Example 1 (Students). Mr. Mindthumper has 40 students in an algebra class and 40 students in a geometry class. How many different students is Mr. Mindthumper teaching if:

(a) there is no one taking both classes?

(b) there are 10 people taking both classes?

The Addition Principle:

Idea: I have a bowl of 20 Starburst and a different bowl of 40 Starburst. When I pour them in the same bowl, I have 60 Starburst.

Note: In part b of the first example we had 3 sets:
**Example 2** (Rolling Dice). One red and one green six-sided die, marked with the numbers 1 through 6, are rolled at the same time.

(a) How many different rolls can happen?

(b) How many rolls are there with both dice the same?

(c) How many with both dice different?

**The Multiplication Principle:**

*Idea:* If I have 3 different t-shirts and 2 different shorts, then I have $6 = 3 \times 2$ different outfits.

**Example 3** (Arranging Books). We have 5 different Spanish books, 6 different French books, and 8 different Transylvanian books.

(a) How many books are there?
(b) We want two books in different languages. How many choices do we have?

**Note:** To solve this problem we broke it into smaller, more manageable subproblems. This tactic will often make problems easier.

**Definition:** A word is a list of letters whose length is the number of letters it contains.

**Example:** fgrqis is a word of length 6

**Example 4 (Sequence of Letters).** How many length 3 words can be made out of the letters a,b,c,d,e,f

(a) If we allow repeated letters?

(b) If we don’t allow repeats?
(c) If we don’t allow repeats and require an ’e’?

(d) If we allow repeats and require and ’e’?