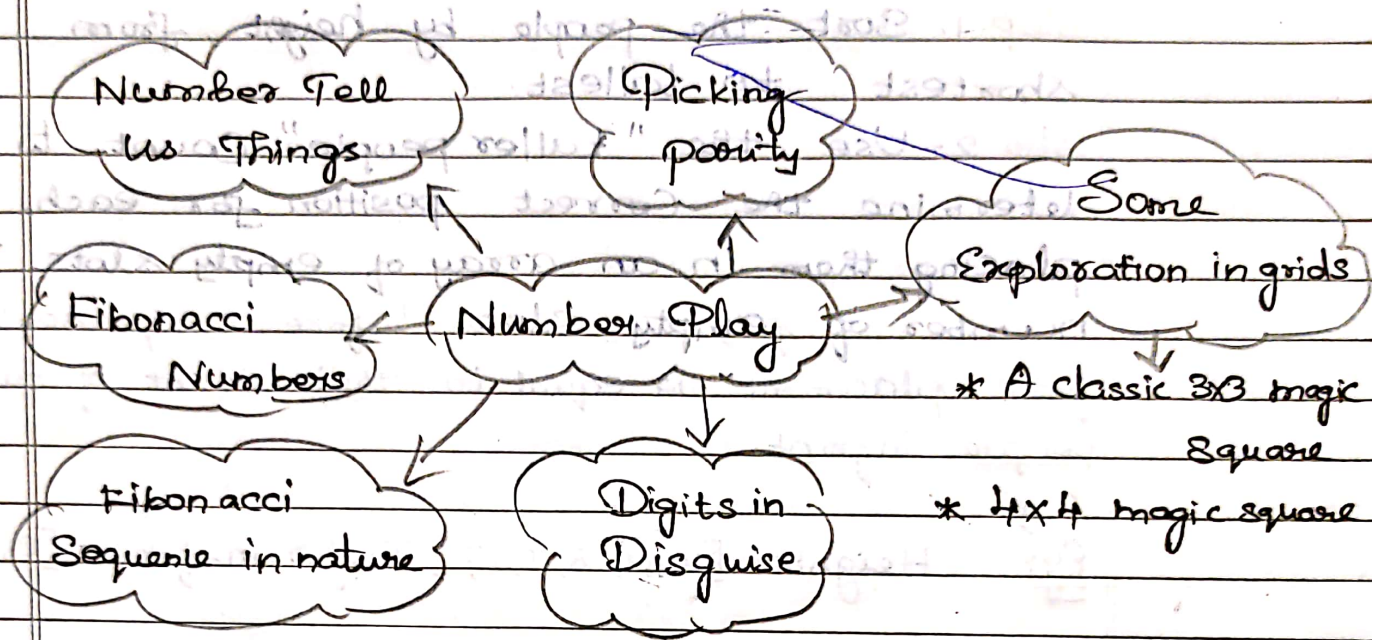


AUGUST

Chapter - 6NUMBER PLAYMind map:-Number Tell us things:-

"Number tell us things" means numbers can give us information or describe a situation. By observing the numbers, we can understand patterns & solve logical reasoning problems.

Eg:-

The most common type of height-based sequence challenge involves a queue of people & related array of numbers.

Each number indicates how many taller people are standing in front of that person.

Height Based Sequences:

To determine the height based final arrangement, you can follow an iterative approach:

Step 1. Sort the people by height, from shortest to tallest.

Step 2. Use the "taller people" Count to determine the correct position for each, placing them in an array of empty slots. The number of empty slots before a person's final placement is equal to their count of taller people in front.

Eg:- Heights = $[10, 9, 8, 7, 6]$, Taller-in-front = $[0, 0, 1, 2, 4]$

(Step 1) Reconstruct = $[6, 7, 8, 9, 10]$ (Shortest $\rightarrow$ tallest)

Using Taller-in-front $[4, 2, 1, 0, 0]$

Final Arrangement = $[9, 8, 7, 10, 6]$

Picking Parity:-

$$* \text{ Even} + \text{ Even} = \text{ Even}$$

$$* \text{ Odd} + \text{ Odd} = \text{ Even}$$

$$* \text{ Even} + \text{ odd} = \text{ Odd}$$

$$* \text{ Even} + \text{ Even} + \dots + \text{ Even} (\text{Odd no. of times}) = \text{ Even}$$

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Some Exploration in grids:-

For a standard 3x3 magic square, the sum of each row, column and main diagonal is always 15. This Constant Sum is also known as the magic Constant.

Calculating the magic Constant:-

To form a normal 3x3 magic square you use the distinct integers from 1 to 9. The magic Constant can be calculated with a simple formula

① Sum of all the numbers in the square:

$$1+2+3+4+5+6+7+8+9 = 45$$

② Divide the total sum by the number of rows (or columns), which is 3.

③ $45 \div 3 = 15$

A classic 3x3 magic square:-

4	9	2	→ 15
3	5	7	→ 15
8	1	6	→ 15
↓	↓	↓	↘
15	15	15	15

A first ever 4x4 magic square:-

1	14	15	4	= 34
12	7	6	9	= 34
8	11	10	5	= 34
13	2	3	16	= 34
"	"	"	"	"
34	34	34	34	34

Rules of a magic Square:

Grid Size: The Puzzle uses $n \times n$ grid, where n is the order of the square.

Distinct numbers:

Each number in the square is used only once.

Magic Constant:

The Sum of the numbers in each row, column and main diagonal must be identical. This value is known as magic Constant.

Fibonacci Numbers:

(Fibonacci Sequence in numbers)

The sequence starts with 0 & 1.

Each subsequent number is the sum of the two numbers before it.

The sequence progresses as follows:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, and so on

Here $F_0 = 0$; $F_1 = 1$; $F_2 = F_0 + F_1 = 0 + 1 = 1$

$$F_3 = F_1 + F_2 = 1 + 1 = 2$$

$$F_n = F_{n-1} + F_{n-2}$$

Digits in Disguise:

Digits in disguise refers to mathematical puzzles, also known as cryptarithms or alphametics, where letters are used to represent digits.

Chapter-7 A Tale of Three Intersecting Lines

- * Right angle (90°)
- * Obtuse angle ($90^\circ < \angle < 180^\circ$)
- * Acute angle ($0^\circ < \angle < 90^\circ$)

- * Scalene (No two sides are equal)
- * Isosceles (2 sides are equal)
- * Equilateral (All sides are equal & each $\angle = 60^\circ$)

Pythagoras theorem
($\text{Hyp}^2 = \text{per}^2 + \text{base}^2$)

Classification

A Tale of Three Intersecting lines

Median
(Bisects the base)

Altitude/Height
Perpendicular to the base

Angle Sum property
(The sum of the measures of three angles of a triangle is 180°)

Exterior Angle property
(An exterior angle is equal to sum of interior opposite angles)

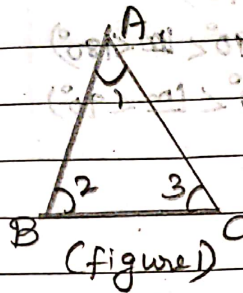
Triangle:

A triangle is a closed planar shape consisting of three line segments.

vertices: A, B, C

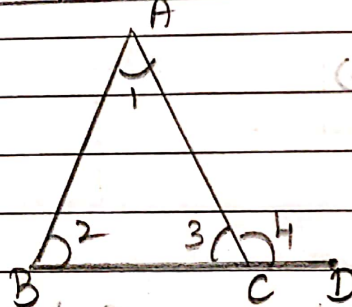
Sides: AB, BC, CA

Angles: $\angle ABC$, $\angle ACB$, $\angle BAC$

Angle Sum property:-

The sum of the measures of three angles of a triangle is 180° . This is known as angle sum property of a triangle.

In figure 1, $\angle 1 + \angle 2 + \angle 3 = 180^\circ$.

Exterior angle property:-

An exterior angle = Sum of interior opposite angle.

ie) $\angle 4 = \angle 1 + \angle 2$

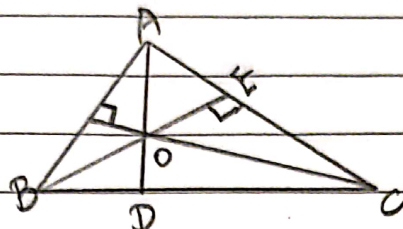
Special property:-

* The sum of the lengths of two sides of a triangle is greater than the length of the third side.

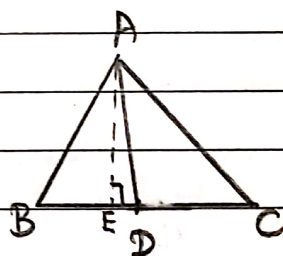
* The difference between the lengths of two sides of a triangle is smaller than the length of the third side.

Altitude of a triangle:-

A triangle's altitude is the perpendicular line segment from the vertex to the opposite side.

Medians of a triangle:-

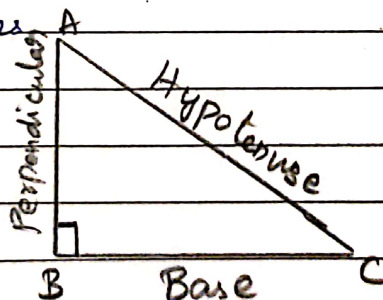
The median of a triangle is the line segment that connects the vertex to the opposite side's mid point. A triangle has 3 median points.



D is the mid point of BC.
 $BD = DC$.

Pythagoras theorem & right-angled triangles:-

In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.



$$AC^2 = BC^2 + AB^2$$

Pythagorean triplets:-

Three natural numbers in which the square of the largest number is equal to the sum of the squares of the other two form a pythagorean triplets.

Eg:- (3, 4, 5), (5, 12, 13) etc are pythagorean triplets

A triplet (m, n, p) of natural numbers m, n and p is said to be a Pythagorean triplet if $m^2 + n^2 = p^2$.

If m is odd, then the Pythagorean triplet is $(m, \frac{m^2-1}{2}, \frac{m^2+1}{2})$

If m is even, then the Pythagorean triplet is $(2m, m^2-1, m^2+1)$

Equilateral Triangle

Steps of Construction:-

1. Construct a line XY and consider a point D on this line.

2. Draw perpendicular PD on the line XY .

3. Now, cut a line segment AD from D which is equal to 6 cm.

4. Generate 30° at A on both sides of AD , i.e., $\angle CAD$ & $\angle BAD$ where B & C lie on the line XY .

5. ABC is the required equilateral triangle.

