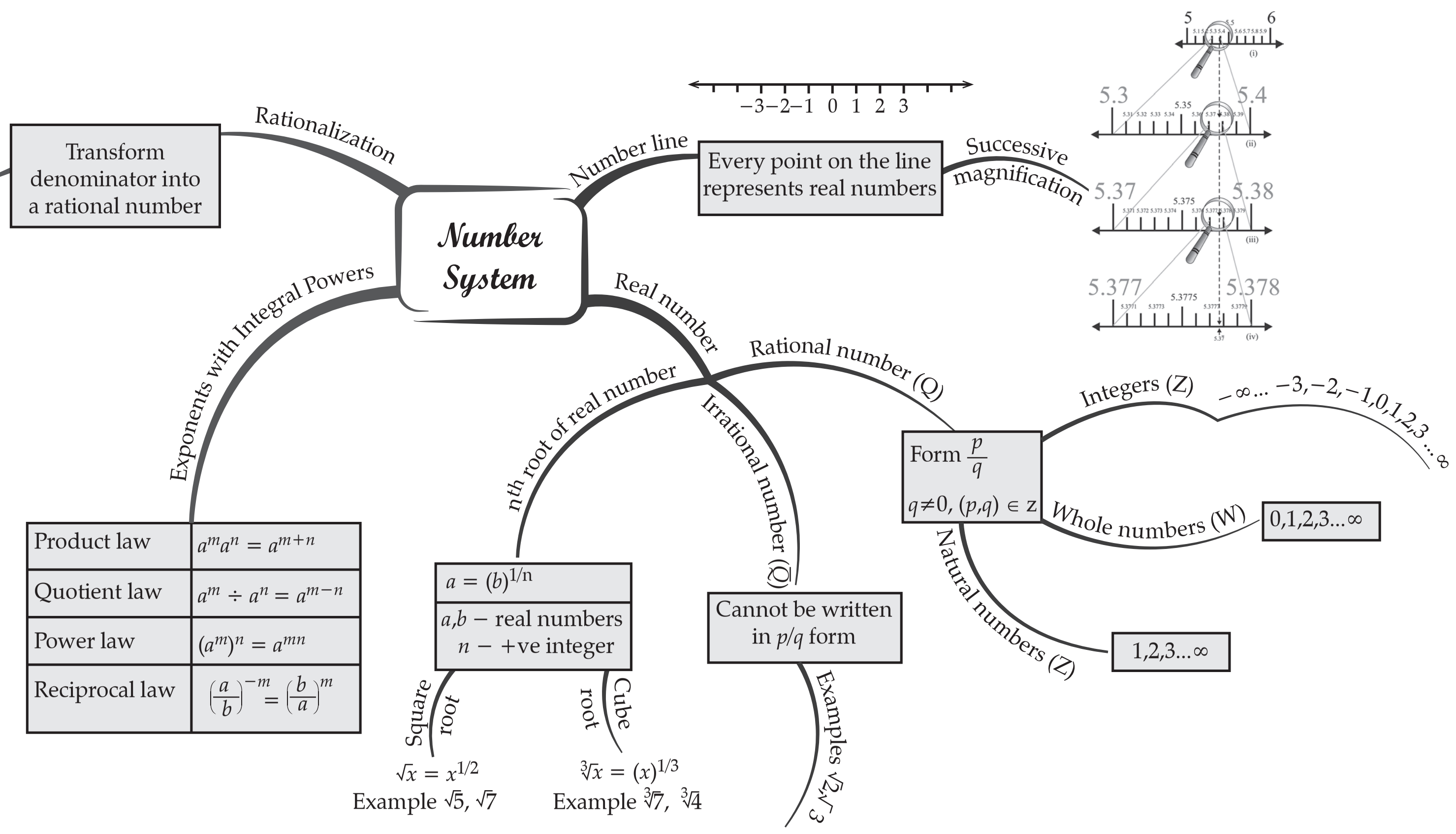
MIND MAP : LEARNING MADE SIMPLE

Chapter-1

Term	Rationalising factor
$\frac{1}{\sqrt{r}}$	$\sqrt{r}$
$\frac{1}{\sqrt{r}-s}$	$\sqrt{r}+s$
$\frac{1}{\sqrt{r}+s}$	$\sqrt{r}-s$
$\frac{1}{\sqrt{r}-\sqrt{s}}$	$\sqrt{r}+\sqrt{s}$
$\frac{1}{\sqrt{r}+\sqrt{s}}$	$\sqrt{r}-\sqrt{s}$



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Chapter-2

Polynomials

Algebraic Identities

$(x+y)^2$	$x^2 + 2xy + y^2$
$(x-y)^2$	$x^2 - 2xy + y^2$
x^2-y^2	$(x - y)(x + y)$
$(x+a)(x+b)$	$x^2 + (a + b)x + ab$
$(x + y + z)^2$	$x^2+y^2+z^2+2xy+2yz+2zx$ $= x^2+y^2+z^2+2(xy+yz+zx)$
$(x + y)^3$	$x^3 + y^3 + 3xy(x + y)$
$(x - y)^3$	$x^3 - y^3 - 3xy(x - y)$
$x^3+y^3+z^3-3xyz$	$(x+y+z)(x^2+y^2+z^2-xy-yz-zx)$
If $x + y + z = 0$	(i) $x^3+y^3+z^3 = 3xyz$ (ii) $\frac{x^2}{yz} + \frac{y^2}{xz} + \frac{z^2}{xy} = 3$
$x^3 + y^3$	$(x+y)(x^2-xy+y^2)$
$x^3 - y^3$	$(x-y)(x^2+xy+y^2)$

Polynomial

An algebraic expression of the form: $f(x) = a_nx^n + a_{n-1}x^{n-1} + ... a_1x^1 + a_0x^0$

Polynomial in one variable: $ax^3 - bx^2 - cx + d$

Types

Terms

Polynomial	Example
Constant (or independent)	4, – 7/5
Zero	Degree not defined (constant polynomial 0)
Monomial	$4x$
Binomial	$2x + 3$
Trinomial	$3x^2 + 7x + 2$

Degree

Polynomial	Example	Degree
Linear	$3x + 2$	1
Quadratic	$2x^2 + 3x + 1$	2
Cubic	$7y^3 + 6y^2 + 2y + 2$	3

Theorems

Factor Theorem

if $p(x)$ is a polynomial of degree $n \geq 1$, a: any real number

(i) if $(x-a)$ is a factor of $p(x)$, then $p(a) = 0$

(ii) if $p(a) = 0$, then $(x-a)$ is a factor of $p(x)$.

Remainder Theorem

if $p(x)$ polynomial of degree $n>1$, is divided by $x-a$, $p(a)$ is the remainder

Divident = (Divisor × Quotient) + Remainder

Zeroes of polynomial

Number that satisfies the equation

Example

$P(x) = 2x + 1$ find zeroes of the polynomial

$P(x) = 0$

$2x + 1 = 0$

$x = -1/2$

$-1/2$ is the zeros of the polynomial

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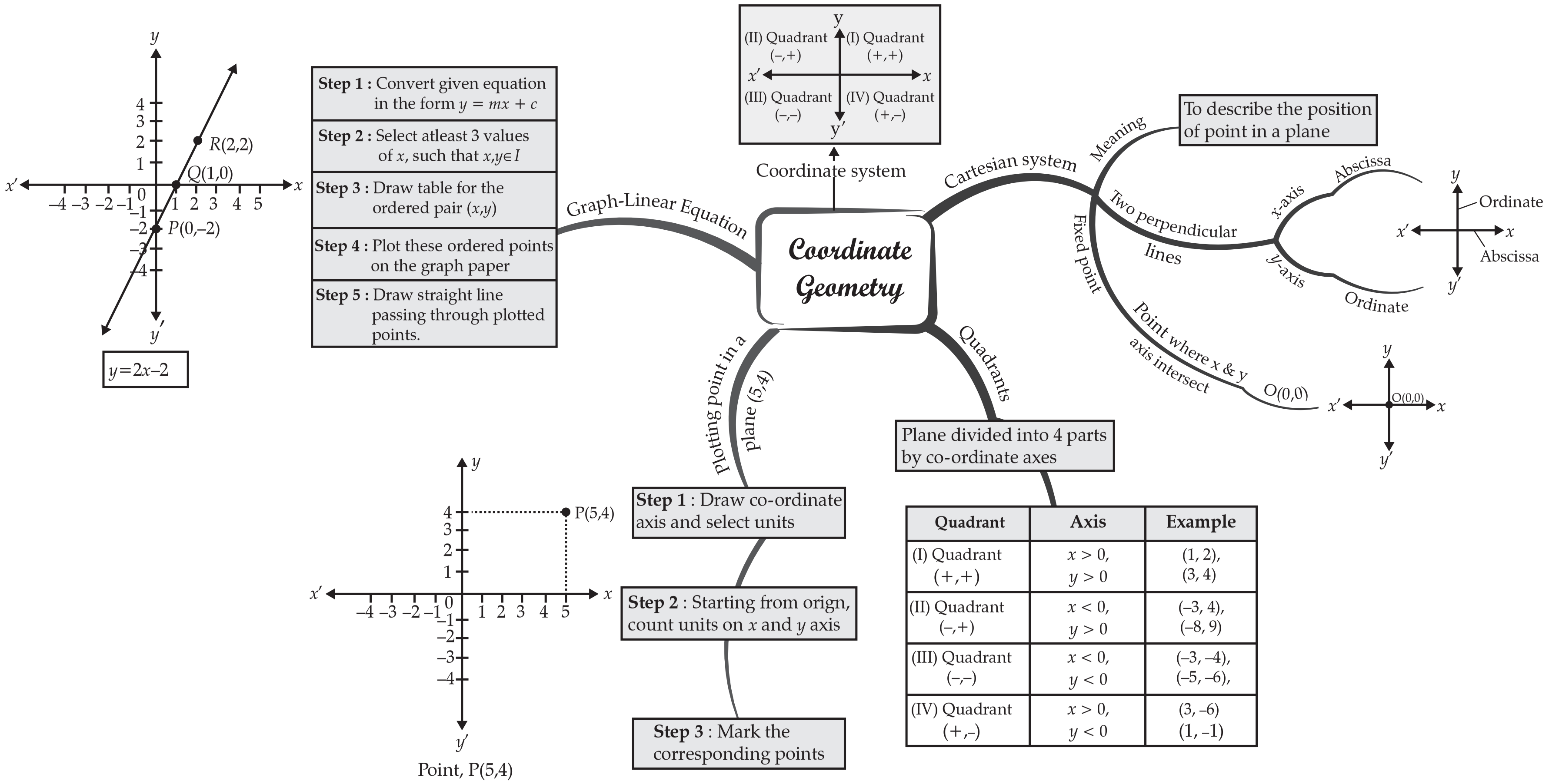
Chapter-3



Quadrant	Axis	Example
(I) Quadrant (+,+)	$x > 0$, $y > 0$	(1, 2), (3, 4)
(II) Quadrant (–,+)	$x < 0$, $y > 0$	(–3, 4), (–8, 9)
(III) Quadrant (–,–)	$x < 0$, $y < 0$	(–3, –4), (–5, –6),
(IV) Quadrant (+,–)	$x > 0$, $y < 0$	(3, –6) (1, –1)

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Chapter-4

Linear Equation in Two Variables

Linear equation

Equation of the form $ax + by + c = 0$

- Where
  - a, b, c - constants
  - $(a,b) \neq (0,0)$
  - x, y - variables
- Example
  - $4x + 3y + 7 = 0$

Steps to find solution

Step 1: Write the equation in two variables, if not present
Step 2: Reduce it to one variable by putting an arbitrary value of any variable, to find a pair of solution.
Step 3: Repeat step 2 for another arbitrary value of variable to find another pair of solution.
It can have one, no or infinitely many solutions.

Example- Graph of Linear Equation

Linear equation: $2x + 3y + 12$

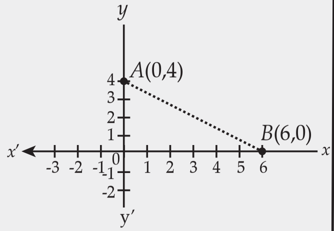
Step 1: From equation, we get

$$y = \frac{12 - 2x}{3}$$

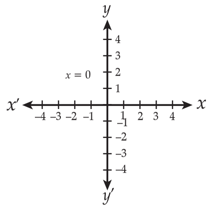
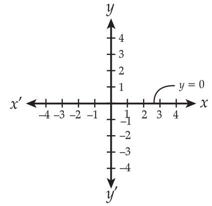
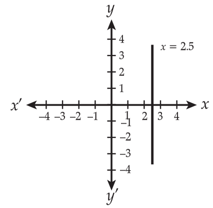
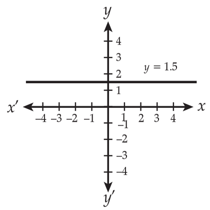
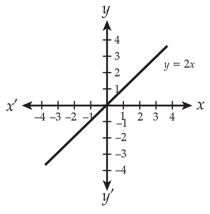
Step 2: Put arbitrary value of x, y.

x	0	0
y	4	6

Step 3: Plot (0,4) and (6,0) on the graph and join them.



Graphical Representation

Equation	Interpretation	Graphical representation
$x = 0$	Equation of y-axis	
$y = 0$	Equation of x-axis	
$x = K$	Straight line parallel to y-axis	
$y = K$	Straight line parallel to x-axis	
$y = mx$	Line passing through origin	

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Chapter-5

Introduction to Euclid's Geometry

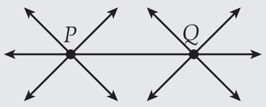
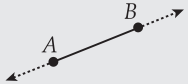
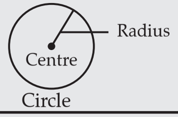
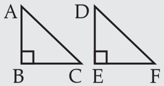
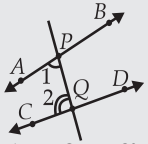
Euclid's Geometry

Axiomatic system, in which all theorems are derived from a small number of axioms

Definitions

Point	Has no width, no length and no depth	Point
Line	Collection of points, can be extended in both directions.	Line
Surface	Two - dimensional collection of points (has length & breadth only)	Surface

Euclid's Postulates

1	A straight line can be drawn from any one point to any other point.	
2	A terminated line can be produced infinitely.	
3	A circle can be drawn with any centre and of any radius.	
4	All right angles are equal to one another.	 $\angle ABC = \angle DEF = 90°$
5	If a straight line falling on two straight lines makes the interior angles on the same side of it, taken together makes less than two right angles, then the two straight lines, if produced indefinitely, meet on that side on which the sum of the angles is less than two right angles.	 $\angle 1 + \angle 2 < 180°$

Euclid's Axioms

1	Things which are equal to the same thing are equal to one another.
2	If equals are added to equals, wholes are equal.
3	If equals are subtracted from equals,the remainders are equal.
4	Things which coincide with one another are equal to one another.
5	The whole is greater than the part.
6	Things which are double of the same things are equal to one another.
7	Things which are halves of the same things are equal to one another.

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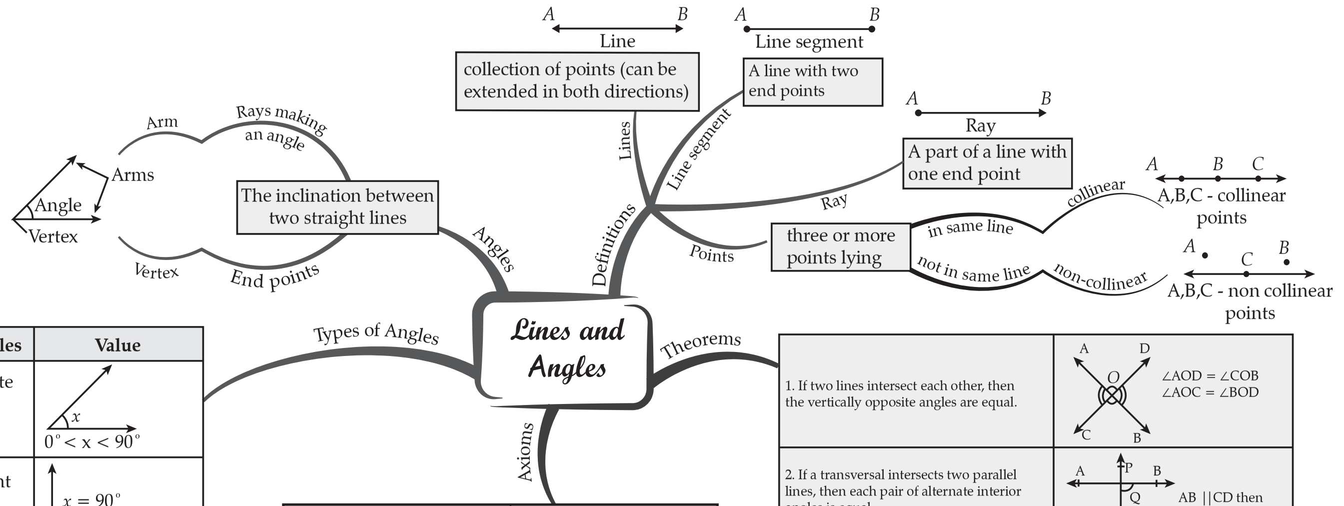
Chapter-6



Types of Angles

Angles	Value
Acute	$0° < x < 90°$
Right	$x = 90°$
Obtuse	$90° < x < 180°$
Straight line	$x = 180°$
Reflex	$180° < x < 360°$

Axioms

1. If a ray stands on a line, then the sum of two adjacent angles so formed is 180°	AB is a line then, ∠AOC + ∠BOC = 180°
2. If the sum of two adjacent angles is 180°, then the non-common arms of the angles form a line.	If ∠AOC + ∠BOC = 180° then AB is a straight line
3. If a transversal intersects two parallel lines, then each pair of corresponding angles is equal.	Here PQ || RS then ∠ABQ = ∠BCS
4. If a transversal intersects two lines such that a pair of corresponding angles is equal, then the two lines are parallel to each other.	If ∠BQR = ∠QRC and ∠AQP = ∠QRD then, AB || CD

Theorems

1. If two lines intersect each other, then the vertically opposite angles are equal.	∠AOD = ∠COB ∠AOC = ∠BOD
2. If a transversal intersects two parallel lines, then each pair of alternate interior angles is equal	AB ||CD then ∠BQR = ∠CRQ
3. If transversal intersects two lines such that a pair of alternate interior angles is equal, then the two lines are parallel	if ∠BQR = ∠CRQ then AB ||CD
4. If a transversal intersects two parallel lines, then each pair of interior angles on the same side of the transversal is supplementary.	AB ||CD then, ∠AQR +∠CRQ = 180°
5. If a transversal intersects two lines such that a pair of interior angles on the same side of the transversal is supplementary, then the two lines are parallel.	if ∠AQR +∠CRQ = 180° then AB ||CD
6. Lines which are parallel to the same line are parallel to each other.	AB ||CD and CD ||EF then AB ||EF
7. The sum of all interior angles of a triangle is 180°	∠A + ∠B + ∠C = 180°

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Chapter-7

Triangles

Triangle

- closed figure formed by three straight lines
- It has three - sides, angles and vertices each

ΔABC

Congruent

- If any three parameters of given triangles are same, the triangles will be congruent.

$\Delta ABC \cong \Delta DEF$

Congruence rule

Rule	Statement	Figure
1. SAS	Two triangles are congruent if two sides and the included angle of one triangle are equal to the two sides and the included angle of the other triangle.	In ΔAOD and ΔCOB $CO = OD$ $\angle COB = \angle AOD$ $OB = OA$ $\therefore\ \Delta AOD \cong \Delta COB$
2. ASA	Two triangles are congruent if two angles and the included side of one triangle are equal to two angles and the included side of other triangle.	In ΔABC and ΔDEF $\angle B = \angle E$ $BC = EF$ $\angle C = \angle F$ $\therefore\ \Delta ABC \cong \Delta DEF$
3. AAS	Two triangles are congruent if any two pairs of angles and one pair of corresponding sides are equal.	Given $AB \mid\mid CD$ In ΔAOB and ΔCOD $\angle ABO = \angle DCO$ $\angle AOB = \angle DOC$ $OA = OD$ $\therefore\ \Delta AOB \cong \Delta COD$
4. SSS	If three sides of one triangle are equal to the three sides of another triangle, then two triangles are congruent.	In ΔABC and ΔDEF $AC = DF$ $AB = DE$ $BC = FE$ $\therefore\ \Delta ABC \cong \Delta DEF$
5. RHS	If in two right triangles the hypotenuse and one side of one triangle are equal to the hypotenuse and one side of the other triangle, then the two triangles are congruent.	In ΔABC and ΔDEF $AC = DF = 5cm$ $BC = FE = 4cm$ $AB = \sqrt{AC^2 - BC^2} = \sqrt{5^2 - 4^2} = 3$ $DE = \sqrt{DF^2 - EF^2} = \sqrt{5^2 - 4^2} = 3$ $\therefore\ AB = DE$ Hence $\Delta ABC \cong \Delta DEF$

Properties

Statement	Figure
Angles opposite to equal side of an isosceles triangle are equal	$AB = AD$ $\angle B = \angle C$
The sides opposite to equal angles of a triangle are equal	$\angle BAC = \angle CAD$ $\angle ADB = \angle ADC$ $\Delta ABD \cong \Delta ACD$ (ASA rule) Hence, $AB = AC$

Inequalities

Statement	Figure
In any triangle, the angle opposite to the longer side is larger.	AC is the longest side $\therefore\ \angle B$ is largest
In any triangle, the side opposite to the larger (greater) angle is longer.	if $\angle B$ is the largest $\therefore$ AC is longest
The sum of any two sides of a triangle is greater than the third side.	In ΔABC $AB + AC > BC$ $AB + BC > AC$ $AB + BC > AB$
Difference of any two sides of a triangle is less than the third side.	In ΔABC $AB - BC < CA$ $AB - AC < BC$ $AC - BC < AB$

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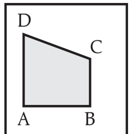
Chapter-8

Quadrilaterals

Quadrilateral

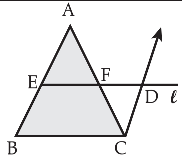
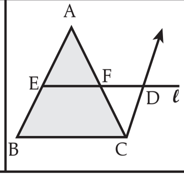
Figure formed by joining four points in an order

It has four - vertices, angles and sides each

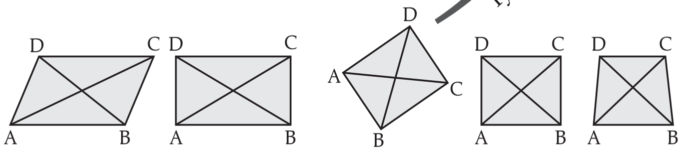


ABCD is a Quadrilateral

Mid-point theorem

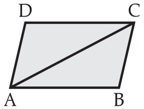
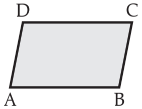
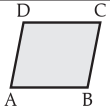
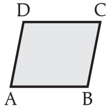
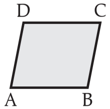
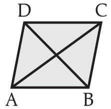
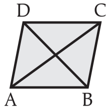
Statement	Figure
The line-segment joining the mid-points of two sides of a triangle is parallel to the third side.	 If E and F are mid-point of AB and AC, then EF || BC
The line drawn through the mid-point of one side of a triangle, parallel to another side bisects the third side	 If E is the mid-point of AB EF || BC, then AF = FC, F is the mid-point of AC

Types



Property	Parallelogram	Rectangle	Rhombus	Square	Trapezium
All sides are congruent	No	No	Yes	Yes	No
Opposite sides are parallel and congruent	Yes	Yes	Yes	Yes	Parallel but not congruent
All angles are congruent	No	Yes	No	Yes	No
Opposite angles are congruent	Yes	Yes	Yes	Yes	Yes
Diagonals are congruent	No	Yes	No	Yes	Yes
Diagonals are perpendicular	No	No	Yes	Yes	No
Diagonals bisect each other	Yes	Yes	Yes	Yes	No
Adjacent angles are supplementary	Yes	Yes	Yes	Yes	Yes

Properties

Statement	Figure
1. A diagonal of a parallelogram divides it into two congruent triangles.	 ABCD is a parallelogram AC diagonal then $\Delta ABC \cong \Delta ADC$
2. In a parallelogram, opposite sides are equal and parallel.	 In parallelogram ABCD, AB || CD, AD || BC, and AB = CD, AD = BC
3. If each pair of opposite sides of a quadrilateral are equal and parallel, then it is a parallelogram.	 If AB || CD, AD || BC, and AB = CD, AD = BC then ABCD is a parallelogram
4. In a parallelogram, opposite angles are equal.	 In parallelogram ABCD, $\angle A = \angle C, \angle B = \angle D$
5. If in a quadrilateral, each pair of opposite angle is equal, then it is a parallelogram.	 If $\angle A = \angle C, \angle B = \angle D$ then ABCD is a parallelogram
6. The diagonals of a parallelogram bisect each other.	 In parallelogram ABCD, OA = OC then OB =OD
7. If the diagonals of a quadrilateral bisect each other, then it is parallelogram.	 If OA = OC OB = OD then ABCD is parallelogram

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Chapter-9

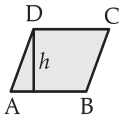
Areas of Parallelograms & Triangles

Area

Number (in some unit) associated with part of the plane enclosed by the figure

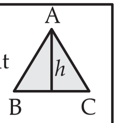
Area of parallelogram

ABCD is a parallelogram = Base × Height

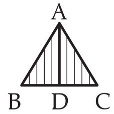


Area of triangle

Area of triangle $= \frac{1}{2} \times$ Base × Height



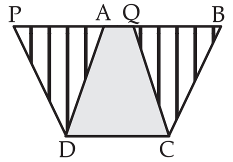
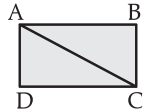
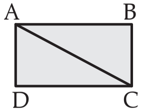
Median of a triangle divides it into two equal areas



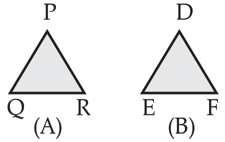
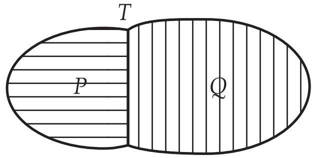
AD - median

ar ΔABD = ar ΔACD

Theorems

Statement	Figure
1. Parallelograms on the same base and between same parallels are equal in area.	 ar (ABCD) = ar (PQCD)
2. Two triangles on the same base (or equal bases) and between the same parallels are equal in area	 ar ΔADC = ar ΔABC
3. Two triangles having the same base (or equal bases) and equal areas lie between the same parallels	 if ar ΔADC = ar ΔABC then AB || CD

Properties

(i) If *A* and *B* are congruent figures,	ar (*A*) = ar (*B*)	 (A) (B) if PQR ≅ DEF then ar (A) = ar (B)
(ii) If a planar region formed by a figure T is made up of two non-overlapping planar regions formed by figures *P* and *Q*	ar (*T*) = ar(*P*) + ar (*Q*)	 Area of figure *T* = *Area of figure P* + Area of figure *Q*

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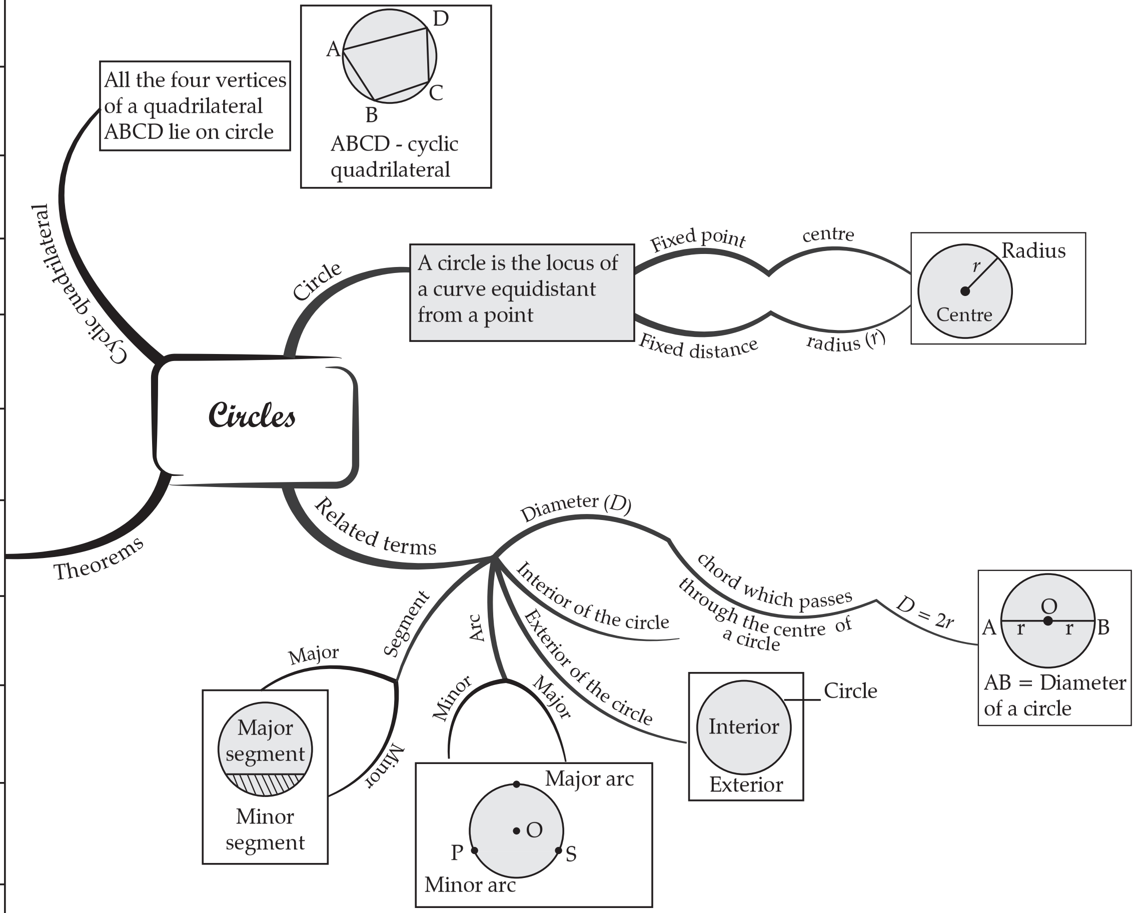
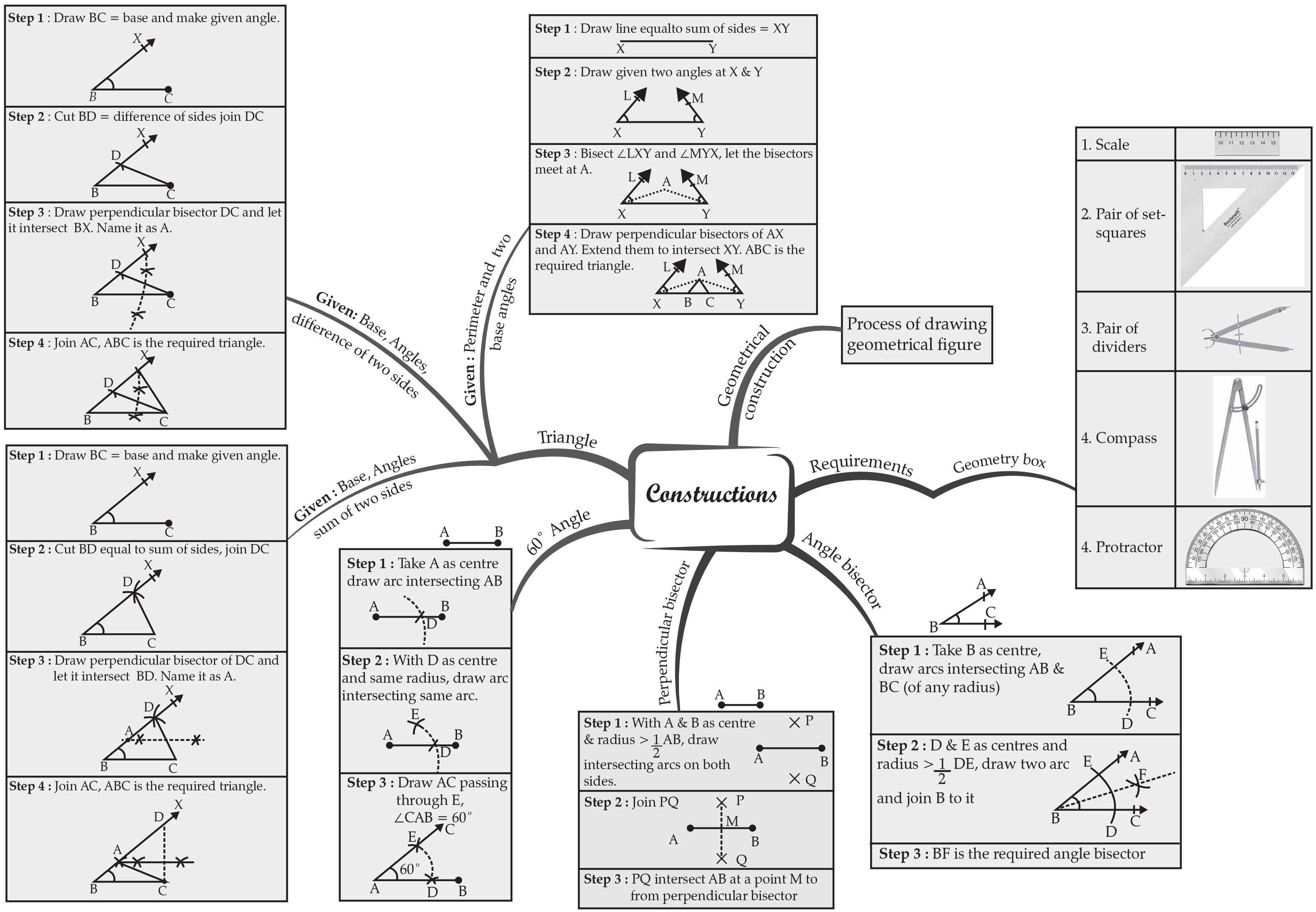
Chapter-10

Statement	Figure
1. Equal chords of a circle subtend equal angles at the centre.	AB = CD then ∠AOB = ∠COD
2. If the angles subtended by the chords of a circle at the centre are equal, then the chords are equal.	∠AOB = ∠COD then AB = CD
3. The perpendicular from the centre of a circle to a chord bisects the chord.	OM ⊥ AB then AM = MB
4. The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord.	If AM = MB then OM ⊥ AB
5. There is one and only one circle passing through three given non-collinear points.	
6. Equal chords of a circle are equidistant from the centre.	AB = CD then OL = OM
7. Chords equidistant from the centre of a circle are equal in length.	If OL = OM then AB = CD
8. The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.	Reflex ∠POQ = 2 ∠PAQ
9. Angles in the same segment of a circle are equal.	∠RPS = ∠RQS
10. If a line segment joining two points subtends equal angles at two other points lying on the same side of the line containing the line segment, the four points lie on a circle.	∠ACB = ∠ADB then A,B,C,D lie on the circle
11. The sum of either pair of opposite angles of a cyclic quadrilateral is 180°.	∠P + ∠R = 180° ∠Q + ∠S = 180°
12. If the sum of a pair of opposite angles of a quadrilateral is 180°, then quadrilateral is cyclic.	If ∠P + ∠R = 180° ∠Q + ∠S = 180° then PQRS is cyclic quadrilateral



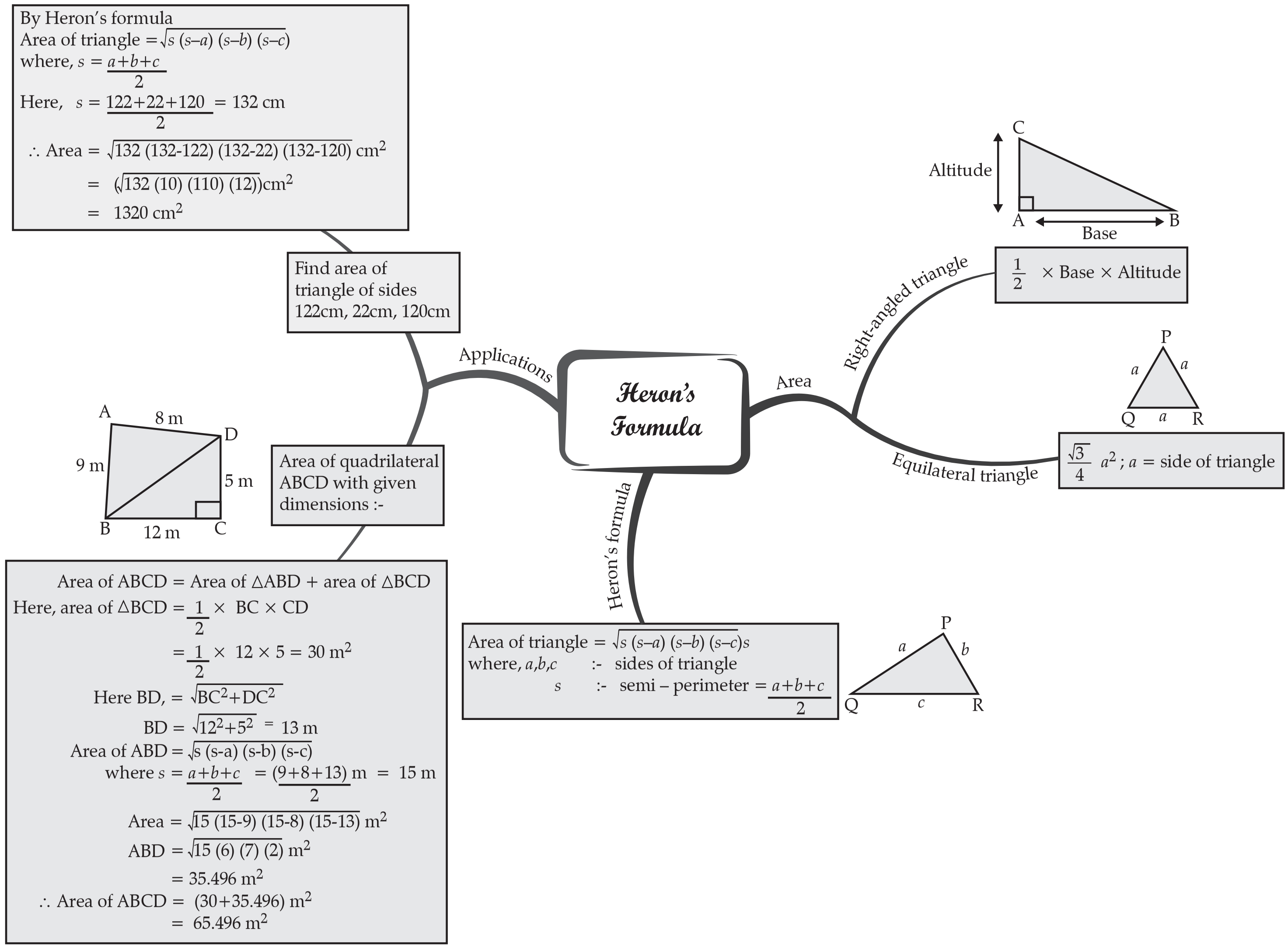
MIND MAP : LEARNING MADE SIMPLE

Chapter-11



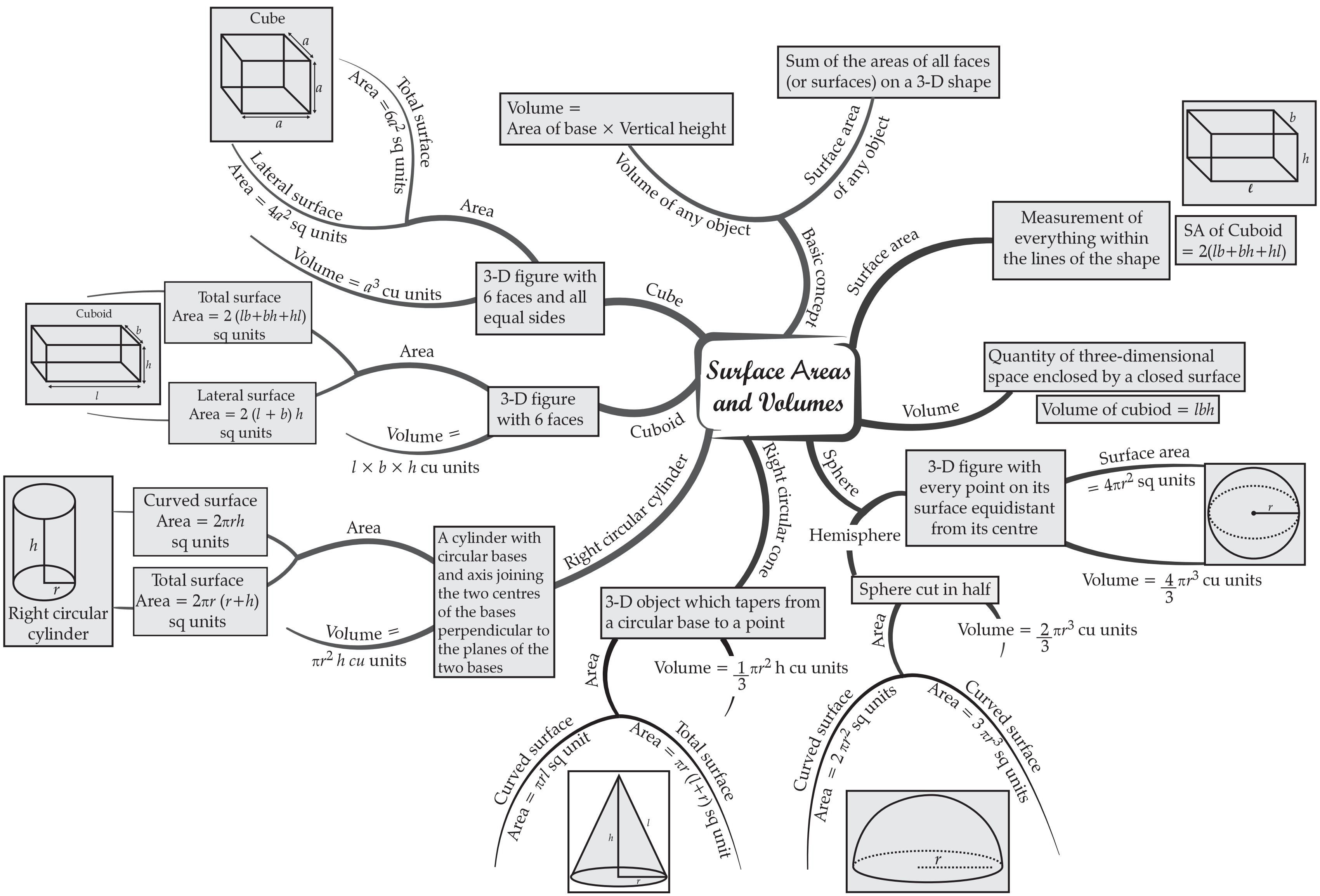
MIND MAP : LEARNING MADE SIMPLE

Chapter-12



MIND MAP : LEARNING MADE SIMPLE

Chapter-13



MIND MAP : LEARNING MADE SIMPLE

Chapter-14

Statistics

Data

Set of values of qualitative or quantitative information

Items	Quantities
A	20
B	30
C	50
D	60

Statistics

Area of study dealing with the presentation, analysis and interpretation of data

Tally marks

Shows valuable data set

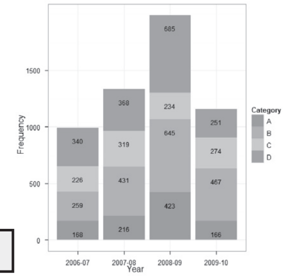
Distance (in km) of 20 students from their residence to school is given as -

6 7 5 7 7 8 7 6 9 7
4 10 6 8 8 9 5 6 4 8

Construct a grouped frequency distribution table

Distance	Tally	Frequency
4	ll	2
5	ll	2
6	llll	4
7	~~llll~~	5
8	llll	4
9	ll	2
10	l	1

Frequency distribution table



Bar graph

Central Tendency - Ungrouped data

Mean

Calculated by adding all the values and dividing it by total number of observations.

Mean, $\bar{x} = \dfrac{\sum_{i=1}^{n} x_i}{n}$

Median

Value of the middle most observation.

Observation odd number: Median = value of $\left(\dfrac{n+1}{2}\right)^{th}$ observation

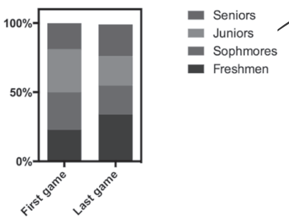
Observation even number: Median = value of $\dfrac{\left(\dfrac{n}{2}\right)^{th} \text{observation} + \left(\dfrac{n}{2}+1\right)^{th} \text{observation}}{2}$

Mode

Most frequently occured observation

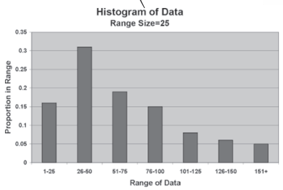
Graphical representation grouped data

Bar graphs



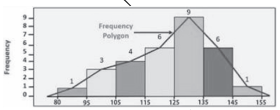
Bar graph

Histograms



Histogram

Frequency polygons



Frequency polygon

MIND MAP : LEARNING MADE SIMPLE

Chapter-15

Probability

Definition

The extent to which something is likely to happen

Impossible	Even chance	Certain
← Less likely		More likely →

Related terms

- **Outcome**: Something that follows as a result or consequence
- **Event**: Collection of some outcomes of an experiment
- **Trial**: Action which results in one or several outcomes

Probability value

- [0,1]
- Not greater than 1

Emperical probability

$$P(E) = \frac{\text{Number of trials in which event happened}}{\text{Total number of trials}}$$

Examples

Dice

A dice is thrown 2 times. Find the probability of getting 11

Total number of trials = 6^n, n is the number of times dice is thrown

$= 6^2 = 36$

Outcomes for getting 11 = (5,6) (6,5)

$$P(E) = \frac{\text{Number of getting 11}}{\text{Total number of trials}} = \frac{2}{36}$$

$$= \frac{1}{18}$$

Coin

A coin is tossed 3 times. Find probability of 3 heads?

Total number of trials = 2^n, n is number of times coin is tossed

$= 2^3$

$= 8$

i.e. HHH, HHT, HTT, HTH, TTH, THH, TTT, THT

$$P(E) = \frac{\text{Number of times 3 heads occured}}{\text{Total number of trials}}$$

$$= \frac{1}{8}$$