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Chapter 01

Real Numbers

- For given positive integers 'a' and 'b' there exist unique whole numbers 'q' and 'r' satisfying the relation $a = bq + r,\ 0 \le r < b$..
- **Euclid's division algorithms:** HCF of any two positive integers *a* and *b*. With $a > b$ is obtained as follows:
  Step 1: Apply Euclid's division lemma to *a* and *b* to find *q* and *r* such that
  $a = bq + r\ ,\ 0 \le r < b.$
  a= Dividend
  b=Divisor
  q=quotient
  r=remainder
  Step II: If $r = 0,\ HCF\ (a,\ b) = b\ if\ r \neq 0,$ apply Euclid's lemma to b and r.
  Step III: Continue the process till the remainder is zero. The divisor at this stage will be the required HCF
- **The Fundamental Theorem of Arithmetic:** Every composite number can be expressed (factorized) as a product of primes and this factorization is unique, apart from the order in which the prime factors occur. Ex : $24 = 2 \times 2 \times 2 \times 3 = 3 \times 2 \times 2 \times 2$
- Let $x = \frac{p}{q}, q' \neq 0$ to be a rational number, such that the prime factorization of 'q' is of the form 2m 5n, where m, n are non-negative integers. Then x has a decimal expansion which is terminating.
- Let $x = \frac{p}{q},\ q \neq 0$ be a rational number, such that the prime factorization of q is not of the form 2m5n, where m, n are non-negative integers. Then x has a decimal expansion which is non-terminating repeating.
- $\sqrt{p}$ is irrational, which p is a prime. A number is called irrational if it cannot be written in the form $\frac{P}{q}$ where *p* and *q* are integers and $q \neq 0$.

Chapter-02

Polynomials

- An algebraic expression of the form $a_0x^n + a_1x^{n-1} + a_2x^{n-2} + \ldots + a_{n-1}x + a_n$, where $a_0, a_1, a_2 \ldots a_n$ are real numbers, n is a non-negative integer and $a_0 \neq 0$ is called a polynomial of degree n.
- **Degree:** The highest power of x in a polynomial p(x) is called the degree of polynomial.
- Polynomials of degrees 1, 2 and 3 are called linear, quadratic and cubic polynomials respectively.
- **Types of Polynomial:**
  (i) **Constant Polynomial:** A polynomial of degree zero is called a constant polynomial and it is of the form p(x) = k.
  (ii) **Linear Polynomial:** A polynomial of degree one is called linear polynomial and it is of the form p(x) = ax + b where a, b are real numbers and $a_0 \neq 0$.
  (iii) **Quadratic Polynomial:** A quadratic polynomial in x with real coefficient is of the form $ax^2 + bx + c$, where a, b, c are real numbers with $a \neq 0$.
  (iv) **Cubical Polynomial:** A polynomial of degree three is called cubical polynomial and is of the form p(x) = $ax^3 + bx^2 + cx + d$ where a, b, c, d are real numbers and $a \neq 0$.
  (v) **Bi-quadratic Polynomial:** A polynomial of degree four is called bi-quadratic polynomial and it is of the form $p(x) = ax^2 + bx^3 + cx^2 + dx + e$, where a, b, c, d, e are real numbers and $a \neq 0$.
- The zeroes of a polynomial p(x) are precisely the x–coordinates of the points where the graph of y = p(x) intersects the x-axis i.e. x = a is a zero of polynomial p(x) if p(a) = 0.
- A polynomial can have at most the same number of zeros as the degree of polynomial.
- For quadratic polynomial $ax^2 + bx + c$ ($a \neq 0$) Sum of zeros = $-\frac{b}{a}$ Produce of zeros = $\frac{c}{a}$
- The division algorithm states that given any polynomial p(x) and polynomial g(x), there are polynomials q(x) and r(x) such that: $p(x) = g(x).q(x) + r(x),\ g(x) \neq 0$ where r(x) = 0 or degree of r(x) < degree of g(x)
- The division algorithm states that given any polynomial p(x) and polynomial g(x), there are polynomials q(x) and r(x) such that: p(x) = g(x). q (x) + r(x), g(x) = 0 where r(x) = 0 or degree of r(x) < degree of g(x).

Chapter-03

Pair of Linear Equation in Two Variables

- **Algebraic Expression:** A combination of constants and variables, connected by four fundamental arithmetical operations of $+,-,\times$ and $\div$ is called an algebraic expression. For example, $3x^2+4xy-5y^2$ is an algebraic expression.
- **Equation:** An algebraic expression with equal to sign (=) is called the equation. Without an equal to sign, it is an expression only. For example, 3x + 9 = 0 is an equation, but 3x + 9 is an expression.
- **Linear Equation:** If the greatest exponent of the variable(s) in a equation is one, then equation is said to be a linear equation.
- The most general form of a pair of linear equations is:

  $a_1x+b_1y+c_1=0$

  $a_2x + b_2y + c_2 = 0$ Where $a_1,\ a_2,\ b_1,\ b_2,\ c_1,\ c_2$ are real numbers and

  a1

  2 + b1

  $a_1^2+b_1^2\neq 0, a_2^2+b_2^2\neq 0.$
- The graph of a pair of linear equations in two variables is represented by two lines;
  - (i) If the lines intersect at a point, the pair of equations is consistent. The point of intersection gives the unique solution of the equation.
  - (ii) If the lines coincide, then there are infinitely many solutions. The pair of equations is consistent. Each point on the line will be a solution.
  - (iii) If the lines are parallel, the pair of the linear equations has no solution. The pair of linear equations is inconsistent.
- If a pair of linear equations is given by $a_1x+b_1Y+c_1=0$ and $a_2x+b_2y+c_2=0$
  - (i) $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}\Rightarrow$ the pair of linear equations is consistent. (Unique solution).
  - (ii) $\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}\Rightarrow$ the pair of linear equations is inconsistent (No solution).
  - (iii) $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}\Rightarrow$ the pair of linear equations is dependent and consistent (infinitely many solutions).

Chapter-04
Quadratic Equation

- **Quadratic Polynomial:** A polynomial of the form ax^2+bx+c is called a quadratic expression in the variable x. This is a polynomial of the second degree. In quadratic expression ax^2+bx+c, a is the coefficient of x^2, b is the coefficient of x and c is the constant term (or coefficient of x°..
- **Quadratic Equation:** An equation of the form $ax^2+bx+c=0$, $a\neq 0$, is called a quadratic equation in one variable x, where a, b, c are constants.
- The equation $ax^2 + bx + c = 0$, $a \neq 0$ is the standard form of a quadratic equation, where a, b and c are real numbers.
- A real number α is said to be a root of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$. If $a\alpha^2+b\alpha+c=0$, the zeroes of quadratic polynomial $ax^2 + bx + c$ and the roots of the quadratic equation $ax^2 + bx + c = 0$ are the same.
- If we can factorise $ax^2 + bx + c = 0$, $a \neq 0$ into product of two linear factors, then the roots of the quadratic equation can be found by equating each factors to zero.
- The roots of a quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ are given by $\frac{-b\pm\sqrt{b^2-4ac}}{2a}$, provided that $b^2 - 4ac \geq 0$.
- A quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ has __________

  (a) Two distinct and real roots, if $b^2-4ac>0$.

  (b) Two equal and real roots, if $b^2-4ac=0$.

  (c) Two roots are not real, if $b^2-4ac<0$.
- A quadratic equation can also be solved by the method of completing the square.

  (i) $a^2 + 2ab + b^2 = (a+b)^2$

  (ii) $a^2 - 2ab + b^2 = (a-b)^2$
- Discriminant of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ is given by $D=b^2-4ac$.

Chapter-05

Arithmetic Progression

- **Sequence:** A set of numbers arranged in some definite order and formed according to some rules is called a sequence.
- **Progression**: The sequence that follows a certain pattern is called progression.
- **Arithmetic Progression**: A sequence in which the difference obtained by subtracting any term from its preceding term is constant throughout, is called an arithmetic sequence or arithmetic progression (A.P.). The general form of an A.P. is a, a + d, a + 2d, ... (a: first term common difference).
- **General Term**: If 'a' is the first term and 'd' is common difference in an A.P., then n^{th} term (general term) is given by $a_n = a + (n - 1)\, d$.
- The formula $a_n = a + (n-1)d$ contains four quantities a_n, a, n and d. Three quantities being given, the fourth can be find out by using the above relation.
- If only two quantities are given, two conditions (equations) in the problem should be given. Therefore, to determine these two unknowns, we have to solve both the conditions (equations) linearly.
- Sum of n Terms of an A.P.: If 'a' is the first term and 'd' is the common difference of an A.P., then sum of first n terms is given by $S_n = \frac{n}{2}\{2a + (n-1)\, d\}$ If 'l' is the last term of a finite A.P. then the sum is given by $S_n = \frac{n}{2}\{a + l\}$
- (i) If a_n is given, then common difference $d = a_n - a_{n-1.}$

  (ii) If S_n is given, then n^{th} term is given by $a_n = s_n - s_{n-1}$

  (iii) If a, b, c is in A.P., then 2b = a + c.

  (iv) If a sequence has n terms, its r^{th} term from the end $= (n - r + 1)^{th}$ term from the beginning.

Chapter-06
Triangles

- **Similar Triangles**: Two triangles are said to be similar if their corresponding angles are equal and their corresponding sides are proportional.
- All congruent figures are similar but the converse is not true.
- Two polygons with same number of sides are similar, if
  - (i) Their corresponding angles are equal and
  - (ii) Their corresponding sides are in the same ration (i.e., proportion).
- Criteria for Similarity: in and ΔABC and ΔDEF
  - (i) **AAA Similarity**: $\Delta ABC \sim \Delta DEF$ When $\angle A = \angle D, \angle B = \angle E$ and $\angle C = \angle F$
  - (ii) **SAS Similarity:** $\Delta ABC \sim \Delta DEF$ when $\frac{AB}{DE} = \frac{BC}{EF}$ and $\angle B = \angle E$
  - (iii) **SSS Similarity**: $\Delta ABC \sim \Delta DEF$, $\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF}$
- The proof of the following theorems can be asked in the examination:
  - (i) **Basic Proportionality Theorem**: If a line is drawn parallel to one side of a triangle to intersect the other sides in distinct points, the other two sides are divided in the same ratio.
  - (ii) The ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides.
  - (iii) **Pythagoras Theorem**: In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.
  - (iv) **Converse of Pythagoras Theorem**: In a triangle, if the square of one side is equal to the sum of the squares of the other two sides then the angle opposite to the first side is a right angle.
- **Right Angled Triangle:**

(i) If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse, then the triangles on both sides of the perpendicular are similar to the Whole triangle and also to each other.

(ii) In the right triangle, the square of the hypotenuse is equal to the sum of the square of the other two sides (Pythagoras Theorem).

(iii) If in a triangle, square of one side is equal to the sum of the squares of the other two sides, then the angle opposite to the first side is a right angle.

- **Thales Theorem:** If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio (Basic Proportionally Theorem or Thales Theorem).
- If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side.

CBSE Class 10 Mathematics

Revision Notes

CHAPTER 07

COORDINATE GEOMETRY

1. **Distance Formula**
2. **Section Formula**
3. **Area of a Triangle**

1. **Distance Formula:** The length of a line segment joining A and B is the distance between two points $A(x_1, y_1)$ and (x_2, y_2) is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

2. The distance of a point (x, y) from the origin is $\sqrt{(x^2 + y^2)}$. The distance of P from x-axis is y units and from y-axis is x-units.

3. **Section Formula:** The co-ordinates of the points p(x, y) which divides the line segment joining the points $A(x_1, y_1)$ and $B(x_2\ , y_2)$ in the ratio $m_1 \ : \ m_2$ are $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$ we can take ratio as $k \ : \ 1, \ \ k = \frac{m_1}{m_2}$

4. **Mid-point Formula:** The mid-points of the line segment joining the points $P(x_1, y_2) \quad and \quad Q(x_2, y_2)$ is $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

5. **Area of a Triangle:** The area of the triangle formed by the points $(x_1, y_1),\ (x_2, y_2)\ and\ (x_3, y_3)$ is the numeric value of the expressions $\frac{1}{2}\left|x_1\left(y_2 - y_3\right) + x_2\left(y_3 - y_1\right) + x_3\left(y_1 - y_2\right)\right|$.

6. If three points are collinear then we cannot draw a triangle, so the area will be zero i.e. $|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)| = 0$

Chapter-08

Introduction to Trigonometry

- Trigonometry is the branch of Mathematics which deals with the measurement of sides and angles of the triangles.
- In a right triangle ABC, right-angled at B,
- sin A = $\dfrac{side\ opposite\ to\ angle\ A}{hypotenuse}, \cos A = \dfrac{side\ opposite\ to\ angle\ A}{hypotenuse}$

  s $\tan A = \dfrac{side\ opposite\ to\ angle\ A}{side\ adjacent\ to\ angle\ A}$

  $\cos ec\ A = \dfrac{1}{\sin A}; \sec A = \dfrac{1}{\cos A}$

  $\tan A = \dfrac{1}{\cot A}, \tan A = \dfrac{\sin A}{\cos A}$

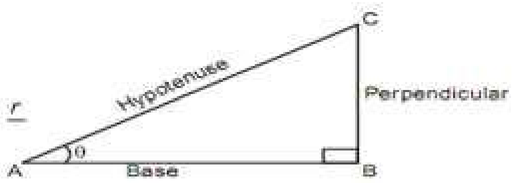
- If one of the trigonometric ratios of an acute angle is known, the remaining trigonometric ratios of the angle can be easily determined.
- The values of trigonometric ratios for angles 0°, 30°, 45°, 60° and 90°.
- The value of sin A or cos A never exceeds 1, whereas the value of sec A or cosec A is always greater than or equal to 1.
- sin (90° – A) = cos A, cos (90° – A) = sin A;
- tan (90° – A) = cot A, cot (90° – A) = tan A;
- sec (90° – A) = cosec A, cosec (90° – A) = sec A.
- $\sin^2$ A + cos2 A = 1,
- $\sec^2$ A – tan2 A = 1 for 0° ≤ A < 90°,
- $\cos ec^2$ A = 1 + cot2 A for 0° < A ≤ 90º.

Chapter-09
Some Application to Trigonometry

- The height or length of an object or the distance between two distant objects can be determined with the help of trigonometric ratio.
- The line of sight is the line drawn from the eye of an observer to the point of the object viewed by the observer.
- Trigonometric Ratios: In $\Delta ABC, \angle B = 90^o$, for angle 'A'

$$\text{Sin A} = \frac{\text{Perpendicular}}{\text{Hypotenuse}},\ \text{Cos A} = \frac{\text{Base}}{\text{Hypotenuse}},\ \tan A = \frac{\text{Perpendicular}}{\text{Base}}$$

$$\text{Cot A} = \frac{\text{Base}}{\text{Perpendicular}},\ \text{Sec A} = \frac{\text{Hypotenuse}}{\text{Base}},\ \text{cosec A} = \frac{\text{Hypotenuse}}{\text{Perpendicular}}$$



- **Reciprocal Relations:**

$$\sin\theta = \frac{1}{\text{cosec}\,\theta},\ \text{cosec}\,\theta = \frac{1}{\sin\theta}$$

$$\cos\theta = \frac{1}{\sec\theta},\ \sec\theta = \frac{1}{\cos\theta}$$

$$\tan\theta = \frac{1}{\cot\theta},\ \cot\theta = \frac{1}{\tan\theta}$$

- **Quotient Relations:**

$$\tan\theta = \frac{\sin\theta}{\cos\theta},\ \cot\theta = \frac{\cos\theta}{\sin\theta}$$

- **Identities:** $\sin^2 + \cos^2 = 1 \Rightarrow \sin^2\theta = 1 - \cos^2\theta$ and $\cos^2\theta = 1 - \sin^2\theta$

$1+\cot^2\theta = \operatorname{cosec}^2\theta \Rightarrow \cot^2\theta = \operatorname{cosec}^2\theta - 1$ and $\operatorname{cosec}^2\theta - \cot^2\theta = 1$

$1+\tan^2\theta = \sec^2\theta \Rightarrow \tan^2\theta = \sec^2\theta - 1$ and $\sec^2\theta - \tan^2\theta = 1$

- **Trigonometric Ratios of Some Specific Angles:**

$\angle A$	0°	30°	45°	60°	90°
$\sin A$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos A$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan A$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
$\operatorname{cosec} A$	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
$\sec A$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
$\cot A$	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

- **Trigonometric Ratios of Complementary Angles:**

$\sin(90^\circ - \theta) = \cos\theta$, $\cos(90^\circ - \theta) = \sin\theta$, $\tan(90^\circ - \theta) = \cot\theta$

$\cot(90^\circ - \theta) = \tan\theta$, $\sec(90^\circ - \theta) = \operatorname{cosec}\theta$, $\operatorname{cosec}(90^\circ - \theta) = \sec\theta$

- **Line of Sight**: The line of sight is the line drawn from the eyes of an observer to a point in the object viewed by the observer.
- **Angle of Elevation**: The angle of elevation is the angle formed by the line of sight with the horizontal, when it is above the horizontal level i.e. the case when we raise our head to look at the object.
- **Angle of Depression**: The angle of depression is the angle formed by the line of sight with the horizontal when it is below the horizontal i.e. case when we lower our head to look at the object.

Chapter-10

Circles

- **Circles:** A circle is a collection of all those points in a plane which are at a constant distance (radius) from a fixed point (center).
- **Secant:** A line which intersects a circle in two distinct points is called a secant of the circle.
- **Tangent to a Circle:** The tangent to a circle is a special case of secant, when the two end points of its corresponding chord coincide.

  (i) There is no tangent to a circle passing through a point lying inside the circle.

  (ii) There is one and only one tangent to a circle passing through a point lying on the circle.

  (iii) There are exactly two tangents to a circle through a point outside the circle.
- **Length of the Tangent:**

  (i) The length of the segment of the tangent from the external point and the point of contact with the circle is called the length of the tangent from the external point to the circle.

  (ii) The length of two tangents drawn from the same external point are equal.

Chapter-11

Constructions

- "**Construction**" in Geometry means to draw shapes, angles or lines accurately. These constructions use only compass, straightedge (i.e. ruler) and a pencil. This is the "pure" form of geometric construction: no numbers involved.
- Construction should be neat and clean and as per scale given in question.
- Steps of construction should be provided only to those questions where it is mentioned.
- **Used of Construction:**

  (i) The perpendicular bisector of a chord of a circle passes through its center.

  (ii) Tangents drawn from an external point to a circle are equal.

  (iii) The angle which tangent makes with a chord of a circle is equal to the angle in its alternate segment.

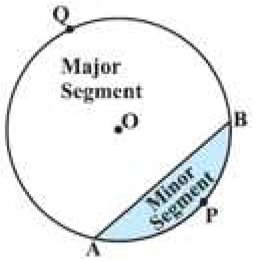
  (iv) Angles in the same segment are equal.

  (v) The tangent to a circle is perpendicular to the line joining the center and the point of contact.

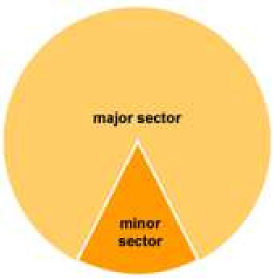
Chapter-12

Area Related to Circles

- **Circle:** A circle is the locus of a point which moves in a plane in such a way that its distance from a fixed point always remains the same. The fixed point is called the center and given constant distance is known as the radius of the circle.
- **Segment of a Circle:** The portion (or part) of a circular region enclosed between a chord and the corresponding arc is called a segment of the circle. In adjacent fig. APB is minor segment and AQB is major segment.



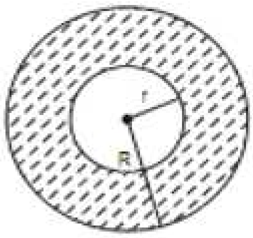
- **Sector of a Circle:** The portion (or part) of the circular region enclosed by the two radii and the corresponding arc is called a sector of the circle. In adjacent figure OAPB is minor sector and OAQB is the major sector.



- Area of circle = πr^2 where 'r' is the radius of the circle.
- Area of Semi circle = $\dfrac{\pi r^2}{2}$
- Area enclosed by two concentric circles

$$= \pi(R^2 - r^2)$$
$$= \pi(R + r)(R - r); R > r$$

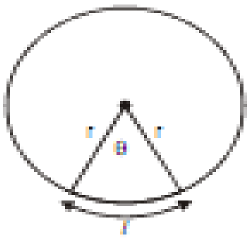
where ‘R’ and ‘r’ are radii of two concentric circles.



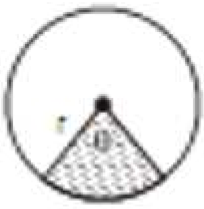
- The arc length ‘l’ of a sector of angle $'\theta'$ in a circle of radius ‘r’ is given by

$$l = \frac{\theta}{360^{o}} \times 2\pi r$$

$$l = \frac{\theta}{180^{o}} \times 2\pi r$$



- If the arc subtends an angle θ, then area of the corresponding sector is $\frac{\theta}{360^{o}} \times \pi r^{2}$



- Angle described by minute hand in 60 minutes = 360°. Angle described by minute hand in 1 minute $= \left(\frac{360^{o}}{60}\right) = 6^{o}$

Chapter-13

Surface Areas and Volumes

- **Cylinder:** A solid obtained by revolving a rectangular lamina about one of its sides is called a right circular cylinder.
- **Right Circular Cone:** A solid obtained by revolving a right-angled triangular lamina about any side (other than the hypotenuse) is called a right circular cone.
- **Sphere:** A sphere is a solid obtained on revolving a circle about any of its diameters.
- **Hemisphere:** When a sphere is cut by a plane through its center into two equal parts, then each part is called a hemisphere.
- **Spherical Shell:** The solid enclosed between two concentric sphere is called a spherical shell.
- **Hemisphere Shell:** The solid enclosed between two concentric hemispheres is called a hemispherical shell.
- **Frustum of a Cone:** If a cone is cut by a plane parallel to the base of the cone, then the portion between this plane and the base is called the frustum of the cone.
- Curved surface area of cylinder of radius r and height $\mathrm{h} = 2\pi\mathrm{rh}$ square units.
- Total surface area of cylinder of radius r and height $h = 2\pi r\ (r + h)$ square units.
- Volume of cylinder of radius r and height $h = \pi r h$ cubic units.
- Curved surface area of cone of radius r, height h and slant height $\mathrm{l} = \pi\mathrm{rl}$ square units where $\mathrm{l} = \sqrt{\mathrm{r}^2 + \mathrm{h}^2}$
- Total surface area of $cone = \pi r\ (l + r)\ sq.$ units.
- Volume of cone $= \frac{1}{3}\pi\mathrm{r}^2\mathrm{h}$ cubic units.
- Total surface area of sphere of radius $r\ units = 4\pi r^2 sq.$ units.
- Curved surface area of hemisphere of radius $r\ units = 2\pi r^2 sq.$ units.
- Total surface area of a solid hemisphere of radius $r\ units = 3\pi r^2 sq.$ units.

Key Notes

- Volume of sphere of radius r units $= \frac{4}{3}\pi r^3$ cubic units.
- Volume of hemisphere of radius r units $= \frac{2}{3}\pi r^3$ cubic units.
- Curved surface area of *frustum* $= \pi l(r + R) + \pi(r^2 + R^2)$ *sq. units*. where l slant height of frustum and radii of circular ends are r and R.
- Total surface area of frustum $= \pi l(r+R) + \pi(r^2 + R^2)$ sq. units.
- Volume of Frustum = $= \frac{1}{3}\pi h(r^2 + R^2 + rR)$ cubic units. Where $l = \sqrt{h^2 + (R-r)^2}$

Chapter-14

Statistics

- **Mean:** The arithmetic mean (or, simply mean) is the sum of the values of all the observations divided by the total number of observation.
- The mean for grouped data can be found by:

(i) The direct method = $\bar{X} = \frac{\sum fixi}{\sum fi}$

(ii) The assumed mean method $\bar{X} = a + \frac{\sum fidi}{\sum fi}$, Where $d_i = x_i - a.$

(iii) The step deviation method: $X = a + \frac{\sum fiui}{\sum fi} \times h$, where $U_1 = \frac{X_i - a}{h}$

- The mode for the grouped data can be found by using the formula:

$$\text{mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

l = lower limit of the modal class.

f_1 = frequency of the modal class.

f_o = frequency of the preceding class of the modal class.

f_2= frequency of the succeeding class of the modal class.

h = size of the class interval.

Modal class - class interval with highest frequency.

- The median for the grouped data can be found by using the formula:

$$\text{median} = l + \left[\frac{n/2 - Cf}{f}\right] \times h$$

l = lower limit of the median class.

n = number of observations.

Cf = cumulative frequency of class interval preceding the median class.

f = frequency of median class.

h = class size.

- Empirical Formula: Mode = 3 median - 2 mean.
- Cumulative frequency curve or an Ogive:

  (i) Ogive is the graphical representation of the cumulative frequency distribution.

  (ii) Less than type Ogive:

- Construct a cumulative frequency table.
- Mark the upper class limit on the x = axis.

  (i) More than type Ogive:

  (ii) Construct a frequency table.

  (iii) Mark the lower class limit on the x-axis.

- To obtain the median of frequency distribution from the graph:

  (i) Locate point of intersection of less than type Ogive and more than type Ogive:

  (ii) Draw a perpendicular from this point on x-axis.

  (iii) The point at which it cuts the x-axis gives us the median.

Chapter-15

Probability

- **Probability:** If there are n elementary events associated with a random experiment and m of them are favourable to an event A then the probability of happening of event A is defined as the ratio $\frac{m}{n}$ and is denoted by P(A).
- The Theoretical probability of an event E written as (E) is

$$P(E)=\frac{\text{Number of outcomes favourable of E}}{\text{Number of all possible outcomes of the experiment}}$$

- The sum of the probability of all the elementary events of an experiment is 1.
- The probability of a sure event is 1 and probability of an impossible event is 0.
- If E is an event, in general, it is true that $P(E) + P(\overline{E}) = 1$.
- From the definition of the probability, the numerator is always less than or equal to the denominator therefore $0 \leq P(E) \leq 1$.
- **Elementary Event:** An outcome of a random experiment is called an elementary event.
- **Compound Event:** An event associated to a random experiment is a compound event, if it is obtained by combining two or more elementary events associated to the random experiment.
- **Sure Event:** Those events whose probability is one.
- **Impossible Event:** Those events whose probability is zero.
- **Occurrence of an Event:** An event A associated to a random experiment is said to occur, if any one of the elementary events associated to the event A is an outcome.