

RAM Math Circle - Chennai
Session 5

Session format:

- 60 minutes: Counting problems
 - 30 minutes: Geometry with paper folding
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1 Introduction to counting

We continued working on counting problems based on the addition and multiplication principles.

Addition principle: *If there are m different elements in set A and n different elements in set B , then the total number of ways of choosing 1 element from either set A or set B is $m + n$.*

Multiplication principle: *If there are m different elements in set A and n different elements in set B , then the total number of ways of choosing an element from set A and an element from set B is $m \times n$.*

1. A store carries 8 styles of pants. For each style there are 10 different possible waist sizes, 6 pant lengths and 4 colour choices. How many different types of pants could the store have?
2. In how many ways may one right and one left shoe be selected from 6 pairs of shoes **without** obtaining a pair?
3. There are 4 different roads from Alwarpet to T.Nagar, 3 different roads from T.Nagar to Marina, and 2 different roads from Alwarpet to Marina directly.
 - (a) How many different routes from Alwarpet to Marina altogether?
 - (b) How many different routes from Alwarpet to Marina and back if any road can be used once in each direction (i.e. the route can be repeated on the return journey)?
 - (c) How many different routes from Alwarpet to Marina and back that do not use any road twice?
 - (d) How many different routes from Alwarpet to Marina and back that visit T.Nagar at least once?
4. How many four-letter 'words' (sequences of letters with repetition, that may or may not make sense in English) are there in which the first and last letters are vowels?
5. How many ways are there to roll two dice to yield a sum divisible by 3?

2 Geometry with paper folding

We started constructing an octahedron using modular origami. We learned a basic construction called ‘waterbomb’ and learned to put 3 waterbomb modules together using the pocket-and-flap method. We will complete the construction next week.

3 Food for thought

1. How many times is the digit 0 written when listing all numbers from 1 to 3333?
2. A *binary sequence of length n* is a sequence in which each term is either 0 or 1. For example, here are all binary sequences of length 3:

0 0 0	0 1 1
0 0 1	1 1 0
0 1 0	1 0 1
1 0 0	1 1 1

- (a) How many binary sequences of length 4 are there? (You may or may not list them all.)
- (b) How many binary sequences of length 5?
- (c) How many binary sequences of length n ? (Here n can be any positive integer, so your answer should be a formula in terms of n).

