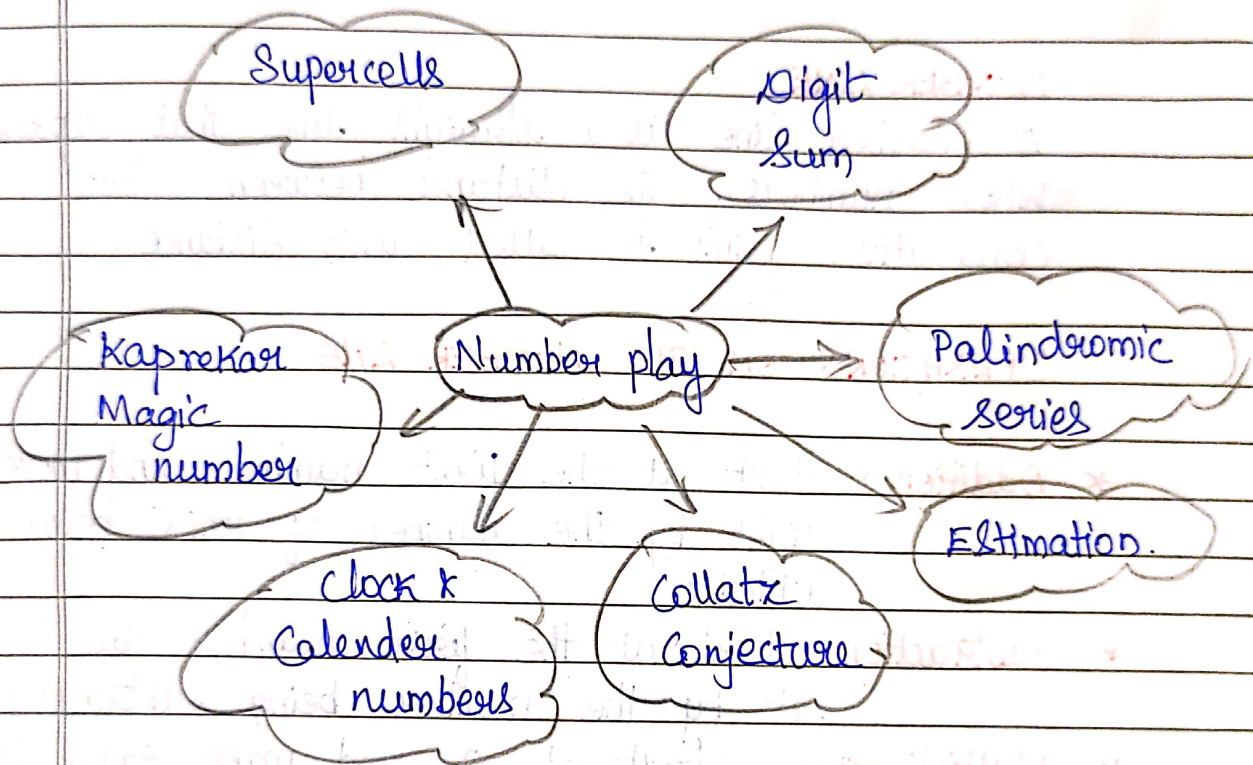


CHAPTER - 3 NUMBER PLAY

Mind Map



FUNDAMENTALS & THE NUMBER LINE

SUPERCELLS

A number in a grid or sequence that is strictly greater than all of its immediate neighbours (left, right, above or below)

NUMBER LINE

A Number line is a straight line that represents whole numbers. The distance between two consecutive points is called unit distance.

OPERATIONS ON THE NUMBER LINE

- * **Addition**: Start at the first number and move right by the number of units being added.
- * **Subtraction**: Start at the first number and move left by the number being subtracted.
- * **Multiplication**: Start at 0 and make equal sized jumps to right.

DIGIT RULES & SERIES

DIGIT SUM

The sum of all individual digits in a number

Digit Sum ranges for n -digit numbers

Smallest Sum: Always 1

Largest Sum: Always $9n$

Number of digit	Smallest digit sum	Largest digit sum
2	1	18
3	1	27
4	1	36
n	1	9n

PALINDROMIC SERIES

A sequence of numbers or terms that reads exactly the same forward and backward

Eg: 121, 131, madam

KAPREKAR MAGIC NUMBER

The number 6174 is called Kaprekar's constant

If you take any 4-digit number (with at least two different digits), arrange its digits in descending and ascending order, subtract the smaller from the larger and repeat the process. You will always reach 6174 in few steps.

CLOCK AND CALENDER NUMBERS

CLOCK PATTERN

- * Multiples of 5
- * Numbers opposite to each other add up to 13.
- * The hour hand moves exactly 30° every hour.

CALENDAR PATTERNS

- * Days of the week repeat every 7 days.
- * 31-Day Month Pattern (use Knuckle Trick)
- * Leap year pattern (divisible by 4)
- * 1st, 8th, 15th, 22nd and 29th of any month always fall on the exact same weekday.

COLLATZ CONJECTURE

A famous number pattern and an unsolved math puzzle

Start with any positive number and apply these rules

Number type	Rule applied
Even	Divide by 2
Odd	Multiply by 3 and add 1

No matter what number you start with, the sequence will eventually reach 1

MENTAL MATH

It builds speed, accuracy and confidence in math
mental math is important

- * Improves number sense
- * Helps in everyday life (Shopping, time)
- * Speeds up problem solving in exams

Mental math tricks

- * making 10s/100s : Breaking numbers down to add or Subtract faster.

multiplying by 5: multiply the number by 10, then divide it in half.

Dividing by 5: multiply the number 2, then divide it by 10.

ESTIMATION TECHNIQUES

Rounding: Look at the digit to the right of your target place value.

0-4 → round down

5-9 → round up

Front-End Estimation: keep only the first digit and change the rest to zero.

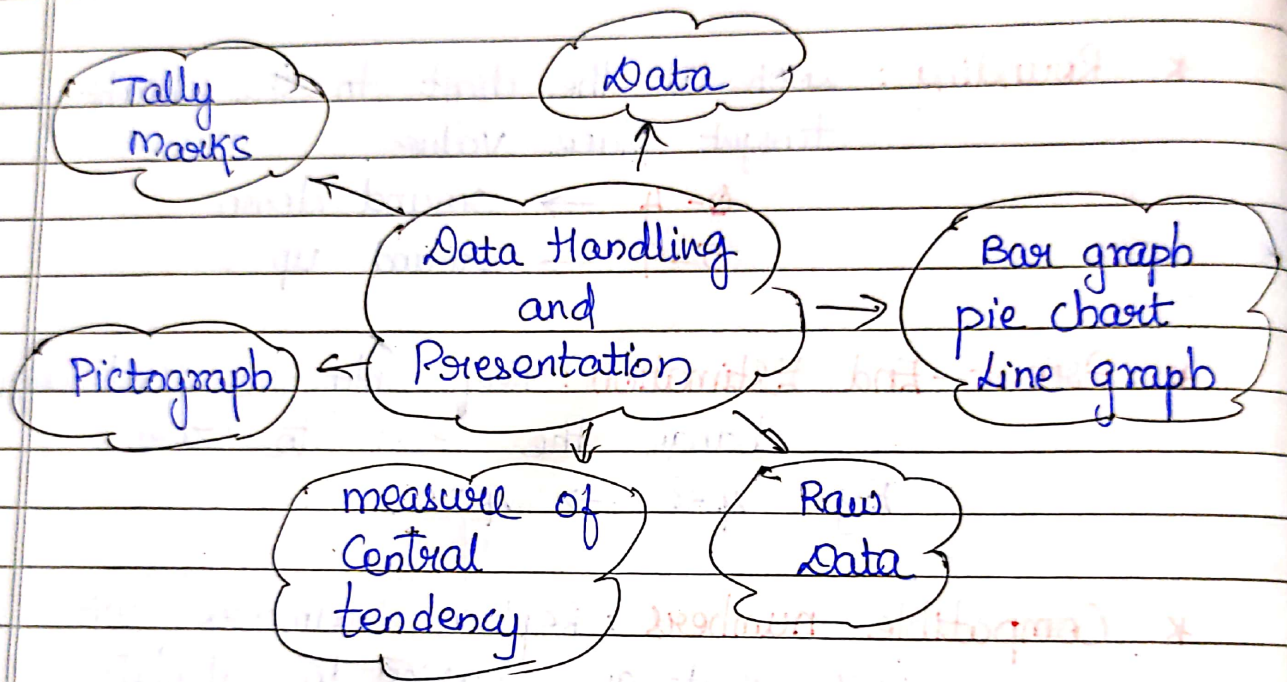
Eg: 436 → 400

Compatible numbers: Replace numbers with nearby ones that are easier to calculate.

Eg: $59 \times 21 \rightarrow 60 \times 20$

CHAPTER-4 DATA HANDLING AND PRESENTATION

MIND MAP



Data :

A collection of information gathered in the form of numerical figures or facts.

Raw Data:

The data obtained in its original form is called raw (or ungrouped) data.

If the raw data is classified or divided into groups it is called grouped data.

Array:

Arranging the observations in ascending or descending order is called an array.

Frequency:

The number of times a particular observation occurs in a data set.

Range:

The difference between the maximum and minimum values in a given set of data.

$$\text{Range} = \text{maximum value} - \text{Minimum value}$$

Types of Data

1. **Discrete Data**: Data that can be counted (e.g. - number of students, marks obtained)
2. **Continuous Data**: Data that is measured (e.g. height, weight, time)

Tally marks:

Vertical bars (|) used to count and organize observations. Every fifth observation is marked diagonally across the four preceding vertical lines (||||) to form a group of 5.

Grouped Data terms

Class Interval: Dividing data into groups or intervals.

Class limits: The smallest value is the lower ^{class} limit and the largest value is the upper ^{class} limit.

Class Size / length: The difference between the upper and the lower boundary of a class.

Pictograph:

Pictograph is a way of representing data by using figures or pictures.

Bar Graph:

A visual display using bars of uniform width drawn horizontally or vertically with equal spacing to compare quantities.

Double Bar Graph:

uses two adjacent bars to compare two sets of related data side-by-side.
(e.g. comparing marks of boys and girls across subjects)

Line Graph:

Line graph is a plot of points on graph paper that are related to two variables.

Pie chart

A Piechart is a circular diagram in which a circle is divided into two or more than two sectors. Each sector represents a component of the data according to the weightage of that component.

Measures of Central Tendency

Arithmetic Mean

$$\text{Mean} = \frac{\text{Sum of the observations}}{\text{Number of observations}}$$

Median:

Median refers to the value that lies in the middle of the data.

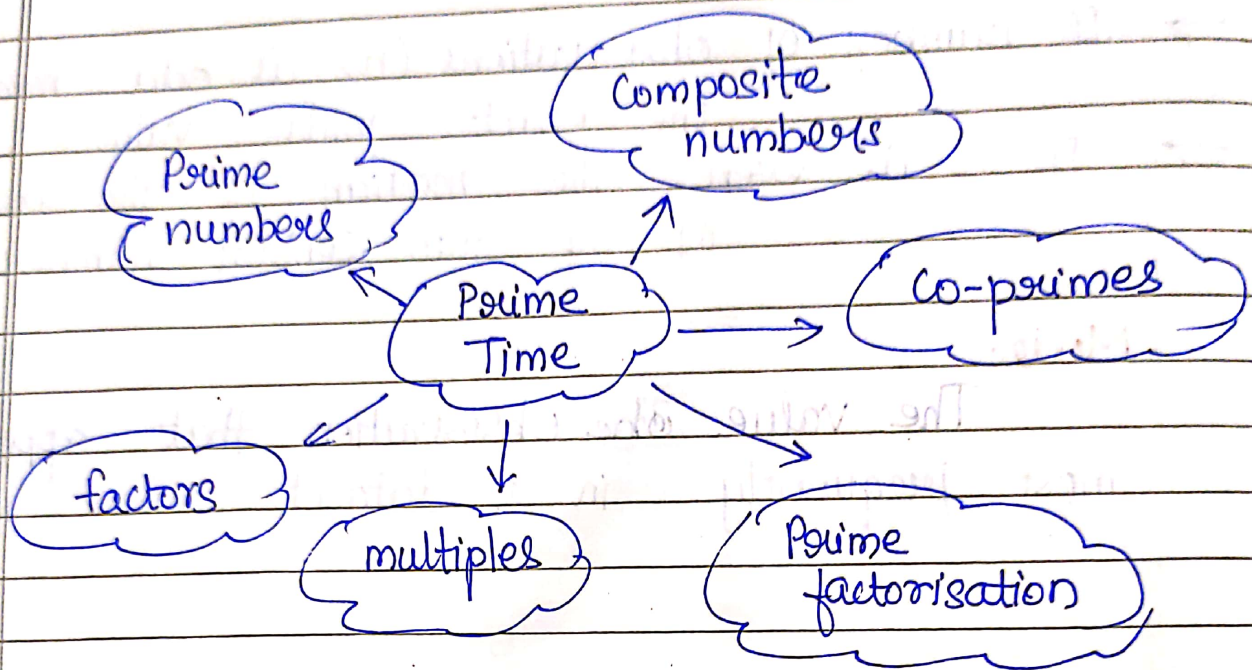
- If number of observations (n) is odd, median is the exact middle value.
- If n is even, the median is the average of the two central numbers.

Mode:

The observation that appears most frequently in a dataset.

CHAPTER-5 PRIME TIME

MIND MAP



Multiples:

The numbers obtained by multiplying the given number with a natural number are called multiples of a given number.

Ex: Multiples of 2 are 2, 4, 6, 8, ...

factors:

A number that divides another number exactly (leaving a remainder of 0), the divisor is a factor of the dividend.

Ex: factors of 12 are 1, 2, 3, 4, 6, 12

Prime numbers:

Natural numbers which have exactly two distinct factors (1 and the number itself)

Ex: 2, 3, 5, 7, 11, 13, 17, 19, ...

Note: 2 is the only even prime number, all other prime numbers are odd.

Composite Numbers:

Natural numbers which have more than two factors

Ex: 4, 6, 8, 9, 10, 12, ...

* 1 is neither prime nor composite (it is called unity).

Co-prime Numbers

Two natural numbers that have only 1 as their common factor.

Ex: (2, 3), (15, 16)

Twin Primes

Two prime numbers with only one composite number between them.

Ex: (3, 5), (5, 7), (11, 13)

Perfect Number

A number where the sum of all its factors equals twice the number.

Ex: factors of 6 : 1, 2, 3, 6

$$1 + 2 + 3 + 6 = 12 = 2(6)$$

Prime Factorization, HCF and LCM

A. Prime Factorization

Expressing a composite number as a product of prime factors.

Ex: $150 = 2 \times 3 \times 5 \times 5$

B. HCF (Highest Common factor)

The largest common factor shared between two or more numbers. It is also called GCD (Greatest Common Divisor)

C. LCM (Least common multiple)

LCM of two or more numbers is the lowest of their common multiples.

HCF and LCM by prime factorization

- * HCF : Multiply only the common prime factors using their lowest powers
- * LCM : multiply all prime factors from the numbers using their highest powers

Divisibility Rules

If a number is divisible
by

Rules

*

2

*

The last digit is 0, 2, 4, 6, 8

E.g. $\rightarrow 8432$

*

3

*

Sum of the digits is divisible by 3

E.g. $\rightarrow 592482 \rightarrow 5+9+2+4+8+2$

$= 30$

*

4

*

Number formed by the last two digits is divisible by 4

E.g. $\rightarrow 892648$

*

5

*

Unit's digit is either 0 or 5

E.g. $\rightarrow 20820, 50345$

*

6

*

Number is divisible by both 2 & 3

E.g. $\rightarrow 35256$

[last digit = 6, digit sum = 21]

*

7

*

Double the last digit and subtract it from remaining number check the result is divisible by 7

E.g. $\rightarrow 2961 \rightarrow 296 - (1 \times 2)$

*

8

*

Number formed by last three digits is divisible by 8

E.g. $\rightarrow 953360 \rightarrow 360$ is divisible by 8.

*

9

*

Sum of the digits is divisible by 9

E.g. $\rightarrow 60732 \rightarrow 6+0+7+3+2 = 18$

* 10

* unit's digit is 0

E.g. 96410

* 11

* Difference between the sum of digits at odd places and even places is '0' or divisible by 11.

E.g. 4832718

$$(8+7+3+4) - (1+2+8) = 11$$

MAGIC SQUARE

Fill a square grid with numbers so that each row, column and diagonal add up to the same total.

E.g.

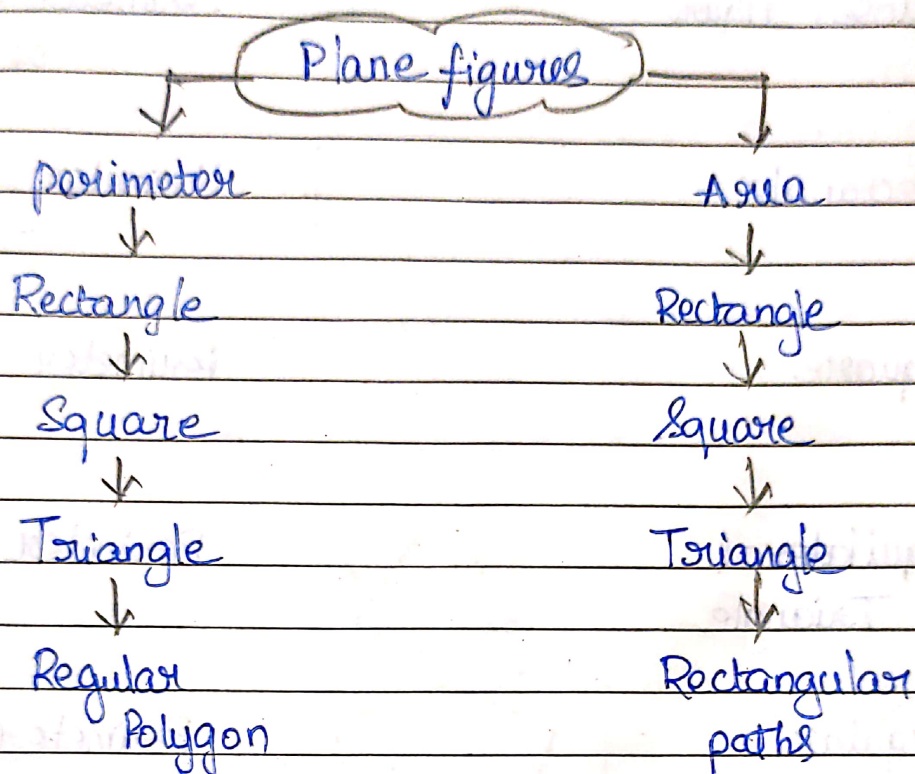
2	7	6
9	5	1
4	3	8

Each row, column, and diagonal adds up to 15.

CHAPTER - 6

PERIMETER AND AREA

MIND MAP.

Perimeter

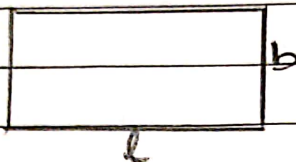
Perimeter is the total distance covered along the boundary to enclose a closed figure (the total length of its outer boundary).
E.g. fencing a field

Formulae for perimeters

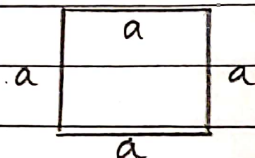
SHAPE

* closed figure

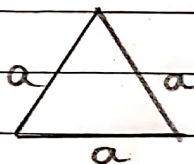
* Rectangle



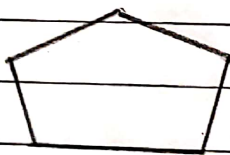
* Square



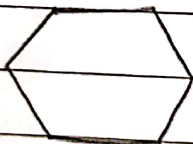
* Equilateral Triangle



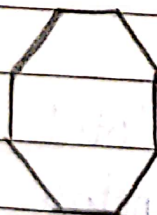
* Regular Pentagon



* Regular Hexagon



* Regular Octagon



FORMULA

Perimeter = Sum of lengths of all sides

Perimeter = $2(\text{Length} + \text{Breadth})$
 $= 2(l + b)$ units

Perimeter = $4 \times \text{Side}$
 $= 4a$ units

Perimeter = $3 \times \text{Side}$
 $= 3a$ units

Perimeter = $5 \times \text{Side}$

Perimeter = $6 \times \text{Side}$

Perimeter = $8 \times \text{Side}$

Area

Area refers to the amount of surface enclosed by a closed figure.

Measuring Area using Squared / Graph paper when estimating area on grid paper.

- * Count fully filled Squares as 1 Sq unit
- * Count exactly half filled Squares as $\frac{1}{2}$ Sq unit
- * Count Squares filled more than half as 1 Sq unit
- * Ignore Squares filled less than half.

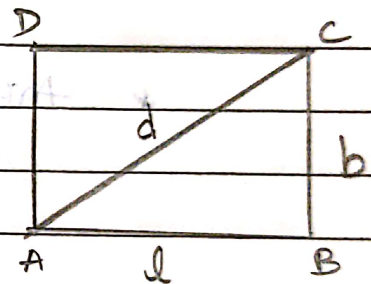
Rectangle

$$\begin{aligned} * \text{Area} &= \text{Length} \times \text{Breadth} \\ &= l \times b \text{ Sq units} \end{aligned}$$

$$* \text{Length, } l = \frac{\text{Area}}{b}$$

$$* \text{Breadth, } b = \frac{\text{Area}}{l}$$

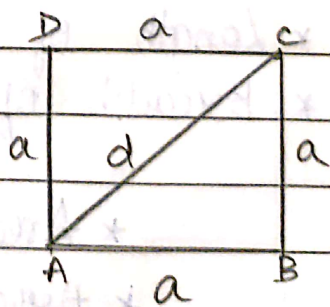
$$* \text{Diagonal, } d = \sqrt{l^2 + b^2}$$



Square

$$\begin{aligned} * \text{Area} &= \text{Side} \times \text{Side} \\ &= a^2 \text{ Sq. units} \end{aligned}$$

$$\begin{aligned} * \text{Diagonal, } d &= \sqrt{a^2 + a^2} \\ &= \sqrt{2} \cdot a \text{ units} \end{aligned}$$



$$* \text{Area using Diagonal, Area} = \frac{(\text{Diagonal})^2}{2}$$

Triangle

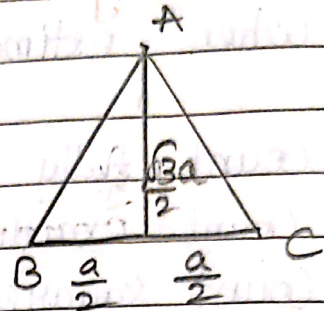
$$* \text{Area} = \frac{1}{2} (\text{Base} \times \text{Height})$$

$$= \frac{1}{2} b \cdot h$$

Equilateral Triangle

$$* \text{Height} = \frac{\sqrt{3}}{2} a$$

$$* \text{Area} = \frac{\sqrt{3}}{4} a^2$$



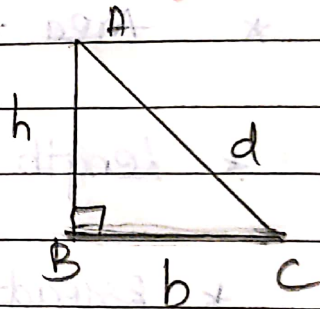
Right - Angle Triangle

By pythagoras theorem,

$$(\text{Hypotenuse})^2 = (\text{side})^2 + (\text{side})^2$$

$$* \text{Area} = \frac{1}{2} b \cdot h$$

$$= \frac{1}{2} b \sqrt{d^2 - b^2}$$



Rectangular paths

If 'l', 'b' are length and breadth of inner rectangle and 'w' be width of path

$$* \text{Length of outer rectangle} = l + 2w$$

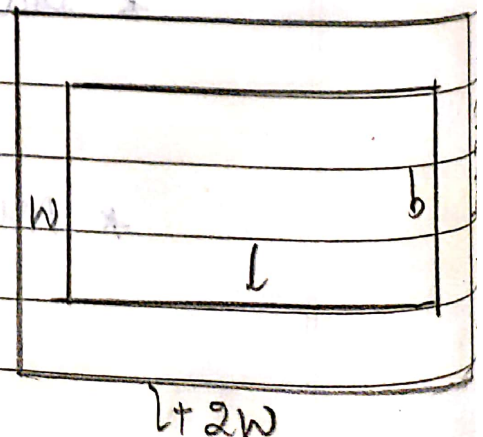
$$* \text{Breadth of outer rectangle} = b + 2w$$

$$* \text{Area of inner rectangle} = lb$$

$$* \text{Area of outer rectangle} = (l + 2w)(b + 2w)$$

$$\text{Area of path} = (l + 2w)(b + 2w) - lb$$

$$= 2(l + b)w + 4w^2$$



Relation between units of area:

$$100 \text{ mm}^2 = 1 \text{ cm}^2$$

$$100 \text{ cm}^2 = 1 \text{ dm}^2$$

$$100 \text{ dm}^2 = 1 \text{ m}^2$$

$$100 \text{ m}^2 = 1 \text{ are}$$

$$100 \text{ are} = 1 \text{ hectare}$$

$$100 \text{ hectares} = 1 \text{ Sq. Km}$$