for small ears. If the probability of getting one recessive allele is .5 and the probability of receiving two dominant alleles is .25. What chance does Dumbo, the elephant, have of getting small ears? *Hint: The probability adds up to 1*

4   Sum It All Up

Now that you are more comfortable with Venn diagrams, take Problem 1 and try to find the total number of students in terms of values x y and z. Use the diagram below as a guide.
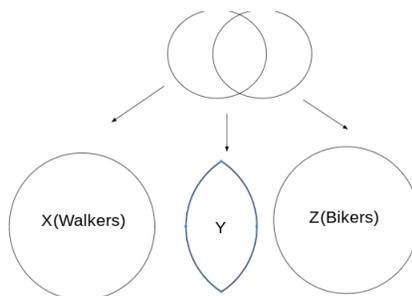
5   Challenge

1. Great news! Everyone in Mr. Lomas' math class earned an A+ on the last math test, so he decided to treat them to ice cream. At the shop, there were three flavors to choose from: chocolate, vanilla, and sorbet. They could either get 1, 2, or all three flavors (one scoop per flavor). Unfortunately, the register is broken, but Mr. Lomas noted that there were 26 scoops of chocolate in total, 5 people with three scoops, 2 people who chose only sorbet, 17 cups with 2 scoops, 10 people who decided to get chocolate and vanilla, 5 strictly vanilla-lovers, and 4 people who got chocolate and sorbet. How many students were there total?

    If the shop charges 50 cents per scoop, how much did Mr. Lomas spend?

2. You are playing a carnival game where there are red, blue, and purple (both red and blue) bottles, and you have to guess the number of purple bottles. You see 18 bottles in front of you, but they are faced down so you can't see the colors. The carnival worker tells you that 11 have a blue bottom and 13 of them are red, and 3 are clear. Try to win the game using a Venn diagram.

3. Referring to the formula you created, try writing Y in terms of X and Z and the total.