Ch – 1 : REAL NUMBERS

1. The **natural** (or counting) **numbers** are 1,2,3,4,5, etc. There are infinitely many natural numbers. The set of natural number is denoted by **N**.
2. The **whole numbers** are the natural numbers together with 0.The set of whole number is denoted by **W.**
3. The **integers** are the set of real numbers consisting of the natural numbers, their additive inverses and zero i.e., {...,−5,−4,−3,−2,−1,0,1,2,3,4,5,...}.The set of integers is denoted by **Z or I .**
4. **Rational numbers** are the numbers that can be expressed in the form of a ratio (i.e., p/q and q≠ 0) .The set of rational number is denoted by **Q.**
5. **Irrational numbers** cannot be expressed as a fraction. The set of irrational number is denoted by Q^c .
6. **Real numbers** is a union of rational and irrational numbers . i.e., { , ……. , 1 , $\sqrt{2}$, … , 2 , ,,,}.The set of real number is represented by **R**.
7. A **terminating decimal** is a decimal, that has an end digit. It is a decimal, which has a finite number of digits(or terms).
8. **Non-terminating decimals** are the one that does not have an end term. It has an infinite number of terms.
9. (**Euclid's Division Lemma**) : Given positive integers a and b, there exist unique integers q and r satisfying a = bq + r, 0 ≤ r < b.
10. To obtain the HCF of two positive integers, say c and d, with c > d, follow the steps below:
    (i) Apply Euclid's division lemma, to c and d. So, we find whole numbers, q and r such that c = dq + r, 0 ≤ r < d .
    (ii) If r = 0, d is the HCF of c and d. If r ≠ 0, apply the division lemma to d and r.
    (iii) Continue the process till the remainder is zero. The divisor at this stage will be the required HCF. This algorithm works because HCF (c, d) = HCF (d, r) where the symbol HCF (c, d) denotes the HCF of c and d, etc.
11. (**Fundamental Theorem of Arithmetic**) : Every composite number can be expressed (factorised) as a product of primes, and this factorisation is unique, apart from the order in which the prime factors occur .
12. The Fundamental Theorem of Arithmetic says that every composite number can be factorised as a product of primes. Actually it says more. It says that given any composite number it can be factorised as a product of prime numbers in a 'unique' way, except for the order in which the primes occur.
13. For any integers a and b , HCF(a , b) = Product of the smallest power of each common prime factor in the numbers.
14. For any integers a and b , LCM (a , b) = Product of the greatest power of each prime factor, involved in the numbers.
15. for any two positive integers a and b, HCF (a, b) × LCM (a, b) = a × b.
16. A number 's' is called irrational if it cannot be written in the form , $\frac{p}{q}$ where p and q are integers and q ≠ 0.
17. Let p be a prime number. If p divides a^2 , then p divides a, where a is a positive integer.
18. $\sqrt{2}$, $\sqrt{3}$ are irrational numbers.
19. Let x be a rational number whose decimal expansion terminates. Then x can be expressed in the form , $\frac{p}{q}$ where p and q are coprime, and the prime factorisation of q is of the form $2^n.5^m$, where n, m are non-negative integers.
20. Let x = $\frac{p}{q}$ be a rational number, such that the prime factorisation of q is of the form $2^n.5^m$, where n, m are non-negative integers. Then x has a decimal expansion which terminates.
21. Let x = $\frac{p}{q}$, where p and q are co primes, be a rational number, such that the prime factorisation of q is not of the form $2^n.3^m$, where n, m are non-negative integers. Then, x has a decimal expansion which is non-terminating repeating (recurring).
22. HCF (p, q, r) × LCM (p, q, r) ≠ p × q × r, where p, q, r are positive integers . However, the following results hold good for three numbers p, q and r :

LCM (p, q, r) = $\frac{p.q.r.HCF\,(p,q,r)}{HCF\,(p,q).HCF\,(q,r).HCF\,(p,r)}$

HCF (p, q, r) = $\frac{p.q.r.LCM\,(p,q,r)}{LCM\,(p,q).LCM\,(q,r).LCM\,(p,r)}$

Ch – 2 : POLYNOMIALS

1. If p(x) is a polynomial in x, the highest power of x in p(x) is called the **degree of the polynomial** p(x).
2. A polynomial of degree 1 is called a **linear polynomial** i.e., More generally, any linear polynomial in x is of the form $ax + b$, where a, b are real numbers and a ≠ 0.
3. A polynomial of degree 2 is called a **quadratic polynomial**. More generally, any quadratic polynomial in x is of the form $ax^2 + bx + c$, where a, b, c are real numbers and a ≠ 0.
4. A polynomial of degree 3 is called a **cubic polynomial**. More generally, any cubic polynomial in x is of the form $ax^3 + bx^2 + cx + d$, where a, b, c , d are real numbers and a ≠ 0.
5. If p(x) is a polynomial in x, and if k is any real number, then the value obtained by replacing x by k in p(x), is called the value of p(x) at x = k, and is denoted by p(k).
6. A real number k is said to be a **zero of a polynomial** p(x), if p(k) = 0.
7. In general, if k is a zero of p(x) = ax + b, then p(k) = ak + b = 0, i.e., $k = -\frac{b}{a}$

   So, the zero of the linear polynomial ax + b is $-\frac{b}{a} = \frac{-\,Constant\ term}{Coefficient\ of\ x}$.
8. In general, given a polynomial p(x) of degree n, the graph of y = p(x) intersects the x-axis at atmost n points. Therefore, a polynomial p(x) of degree n has at most n zeroes.
9. In general, if α and β are the zeroes of the quadratic polynomial p(x) = $ax^2 + bx + c$, a ≠ 0, then you know that x – α and x – β are the factors of p(x).

   Therefore, ax^2 + bx + c = k(x – α) (x – β), where k is a constant

   = k[x^2 – (α + β)x + α β]

   = kx^2 – k(α + β)x + k α β

   Comparing the coefficients of x^2 , x and constant terms on both the sides,

   we get a = k, b = – k(α + β) and c = kαβ.

   This gives α + β = $-\frac{b}{a}$, αβ = $\frac{c}{a}$ i.e.,

   Sum of its zeroes = $\frac{-\,(Coefficient\ of\ x)}{Coefficient\ of\ x^2}$

   Product of its zeroes = $\frac{Constant\ term}{Coefficient\ of\ x^2}$
10. In general, it can be proved that if α, β, γ are the zeroes of the cubic polynomial ax^3 + bx^2 + cx + d, then

    Sum of the zeroes = α + β + γ = $-\frac{b}{a}$,

    Sum of the products of the zeroes = αβ + βγ + γα = $\frac{c}{a}$

    Product of the zeroes = α β γ = $-\frac{d}{a}$.
11. If p(x) and g(x) are any two polynomials with g(x) ≠ 0, then we can find polynomials q(x) and r(x) such that p(x) = g(x) × q(x) + r(x), where r(x) = 0 or degree of r(x) < degree of g(x). This result is known as the **Division Algorithm** for polynomials.
12. **Remainder Theorem** is an approach of Euclidean division of polynomials. According to this theorem, if we divide a polynomial P(x) by a factor (x – a); that isn't essentially an element of the polynomial; you will find a smaller polynomial along with a remainder. This remainder that has been obtained is actually a value of P(x) at x = a, specifically P(a). So basically, x -a is the divisor of P(x) if and only if P(a) = 0.

Ch – 3 : PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

1. An equation which can be put in the form ax + by + c = 0, where a, b and c are real numbers, and a and b are not both zero, is called a **linear equation** in two variables x and y.
2. A **solution** of such an equation is a pair of values, one for x and the other for y, which makes the two sides of the equation equal.

3. For any linear equation, that is, each solution (x, y) of a linear equation in two variables, ax + by + c = 0, corresponds to a point on the line representing the equation, and vice versa.
4. A **pair of linear equations in two variables** can be represented, and solved, by the:
   (i) graphical method
   (ii) algebraic method
5. **Graphical Method** : The graph of a pair of linear equations in two variables is represented by two lines.
   (i) If the lines intersect at a point, then that point gives the **unique solution** of the two equations. In this case, the pair of equations is **consistent**.
   (ii) If the lines coincide, then there are **infinitely many solutions** — each point on the line being a solution. In this case, the pair of equations is dependent (**consistent**).
   (iii) If the lines are parallel, then the pair of equations has **no solution**. In this case, the pair of equations is **inconsistent.**
6. **Algebraic Methods** : We have discussed the following methods for finding the solution(s) of a pair of linear equations :
   (i) **Substitution Method**
   (ii) **Elimination Method**
   (iii) **Cross-multiplication Method**
7. **Substitution Method** : We have substituted the value of one variable by expressing it in terms of the other variable to solve the pair of linear equations. That is why the method is known as the substitution method.
8. **Elimination method** : we eliminate one variable first, to get a linear equation in one variable. Let us now note down these steps in the elimination method :
   Step 1 : First multiply both the equations by some suitable non-zero constants to make the coefficients of one variable (either x or y) numerically equal.
   Step 2 : Then add or subtract one equation from the other so that one variable gets eliminated. If you get an equation in one variable, go to Step 3. If in Step 2, we obtain a true statement involving no variable, then the original pair of equations has infinitely many solutions.
   If in Step 2, we obtain a false statement involving no variable, then the original pair of equations has no solution, i.e., it is inconsistent.
   Step 3 : Solve the equation in one variable (x or y) so obtained to get its value.
   Step 4 : Substitute this value of x (or y) in either of the original equations to get the value of the other variable.
9. For any pair of linear equations in two variables of the form $a_1x + b_1y + c_1 = 0$ ....(1) and $a_2x + b_2y + c_2 = 0$ ......(2) then
   (i) When $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, we get a **unique solution.**
   (ii) When $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$, there are **infinitely many solutions**.
   (iii) When $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$, there is **no solution**
10. The lines represented by the equation $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are :
   (i) **Intersecting**, then $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
   (ii) **Coincident**, then $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
   (iii) **Parallel**, then $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Ch – 4 : QUADRATIC EQUATIONS

1. A **quadratic equation** in the variable x is an equation of the form $ax^2 + bx + c = 0$, where a, b, c are real numbers, a ≠ 0.
2. In general, a real number α is called a **root of the quadratic equation** $ax^2 + bx + c = 0$, a ≠ 0 if $a\alpha^2 + b\alpha + c = 0$. We also say that x = α is a **solution of the quadratic equation**, or that α satisfies the quadratic equation.

Note that : The zeroes of the quadratic polynomial $ax^2 + bx + c$ and the roots of the quadratic equation $ax^2 + bx + c = 0$ are the same.

3. If we can factorise $ax^2 + bx + c$, a ≠ 0, into a product of two linear factors, then the roots of the quadratic equation $ax^2 + bx + c = 0$ can be found by equating each factor to zero.
4. A quadratic equation can also be solved by the method of completing the square.
5. **Quadratic formula**: The roots of a quadratic equation $ax^2 + bx + c = 0$ are given by $\frac{-b\pm\sqrt{b^2-4ac}}{2a}$, provided $b^2 - 4ac \geq 0$.
6. $b^2 - 4ac$ is called the **discriminant** of the quadratic equation.
7. A quadratic equation $ax^2 + bx + c = 0$ has
   (i) **two distinct real roots**, if $b^2 - 4ac > 0$,
   (ii) two **equal roots** (i.e., coincident roots), if $b^2 - 4ac = 0$, and
   (iii) **no real roots**, if $b^2 - 4ac < 0$.

Ch – 5 : ARITHMETIC PROGRESSIONS

1. An **arithmetic progression** is a list of numbers in which each term is obtained by adding a fixed number to the preceding term except the first term.
2. This fixed number is called the **common difference** of the AP. Remember that it can be positive, negative or zero .It is denoted by d.
3. Let us denote the first term of an AP by a_1 , second term by a_2 , . . ., nth term by a_n and the common difference by d. Then the AP becomes $a_1, a_2 , a_3 , \ldots , a_n$. So, $a_2 - a_1 = a_3 - a_2 = \cdots = a_n - a_{n-1} = d$.
4. $a , a + d , a + 2d , a + 3d \ldots$ represents an arithmetic progression where a is the first term and d the common difference. This is called the **general form of an AP** .
5. If in an A.P. there are only a **finite number** of terms then such A.P. is called a **finite AP**.
6. If in an A.P. there are only a **infinite number** of terms then such A.P. is called an **infinite AP**. Such APs do not have a last term.
7. The **nth term an of the AP** with first term a and common difference d is given by $a_n = a + (n - 1)d$. a_n is also called the general term of the AP. If there are m terms in the AP, then a_m represents the last term which is sometimes also denoted by l.
8. The **sum of the first n terms** of an AP is given by : $S = \frac{n}{2}[2a + (n - 1)d\ ]$

   5. If l is the last term of the finite AP, say the nth term, then the sum of all terms of the AP is given by : $S = \frac{n}{2}(a + l)$

Ch – 6 : TRIANGLES

1. Two figures are said to be **congruent**, if they have the same shape and the same size .
2. Two figures having the same shape (and not necessarily the same size) are called **similar** figures .
3. All congruent figures are similar but the similar figures need not be congruent.
4. Two polygons of the same number of sides are similar, if
   (i) their corresponding angles are equal and
   (ii) their corresponding sides are in the same ratio (or proportion).
5. The ratio of any two corresponding sides in two equiangular triangles is always the same.
6. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
7. If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side.
8. If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio (or proportion) and hence the two triangles are similar. This criterion is referred to as the **AAA (Angle–Angle–Angle) criterion of similarity** of two triangles.
9. If two angles of one triangle are respectively equal to two angles of another triangle, then the two triangles are similar . This may be referred to as the **AA similarity criterion** for two triangles.

10. If in two triangles, sides of one triangle are proportional to (i.e., in the same ratio of) the sides of the other triangle, then their corresponding angles are equal and hence the two triangles are similar. This criterion is referred to as the **SSS (Side–Side–Side) similarity criterion** for two triangles.
11. If one angle of a triangle is equal to one angle of the other triangle and the sides including these angles are proportional, then the two triangles are similar. This criterion is referred to as the **SAS (Side–Angle–Side) similarity criterion** for two triangles
12. The ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides.
13. If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse then triangles on both sides of the perpendicular are similar to the whole triangle and to each other.
14. **Pythagoras Theorem** : In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.
15. 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 the first side is a right angle.

Ch – 7 : COORDINATE GEOMETRY

1. The distance of a point from the y-axis is called its **x-coordinate, or abscissa.**
2. The distance of a point from the x-axis is called its **y-coordinate, or ordinate**.
3. **Distance formula** : The distance between $P(x_1, y_1)$ and $Q(x_2, y_2)$ is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
4. The **distance** of a point P(x , y) from the origin is $\sqrt{x^2 + y^2}$
5. The **coordinates of the point** P(x, y) which divides the line segment joining the points $A(x_1, y_1)$ and B(x_2, y_2), **internally, in the ratio $m_1 : m_2$** are $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$

   This is known as the **section formula**.
6. If the ratio in which P divides AB is k : 1, then the coordinates of the point P will be $\left(\frac{kx_2+x_1}{k+1}, \frac{ky_2+y_1}{k+1}\right)$
7. **Special Case** : The **mid-point** of a line segment divides the line segment in the ratio 1 : 1. Therefore, the coordinates of the mid-point P of the join of the points A(x_1, y_1) and B(x_2, y_2) is $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$
8. The area of a triangle when its base and corresponding height (altitude) are given. You have used the formula : Area of a triangle = $\frac{1}{2} \times base \times altitude$.
9. The **area of the triangle** formed by the points (x_1, y_1), (x_2, y_2) and (x_3, y_3) is the numerical value of the expression $\frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$

Ch – 8 : INTRODUCTION TO TRIGONOMETRY

1. The word '**trigonometry**' is derived from the Greek words 'tri' (meaning three), 'gon' (meaning sides) and 'metron' (meaning measure).
2. Trigonometry is the study of relationships between the sides and angles of a triangle.
3. Ratios of the sides of a right triangle with respect to its acute angles, called **trigonometric ratios of the angle.**
4. Some identities involving these ratios, called **trigonometric identities.**
5. The trigonometric ratios of the angle A in right triangle ABC are defined as follows :

   sine of ∠ A = $\frac{Side\ opposite\ to\ angle\ A}{Hypotenuse} = \frac{BC}{AC}$

   cosine of ∠ A = $\frac{Side\ adjacent\ to\ angle\ A}{Hypotenuse} = \frac{AB}{AC}$

   tangent of ∠ A = $\frac{Side\ adjacent\ to\ angle\ A}{Side\ adjacent\ to\ angle\ A} = \frac{BC}{AB}$

   cosecant of ∠ A = $\frac{1}{sine\ of\ \angle A} = \frac{Hypotenuse}{Side\ opposite\ to\ angle\ A} = \frac{AC}{BC}$

   secant of ∠ A = $\frac{1}{cosine\ of\ \angle A} = \frac{Hypotenuse}{side\ adjacent\ to\ angle\ A} = \frac{AB}{BC}$

cotangent of ∠ A = $\frac{1}{tangent\ of\ \angle A} = \frac{side\ adjacent\ to\ angle\ A}{side\ opposite\ to\ angle\ A} = \frac{AB}{BC}$

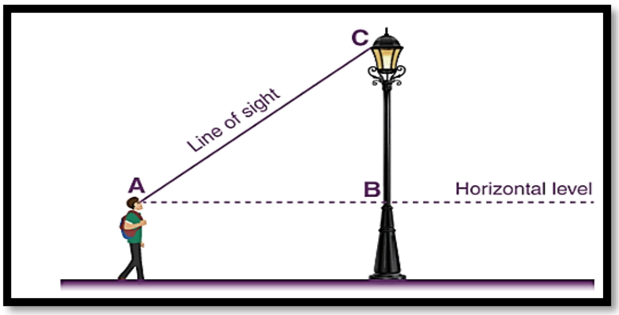
6. The symbol sin A is used as an abbreviation for 'the sine of the angle A'. sin A is not the product of 'sin' and A. 'sin' separated from A has no meaning. Similarly, cos A is not the product of 'cos' and A.
7. The values of the trigonometric ratios of an angle do not vary with the lengths of the sides of the triangle, if the angle remains the same.
8. For the sake of convenience, we may write $\sin^2 A$, $\cos^2 A$, etc., in place of $(\sin A)^2$, $(\cos A)^2$, etc., respectively. But cosec A = $(\sin A)^{-1} \neq \sin^{-1} A$ (it is called sine inverse A).
9. Since the hypotenuse is the longest side in a right triangle, the value of sin A or cos A is always less than 1 (or, in particular, equal to 1).
10. From the table below as ∠ A increases from 0° to 90°, sin A increases from 0 to 1 and cos A decreases from 1 to 0.

$\angle A$	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
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

11. Two angles are said to be complementary if their sum equals 90°.
    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, for all values of angle A lying between 0° and 90° .
12. **Trigonometric Identities:**
    (i)$\sin^2 A + \cos^2 A = 1$
    (ii)$\sec^2 A - \tan^2 A = 1$, for $0° \leq A \leq 90°$
    (iii)$cosec^2 A = 1 + \cot^2 A$, for $0° \leq A \leq 90°$

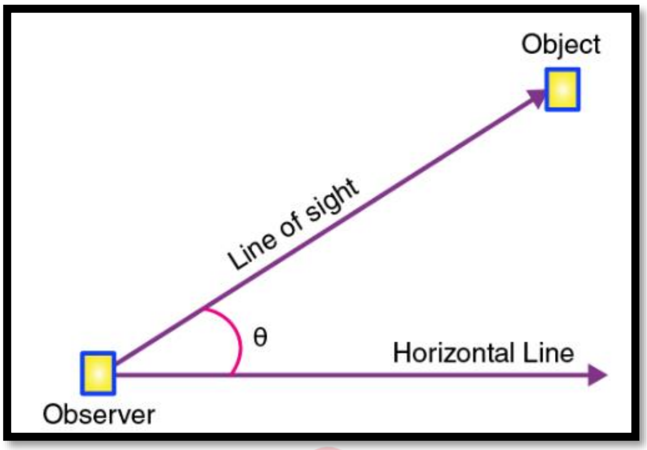
Ch – 9 : SOME APPLICATIONS OF TRIGONOMETRY

1. **Horizontal Level and Line of Sight**
   Line of sight is the line drawn from the eye of the observer to the point on the object viewed by the observer.
   The horizontal level is the horizontal line through the eye of the observer.



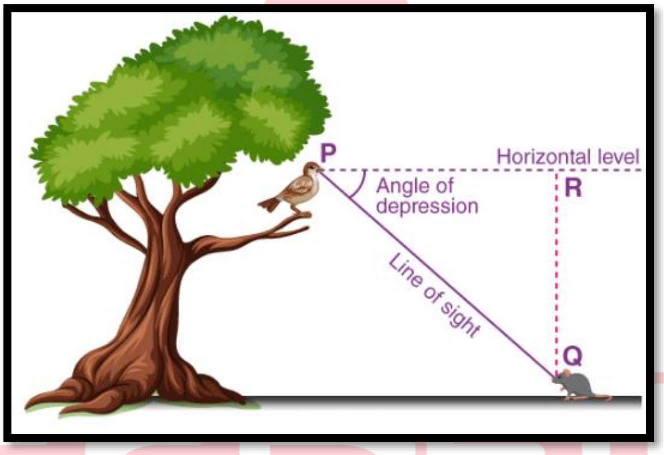
2. **Angle of elevation**

The angle of elevation is relevant for objects above the horizontal level. It is the angle formed by the line of sight with the horizontal level. In the below-mentioned diagram, "θ" denotes the angle of elevation.



3. **Angle of depression**

The angle of depression is relevant for objects below the horizontal level. It is the angle formed by the line of sight with the horizontal level.



4. **Calculating Heights and Distances**

To, calculate heights and distances, we can make use of trigonometric ratios.
Go through the below trigonometric ratio table for reference:

Trigonometry Ratios Table

Angles (In Degrees)	0°	30°	45°	60°	90°	180°	270°	360°
Angles (In Radians)	0°	π/6	π/4	π/3	π/2	π	3π/2	2π
sin	0	1/2	1/√2	√3/2	1	0	-1	0
cos	1	√3/2	1/√2	1/2	0	-1	0	1
tan	0	1/√3	1	√3	∞	0	∞	0
cot	∞	√3	1	1/√3	0	∞	0	∞
cosec	∞	2	√2	2/√3	1	∞	-1	∞
sec	1	2/√3	√2	2	∞	-1	∞	1

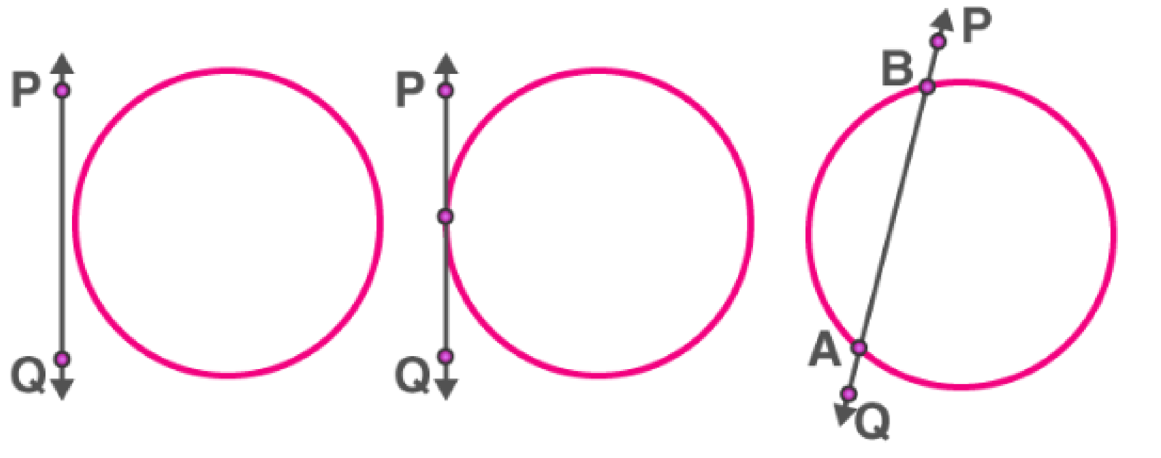
Step 1: Draw a **line diagram** corresponding to the problem.

Step 2: Mark all known heights, distances and angles and denote unknown lengths by variables.

Step 3: Use the values of various **trigonometric ratios** of the angles to obtain the unknown lengths from the known lengths.

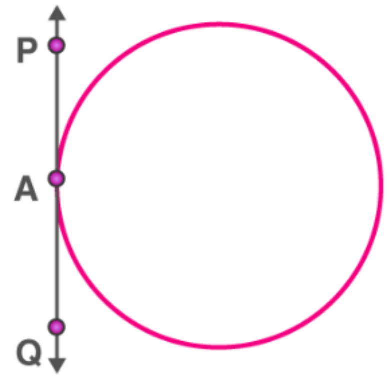
Ch- 10 : CIRCLES

1. A **circle** is a collection of all points in a plane which are at a constant distance (**radius**) from a fixed point (**centre**).
2. For a circle on a plane, there can be three possibilities.
   (i) they can be **non-intersecting**
   (ii) they can have a **single common point**: in this case, the **line touches** the circle.
   (iii) they can have **two common points**: in this case, the **line cuts** the circle.



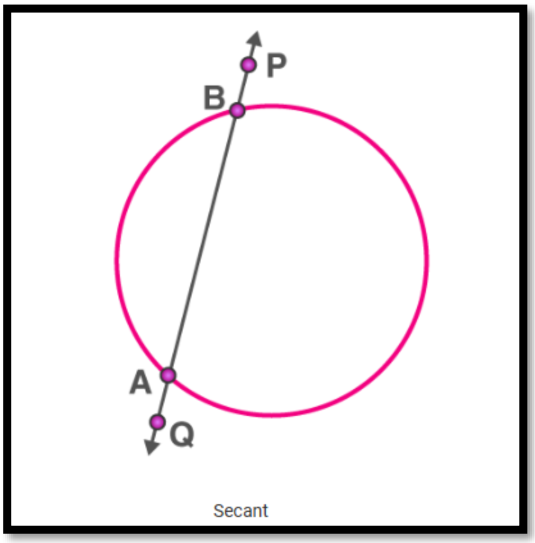
(i) Non intersecting (ii) Touching (iii) Intersecting

3. A **tangent** to a circle is a line that touches the circle at exactly one point. For every point on the circle, there is a **unique tangent** passing through it.



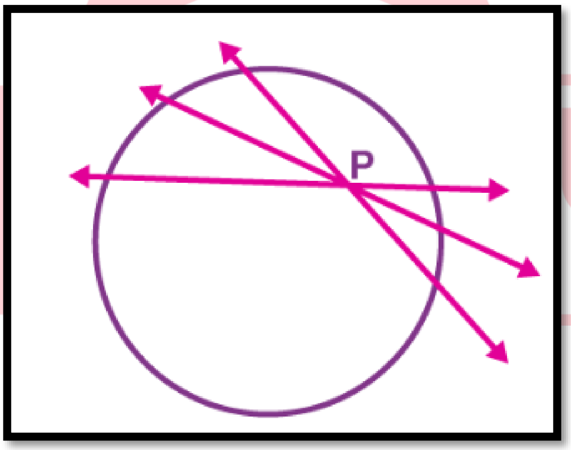
Tangent

4. A **secant** to a circle is a line that has two points in common with the circle. It cuts the circle at two points, forming a chord of the circle.

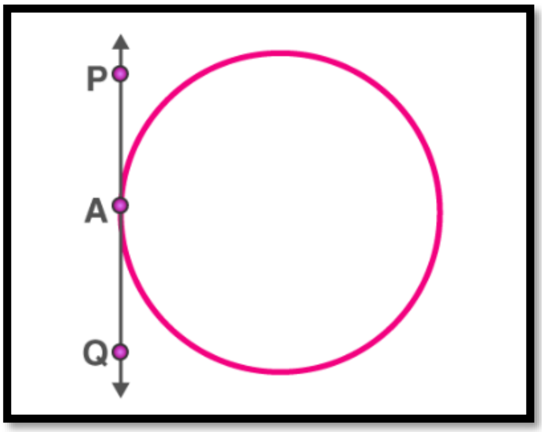


5. The common point of the tangent and the circle is called the **point of contact** and the tangent is said to **touch the circle at the common point**.
6. The tangent at any point of a circle is perpendicular to the radius through the point of contact.
7. we can also conclude that at any point on a circle there can be one and only one tangent.
8. The line containing the radius through the point of contact is also sometimes called the '**normal**' to the circle at the point.
9. For every given secant of a circle, there are exactly two tangents which are parallel to it and touches the circle at two diametrically opposite points.
10. The number of tangents drawn from a given point :

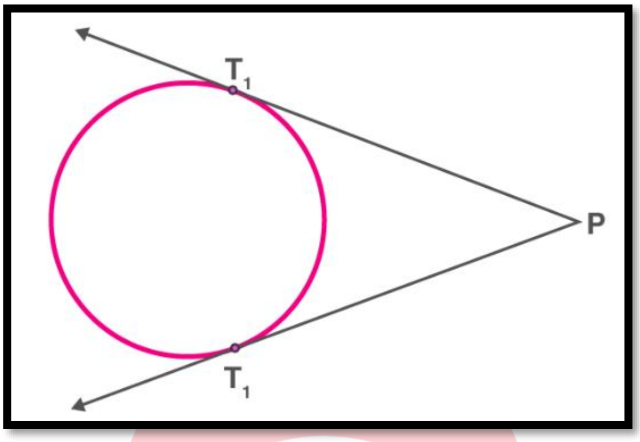
    (i) If the **point is in an interior region** of the circle, any line through that point will be a secant. So, no tangent can be drawn to a circle which passes through a point that lies inside it.



(ii) When a **point of tangency lies on the circle**, there is exactly one tangent to a circle that passes through it.



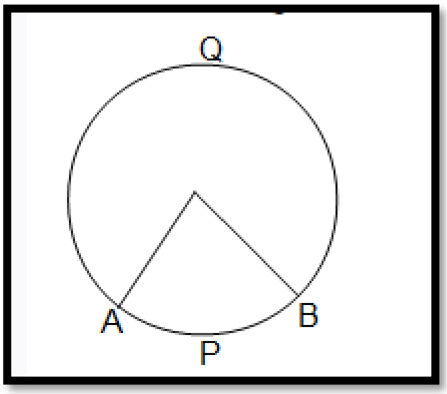
(iii) When the **point lies outside** of the circle, there are accurately two tangents to a circle through it



11. The length of the segment of the tangent from the external point P and the point of contact with the circle is called the **length of the tangent** from the point P to the circle.
12. The lengths of tangents drawn from an external point to a circle are equal.

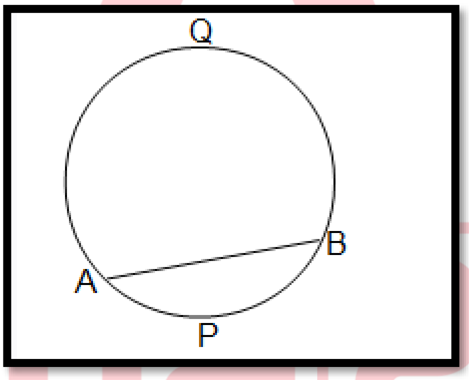
Ch- 11 : AREAS RELATED TO CIRCLES

1. The distance covered by travelling once around a circle is its perimeter, usually called its **circumference**.
2. Circumference of a circle bears a constant ratio with its diameter. This constant ratio is denoted by the Greek letter π (read as 'pi').
   In other words, $\frac{\text{circumference}}{\text{diameter}} = \pi$
   circumference = π × diameter
   = π × 2r (where r is the radius of the circle)
   = 2πr
3. We generally take the value of π as 22 7 or 3.14, approximately.
4. **Area of a circle** is πr^2 , where r is the radius of the circle.
5. The portion (or part) of the circular region enclosed by two radii and the corresponding arc is called a **sector** of the circle



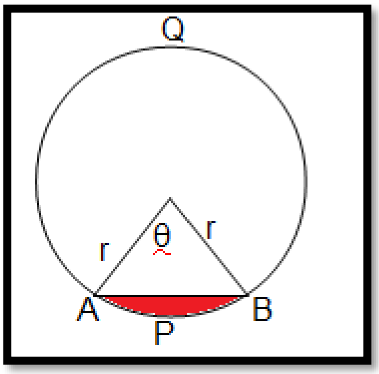
Here OAPB is called **minor sector** and OAQB is called the **major sector**.

6. Sum of the arcs of major and minor sectors of a circle is equal to circumference of the circle. 7.Sum of the areas of major and minor sectors of a circle is equal to area of the circle.
7. **Angle of the sector**:
   The angle subtended by the corresponding arc of the sector at the centre of the circle is called the angle of the sector. Area of a Sector of angle θ = $\frac{\theta}{360°} \times \pi r^2$ or $\frac{1}{2} \times$ length of arc × radius = $\frac{1}{2} lr$ Length of an arc of angle θ = $\frac{\theta}{360°} \times 2\pi r$
8. **Segment of a circle**: The circular region enclosed between a chord and the corresponding arc is called the segment of a circle. **Minor segment** If the boundary of a segment is a minor arc of a circle, then the corresponding segment is called a minor segment. **Major segment** A segment corresponding a major arc of a circle is called as major segment.



Here APB is called **minor segment** and AQB is called **major segment**.

9. The area of a segment is the area of the corresponding sector minus the area of the corresponding triangle.



10. **Area of Segment APB** = Area of Sector OAPB – Area of ΔOAB = $\frac{\theta}{360°} \times \pi r^2 - \frac{1}{2} r^2 \sin\theta$
11. Angle described by minute hand in 60 minutes = 360°.
12. Angle described by minute hand in one minute = $\left(\frac{360}{60}\right)°$.

13. Angle described by hour hand in 12 hours = 360°.
14. Angle described by hour hand in one hour = $\left(\frac{360}{12}\right)°$ = 30°.
15. Angle described by hour hand in one minute = $\left(\frac{30}{60}\right)° = \frac{1}{2}°$

Ch – 12 : SURFACE AREAS AND VOLUMES

1. To determine the surface area of an object formed by combining any two of the basic solids, namely, cuboid, cone, cylinder, sphere and hemisphere.
2. Surface Area of a Combination of Solids :
   (i) Solid is made up of a cylinder with two hemispheres stuck at either end The total surface area of the new solid is the sum of the curved surface areas of each of the individual parts .
   TSA of new solid = CSA of one hemisphere + CSA of cylinder + CSA of other hemisphere
   (ii) Solid is made by putting together a hemisphere and a cone.
   The surface area of the solid, which consists of the CSA of the hemisphere and the CSA of the cone.
   Total surface area of the solid = CSA of hemisphere + CSA of cone
3. Volume of a Combination of Solids : The volume of the solid formed by joining two basic solids will actually be the sum of the volumes of the constituents .
4. Given a right circular cone, which is sliced through by a plane parallel to its base, when the smaller conical portion is removed, the resulting solid is called a Frustum of a Right Circular Cone.
5. The formulae involving the frustum of a cone are:
   (i) Volume of a frustum of a cone = $\frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$.
   (ii) Curved surface area of a frustum of a cone = $\pi l(r_1 + r_2)$, where $l = \sqrt{h^2 + (r_1 - r_2)^2}$
   (iii) Total surface area of frustum of a cone = $\pi l(r_1 + r_2) + \pi(r_1^2 + r_2^2)$ where h = vertical height of the frustum, l = slant height of the frustum r_1 and r_2 are radii of the two bases (ends) of the frustum.

Ch – 13 : STATISTICS

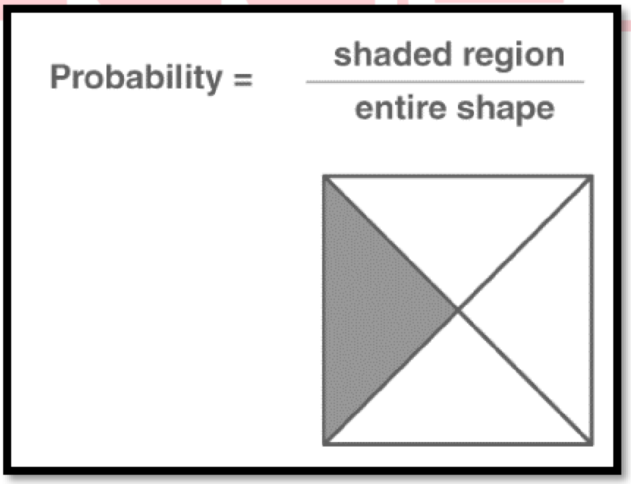
1. **Mean of Grouped Data** : The mean (or average) of observations, as we know, is the sum of the values of all the observations divided by the total number of observations.
2. **Mean** $\bar{x}$ of the data is given by $\bar{x} = \frac{f_1x_1+f_2x_2+\cdots+f_nx_n}{f_1+f_2+\cdots+f_n} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}$
3. **MEAN [Grouped Data]**: The mean for grouped data can be found by the following three methods:
   (i) **Direct Mean Method**: $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$
   Class mark = $\frac{\text{Upper class limit} + \text{Lower class limit}}{2}$
   (ii) **Assumed Mean Method**: In this, an arbitrary mean 'a' is chosen which is called, 'assumed mean', somewhere in the middle of all the values of x. $\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$, where $d_i = x_i - a$
   (iii)**Step Deviation Method** : $\bar{x} = a + \left[\frac{\sum f_i u_i}{\sum f_i}\right] \times h$, where $u_i = \frac{d_i}{h}$, where h is a common divisor of d_i
4. **MEDIAN**: Median is a measure of central tendency which gives the value of the middle-most observation in the data.
   (i)**Ungrouped data** : If n is odd → Median = $\left(\frac{n+1}{2}\right)^{th}$ observation
   If n is even → Median = $\frac{\left(\frac{n}{2}\right)^{th}\text{ observation} + \left(\frac{n}{2}+1\right)^{th}\text{ observation}}{2}$
   Remember ! For ungrouped data , first arrange the observations in ascending order or decreasing order.
   (ii)**Median (Grouped data)** : Median = $l + \left(\frac{\frac{n}{2} - c.f.}{f}\right) \times h$
   where[l = Lower limit of median class; n = Number of observations; f = Frequency of median class; c.f. = Cumulative frequency of preceding class; h = Class size]

(iii) Representing a cumulative frequency distribution graphically as a cumulative frequency curve, or an ogive of the less than type and of the more than type. The median of grouped data can be obtained graphically as the x-coordinate of the point of intersection of the two ogives for this data.

5. **Mode:**
(i) **Ungrouped Data**: The value of the observation having maximum frequency is the mode.
(ii) **Grouped Data**: Mode = $l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$ where[l = Lower limit of modal class; f_1 = Frequency of modal class; f_0 = Frequency of the class preceding the modal class; f_2 = Frequency of the class succeeding the modal class; h = Size of class interval. c.f. = Cumulative frequency of preceding class; h = Class size]

Ch – 14 : PROBABILITY

1. The branch of mathematics that measures the uncertainty of the occurrence of an event using numbers is called **probability**.
2. The chance that an event will or will not occur is expressed on a scale ranging from 0-1.
3. Probability of an Event E is represented by P(E).
4. **Event and outcome** : An Outcome is a result of a random experiment. For example, when we roll a dice getting six is an outcome. An Event is a set of outcomes.
Note: An Event can have a single outcome.
5. **Experimental Probability**: Experimental probability can be applied to any event associated with an experiment that is repeated a large number of times. A trial is when the experiment is performed once. It is also known as empirical probability. **Experimental or empirical probability**: P(E) = Number of trials where the event occurred/Total Number of Trials
6. **Theoretical Probability** : P(E) = Number of Outcomes Favourable to E / Number of all possible outcomes of the experiment Here we assume that the outcomes of the experiment are equally likely.
7. **Elementary Event** : An event having only one outcome of the experiment is called an elementary event.
8. **Sum of Probabilities** :The sum of the probabilities of all the elementary events of an experiment is one.
9. **Impossible event** :An event that has no chance of occurring is called an Impossible event, i.e. P(E) = 0.
10. **Sure event** :An event that has a 100% probability of occurrence is called a sure event. The probability of occurrence of a sure event is one.
11. **Range of Probability of an event** : Probability can range between 0 and 1, where 0 probability means the event to be an impossible one and probability of 1 indicates a certain event i.e. $0 \leq P(E) \leq 1$.
12. **Geometric Probability**
Geometric probability is the calculation of the likelihood that one will hit a particular area of a figure. It is calculated by dividing the desired area by the total area. In the case of Geometrical probability, there are infinite outcomes.



13. **Complementary Events** :

Complementary events are two outcomes of an event that are the only two possible outcomes. This is like flipping a coin and getting heads or tails.

$P(E) + P(\bar{E}) = 1$,where E and $\bar{E}$ are complementary events . The event $\bar{E}$, representing 'not E' , is called the complement of the event E.

Adda 247

Name : _______________

Date of Exam. : _______________

Duration : **3 hours**

Max. Marks : **80**

Study Centre : _______________

General Instructions:

1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

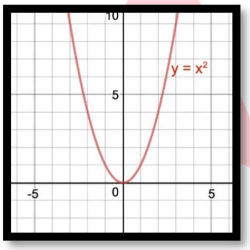
SECTION A

Section A consists of 20 questions of 1 marks each.

Q1. If $m^n = 32$ where m and n are positive integers, then the value of $(n)^{mn}$ is:

(a) 32
(b) 25
(c) 5^{10}
(d) 5^{25}

Q2. The degree of the polynomial whose graph is given below:



(a) 1
(b) 2
(c) 3
(d) cannot be fixed

Q3. If a pair of equation is inconsistent, then the lines will be

(a) parallel
(b) always coincident
(c) always intersecting
(d) intersecting or coincident

Q4. Rs. 4900 were divided among 150 children. If each girl gets Rs. 50 and a boy gets Rs. 25, then the number of boys is:
(a) 100
(b) 102
(c) 104
(d) 105

Q5. The quadratic equation with real coefficient whose one root is $2+\sqrt{3}$ is :
(a) $x^2-2x+1=0$
(b) $x^2-4x+1=0$
(c) $x^2-4x+3=0$
(d) $x^2-4x+4=0$

Q6. Divide 12 into two parts such that their product is 32.
(a) 7 and 5 ss
(b) 8 and 4
(c) 10 and 2
(d) none of these

Q7. Write the next term of the AP $\sqrt{8}, \sqrt{18}, \sqrt{32}, \ldots$
(a) $\sqrt{50}$
(b) $\sqrt{64}$
(c) $\sqrt{36}$
(d) $\sqrt{72}$

Q8. All squares are _____
(a)Congruent
(b)Similar
(c)Not similar
(d)None of these

Q9. The diagonals of a rhombus are 16 cm and 12 cm, in length. The side of the rhombus in length is:
(a) 20 cm
(b) 8 cm
(c) 10 cm
(d) 9 cm

Q10. The Shortest distance of the point (h , k) from x – axis is
(a)h
(b)k
(c)|h|
(d)|k|

Q11. If $\sin(A-B)=\frac{1}{2}$ and $\cos(A+B)=\frac{1}{2}$, then the value of A and B , respectively are
(a)$45° and\ 15°$
(b)$30° and\ 15°$
(c)$45° and\ 30°$
(d)None of these

Q12. Maximum value of $\frac{1}{cosec\,\theta}$, $0°<\theta<90°$

(a)1
(b)-1
(c)2
(d)$\frac{1}{2}$

Q13. The ratio of the length of a rod and its shadow is 1: $\sqrt{3}$. The angle of elevation of the sun is
(a) $30°$
(b) $60°$
(c) $45°$
(d) none of these

Q14. In a circle with centre O, AB and CD are two diameters perpendicular to each other. The length of chord AC is
(a)2AB
(b)$\sqrt{2}AB$
(c)$\frac{1}{2}AB$
(d)$\frac{1}{\sqrt{2}}AB$

Q15. A pendulum swings through an angle of 30° and describes an arc 8.8 cm in length. Find the length of the pendulum.
(a) 16 cm
(b) 16.5 cm
(c) 16.8 cm
(d) 17 cm

Q16. A solid sphere of radius r cm is melted and recast into the shape of a solid cone of height r. Then the radius of the base of cone is
(a) 2r
(b) r
(c) 4r
(d) 3r

Q17. In a bag, there are 100 bulbs out of which 30 are bad ones. A bulb is taken out of the bag at random. The probability of the selected bulb to be good is
(a) 0.50
(b) 0.70
(c) 0.30
(d) None of these

Q18. Which measure of central tendency is given by the x — coordinate of the point of intersection of the more than ogive and less than ogive?
(a) mode
(b) median
(c) mean
(d) all the above three measures

DIRECTION: In the question number 19 and 20, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct option

Q19. **Assertion(A):** In a circle of radius 6 cm, the angle of a sector is 60°. Then the area of the sector is 132/7 cm^2.
Reason(R): Area of sector of the circle = $\frac{\theta}{360°} \times \pi r^2$

(a) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion
(b) Both Assertion and Reason are correct and Reason is not the correct explanation for Assertion.
(c) assertion is true but the reason is false.
(d) both assertion and reason are false.

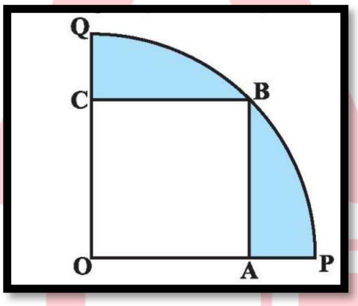
Q20. **Assertion(A):** If the circumference of a circle is 176 cm, then its radius is 28 cm.
Reason(R): Circumference = 2π × radius.
(a) both Assertion and reason are correct and reason is correct explanation for assertion
(b) both Assertion and reason are correct but reason is not correct explanation for Assertion
(c) Assertion is correct but reason is false
(d) both Assertion and reason are false.

SECTION - B

Section B consists of 5 questions of 2 marks each

Q21. A cone of height 24 cm and radius of base 6 cm is made up of modeling clay. A child reshapes it in the form of a sphere. Find the radius of the sphere.

Q22. In fig . a square OABC is inscribed in a quadrant OPBQ . If OA = 20 cm , find the area of the shaded region (Use $\pi = 3.14$)



Q23. If $cosec\ \theta = 2$, show that $\left\{\cot\theta + \frac{\sin\theta}{1+\cos\theta}\right\} = 2$

Q24. Find the ratio in which the point P(-6, a) divides the join of A(-3, -1) and B(-8, 9). Also, find the value of a.

Or

Diagonals of a trapezium ABCD with AB II CD intersects at 0. If AB = 2CD, find the ratio of areas of triangles AOB and COD.

Q25. If the sum of first 7 terms of an AP is 49 and that of 17 terms is 289 , find the sum of first n terms.

Or

Which term of the AP 3 , 8 , 13 , 18 , … is 88 ?

SECTION C

Section C consists of 6 questions of 3 marks each

Q26. Find the value of m so that m + 2, 4m - 6 and 3m - 2 are three consecutive terms of an AP.

Q27. Find the value of k for which the quadratic equation (k + 1)x^2 — 2(k — 1)x + 1 = 0 has real and equal roots.

Q28. A boat covers 32 km upstream and 36 km downstream in 7 hours. In 9 hours, it can cover 40 km upstream and 48 km downstream. Find the speed of the stream and that of the boat in still water.

Or

In a given fraction, if the numerator is multiplied by 2 and the denominator is reduced by 5, we get $\frac{6}{5}$. But if the numerator of the given fraction is increased by 8 and the denominator is doubled, we get $\frac{2}{5}$. Find the fraction.

Q29. Prove that : $\sqrt{\frac{\sec A-1}{\sec A+1}}+\sqrt{\frac{\sec A+1}{\sec A-1}}=2\ cosec\ A$

Q30. The sum of first 9 terms of an AP is 81 and the sum of its firdt 20 terms is 400 . Find the first term and the common difference of the AP.

Or

Which term of the AP 3, 8, 13, 18, ... will be 55 more than its 20th term?

Q31. The product of Archana's age five years ago with her age 8 years later is 30 in years. Find her present age.

SECTION D

Section D consists of 4 questions of 5 marks each

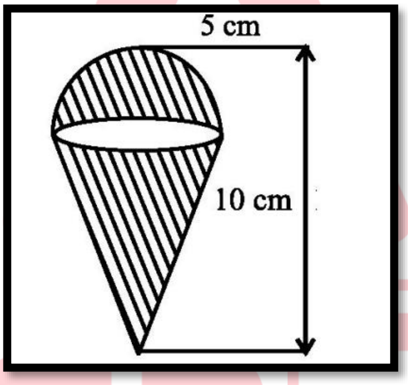
Q32. Weekly income of 600 families is as under :

Income(in Rs.)	0-1000	1000-2000	2000-3000	3000-4000	4000-5000	5000-6000
No. of Families	250	190	100	40	15	5

Compute the median income .

Or

An ice creame cone full of ice ccream having radius 5 cm and height 10 cm as shown in the below fig .Calculate the volume of ice cream , provided that its $\frac{1}{6}$ part is left unfilled with ice cream .



Q33. A box contains 25 cards numbered from 1 to 25. A card is drawn from the box at random. Find the probability of getting the card with

a). a two-digit number

b). a perfect square number

c). a number divisible by 5.

d). a number divisible by 2 or 3.

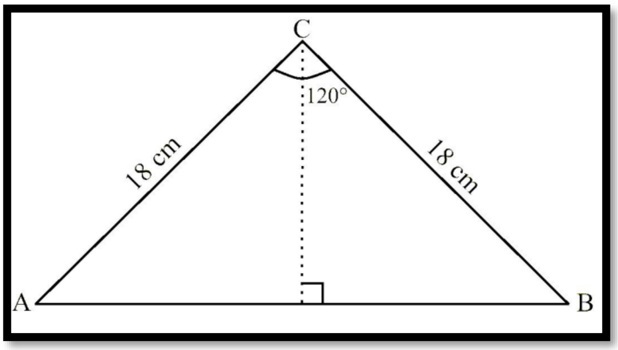
e). a number divisible by 2 and 3.

Or

Find the mean and median for the following frequency distribution.

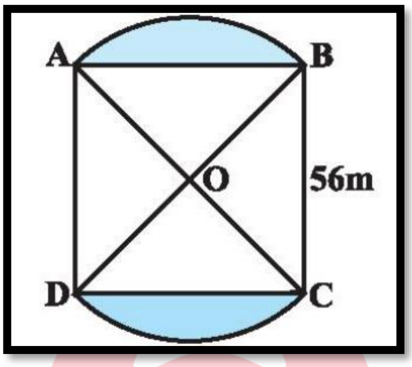
Class	500-520	520-540	540-560	560-580	580-600	600-620
Frequency	14	9	5	4	3	5

Q34. Find the area of Δ CAB with $\angle ACB = 120°$ and CA = CB = 18 cm



Or

In Fig, two circular flower beds have been shown on two sides of a square lawn ABCD of side 56 m. If the centre of each circular flower bed is the point of intersection O of the diagonals of the square lawn, find the sum of the areas of the lawn and the flower beds.



Q35. A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle 30° with it. The distance between the foot of the tree to the point where the top touches the ground is 8 m. Find the height of the tree.

SECTION E

Case study based questions are compulsory

Q36. The below picture are few natural examples of parabolic shape which is represented by a quadratic polynomial. A parabolic arch is an arch in the shape of a parabola. In structures, their curve represents an efficient method of load, and so can be found in bridges and in architecture in a variety of forms.

(i) In the standard form of quadratic polynomial, $ax^2 + bx + c$, a, b and c are

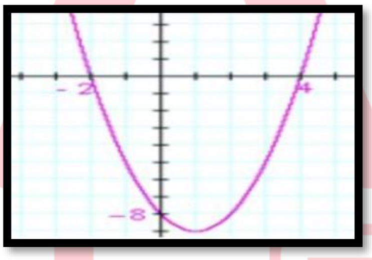
(ii)If the roots of the quadratic polynomial are equal, where the discriminant D = $b^2 - 4ac$, then

(iii) If α and 1/α are the zeroes of the quadratic polynomial $2x^2$ – x + 8k, then k is

Or

An asana is a body posture, originally and still a general term for a sitting meditation pose, and later extended in hatha yoga and modern yoga as exercise, to any type of pose or position, adding reclining, standing, inverted, twisting, and balancing poses. In the figure, one can observe that poses can be related to representation of quadratic polynomial.

(i)The shape of the poses shown is
(ii)The graph of parabola opens downwards, if _______
(iii)In the graph, how many zeroes are there for the polynomial?

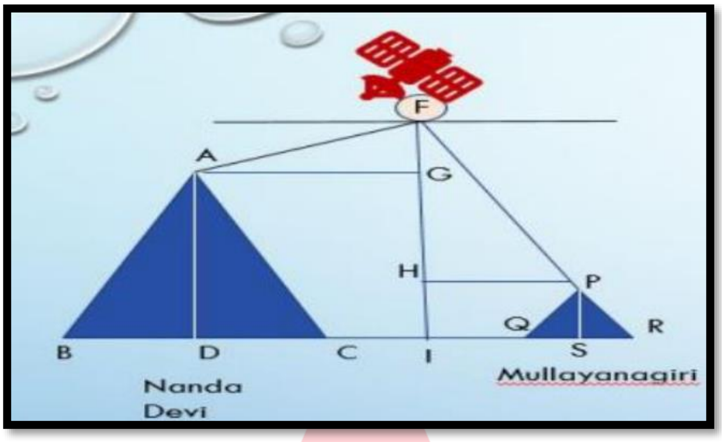


Q37. A group of students of class X visited India Gate on an education trip. The teacher and students had interest in history as well. The teacher narrated that India Gate, official name Delhi Memorial, originally called All-India War Memorial, monumental sandstone arch in New Delhi, dedicated to the troops of British India who died in wars fought between 1914 and 1919. The teacher also said that India Gate, which is located at the eastern end of the Rajpath (formerly called the Kingsway), is about 138 feet (42 metres) in height.

(i)What is the angle of elevation if they are standing at a distance of 42m away from the monument?
(ii)They want to see the tower at an angle of 60°. So, they want to know the distance where they should stand and hence find the distance.
(iii)If the altitude of the Sun is at 60°, then the height of the vertical tower that will cast a shadow of length 20 m is

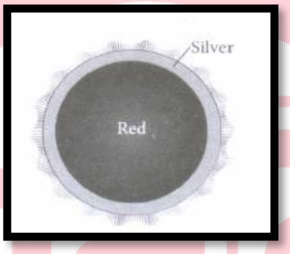
Or

A Satellite flying at height h is watching the top of the two tallest mountains in Uttarakhand and Karnataka, them being Nanda Devi(height 7,816m) and Mullayanagiri (height 1,930 m). The angles of depression from the satellite, to the top of Nanda Devi and Mullayanagiri are 30° and 60° respectively. If the distance between the peaks of the two mountains is 1937 km, and the satellite is vertically above the midpoint of the distance between the two mountains.



(i) The distance of the satellite from the top of Nanda Devi is
(ii)The distance of the satellite from the top of Mullayanagiri is
(iii)The distance of the satellite from the ground is

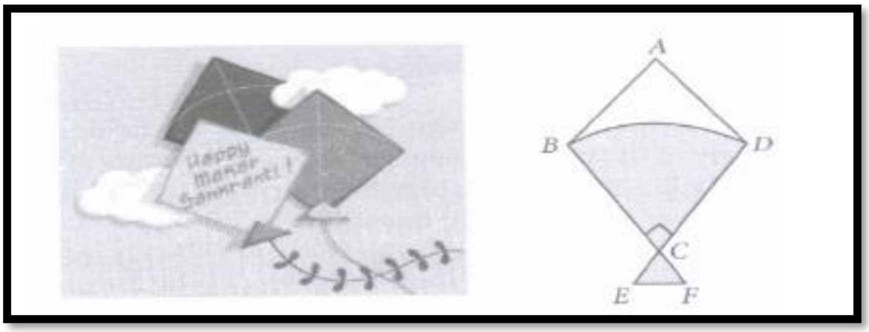
Q38. Principle of a school decided to give badges to students who are chosen for the post of Head boy, Head girl, Prefect and Vice Prefect. Badges are circular in shape with two colour area, red and silver, as shown in figure. The diameter of the region representing red colour is 22 cm and silver colour is filled in 10.5 ern wide ring. Based on the above information, answer the following questions.



(i)The radius of circle representing the red region is
(ii)Find the area of the red region.
(iii) Find the radius of the circle formed by combining the red and silver region.

Or

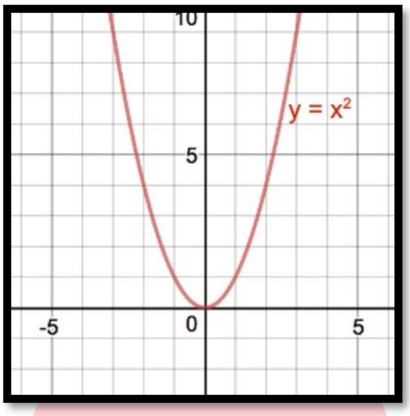
Makar Sankranti is a fun and delightful occasion. Like many other festivals, the kite flying competition also has a historical and cultural significance attached to it. The following figure shows a kite in which BCD is the shape of quadrant of a circle of radius 42 cm, ABCD is a square and Δ CEF is an isosceles right angled triangle whose equal sides are 7 cm long.



Based on the above information , answer the following questions.
(i)Find the area of the square
(ii)Area of quadrant BCD is
(iii)Find the area of Δ CEF

Solutions :
S1. Ans.(c)
Sol. If $m^n = 32$ where m and n are positive integers, then the value of $(n)^{mn}$ is:
$2^5 = 32$
m = 2 , n = 5
Then the value of $(n)^{mn} = (5)^{2\times5} = 5^{10}$

S2. Ans. (b)
Sol.



Polynomial $y = x^2$ then degree of polynomial is 2

S3. Ans. (a)
Sol. A pair of linear equations is called inconsistent when the lines doesn't have any solution. It means both the lines are parallel to each other.

S4. Ans. (c)
Sol. Given: Amount divided among children = Rs. 4,900
Total number of children = 150
Amount each girl got = Rs. 50
Amount each boy got = Rs. 25
To find: Number of boys and girls
Let: Number of girls be x and number of boys be y
Solution: According to the given question,
x+ $y = 150$ ....(1)
also, each girl gets Rs. 50 and each boy gets Rs. 25
i.e.$50x + 25y = 4{,}900$ OR $2x + y = 196$ ... (2)
Solving the equations using substitution method:
Putting $x = 150 - y$ from equation (1) in equation (2)
$\Rightarrow 2(150 - y) + y = 196$
$\Rightarrow 300 - 2y + y = 196$
$\Rightarrow y = 300 - 196 = 104$
Putting $y = 104$ in equation (1)
$\Rightarrow x + 104 = 150$
$\Rightarrow x = 150 - 104 = 46$
Hence, number of girls x is 46 and number of boys y is 104.

S5. Ans. (b)
Sol. The quadratic equation with real coefficient whose one root is $2+\sqrt{3}$ then other root is $2-\sqrt{3}$
$\Rightarrow \left(x-(2+\sqrt{3})\right)\left(x-(2-\sqrt{3})\right)=0$
$\Rightarrow x^2-(2-\sqrt{3})x-(2+\sqrt{3})x+(2+\sqrt{3})(2-\sqrt{3})=0$
$\Rightarrow x^2-2x+\sqrt{3}x-2x-\sqrt{3}x+4-3=0$
$\Rightarrow x^2-4x+1=0$

S6. Ans. (b)
Sol. We have,
Let the two number is x and y.
So,
x + y=12......(1)
Now, According to given question,
x.y = 32
y = $\frac{32}{x}$......(2)

From equation (1) and (2) to, and we get,
$\Rightarrow x^2+32=12x$
$\Rightarrow x^2-12x+32=0$
$\Rightarrow x^2-(8+4)x+32=0$
$\Rightarrow x^2-8x-4x+32=0$
⇒x(x−8)−4(x−8)=0
⇒(x−8)(x−4)=0
If, x – 8 = 0, x = 8
If, x – 4 = 0, x = 4
So,
From (1) to,
x + y = 12
⇒8 + y = 12
⇒y = 4
Hence, the number is 8 and 4.

S7. Ans. (a)
Sol. Given AP is √8, √18, √32,........
Above AP can be written as: 2√2 , 3√2, 4 √2, ...
Here a = 2√2 and d = √2
Next term = 4√2 + √2 = 5√2 = √50

S8. Ans. (b)
Sol. All squares are similar. Two figures can be said to be similar when they are having the same shape but it is not always necessary to have the same size. Yes, we can say that all squares are equal. The size of every square may not be the same or equal but the ratios of their corresponding sides or the corresponding parts are always equal. All the angles of each square are 90 degrees.

S9. Ans.
Sol. Here, half of the diagonals of a rhombus are the sides of the triangle and side of the rhombus is the hypotenuse.
By Pythagoras theorem,
$\left(\frac{16}{2}\right)^2+\left(\frac{12}{2}\right)^2=side^2$
$8^2+6^2=side^2$
$64+36=side^2$

Side =10 cm

S10. Ans. (d)
Sol. Given the point is (h, k).
Now foot of the perpendicular
from (h, k) on x-axis is (h,0)
Now the shortest distance between (h, k) and (h,0)
$= \sqrt{(h-h)^2 + (k-0)^2} = \sqrt{k^2} = |k|$

S11. Ans. (a)
Sol. If $\sin(A-B) = \frac{1}{2}$ and $\cos(A+B) = \frac{1}{2}$, then the value of A and B, respectively are
$\Rightarrow \sin(A-B) = \frac{1}{2}$
$\Rightarrow \sin(A-B) = \sin 30°$
$\Rightarrow A-B = 30°$ ....(i)
$\Rightarrow \cos(A+B) = \frac{1}{2}$
$\Rightarrow \cos(A+B) = \cos 60°$
$\Rightarrow A+B = 60°$ ....(ii)
From (i) and (ii)
$A = 45°, B = 15°$

S12. Ans. (a)
Sol. 1 is maximum value of θ because $\frac{1}{cosec\ \theta} = \sin\theta$
As we know that , maximum value of $sin\ \theta$ is 1

S13. Ans. (b)
Sol. Here, AB = Length of rod BC = Length of shadow. So 1 : 1/√3 = AB/BC √3 = AB/BC We know that AB/BC = tan θ So, tan θ = √3 tan θ = tan 60° θ = 60°

S14. Ans. (d)
Sol. Step-by-step explanation:
Given data Diameter of circle is AB and CD
So , Radius of circle (R) $= \frac{AB}{2}$
It is given that AB and CD is perpendicular to each other and intersect at point O.
So Δ OAC is right angle triangle.
Where , Two side of Δ OAC is radius of circle
∠O = 90°
AC will be hypotenuse of Δ OAC
From Pythagoras rule's
$(Hypotenuse)^2 = (Radius)^2 + (Radius)^2$
$AC^2 = R^2 + R^2$
$AC^2 = 2R^2$
$AC^2 = 2\left(\frac{AB}{2}\right)^2$
So , $AC = \frac{AB}{\sqrt{2}}$

S15. Ans. (c)
Sol. Here, θ = 30°
l = arc = 8.8 cm
l = $\frac{\theta}{360°} \times 2\pi r$

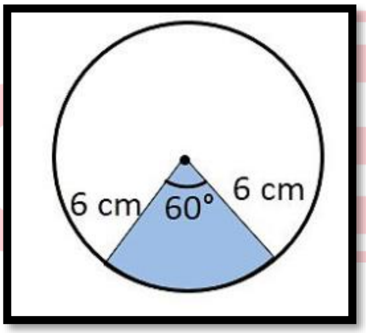
$8.8 = \frac{60°}{360°} \times 2 \times \frac{22}{7} \times r$
r = $\frac{8.8 \times 6 \times 7}{22 \times 2}$ = 16.8 cm

S16. Ans. (a)
Sol. In the given problem , we have a solid sphere which is remolded into a solid cone such that the radius of the sphere is equal to the height of the cone .We need to find the radius of the base of the cone.
Here , radius of the solid sphere $(r_s) = r$ cm
Height of the solid cone (h) = r cm
Let the radius of the base of cone $(r_c) = x$ cm
So, the volume of cone will be equal to the volume of the solid sphere.
Therefore , we get
$\frac{1}{3}\pi r_c^2 h = \frac{4}{3}\pi r_s^3$
$\frac{1}{3}\pi x^2 r = \frac{4}{3}\pi r^3$
$x^2 = 4r^2$
$x = \sqrt{4r^2}$
$x = 2r$
Therefore , radius of the base of the cone is 2r.

S17. Ans. (b)
Sol. No. of good bulbs = 100 - 30 = 70
Probability = 70/100 = 7/10

S18. Ans. (b)
Sol. MEDIAN is the central tendency given by the x-coordinate of the point of intersection of the 'more than' ogive and 'less than' ogive.

S19. Ans. (a)
Sol.



Assertion(A): In a circle of radius 6 cm, the angle of a sector is 60°. Then the area of the sector is 132/7 cm^2.
Given that , Radius = r = 6 cm
And angle of the sector = $\theta = 60°$
We know that , Area of sector of the circle = $\frac{\theta}{360°} \times \pi r^2$

$$= \frac{60}{360} \times \frac{22}{7} \times 6 \times 6$$
$$= \frac{132}{7}\ cm^2$$

A is true
Reason(R): Area of sector of the circle = $\frac{\theta}{360°} \times \pi r^2$
R is true

Therefore , Both Assertion and Reason are correct and Reason is the correct explanation for Assertion

S20. Ans. (a)
Sol. Assertion(A): If the circumference of a circle is 176 cm, then its radius is 28 cm.
Circumference =176 cm
2πr=176
r = $\frac{176}{2\pi} = \frac{176\times7}{2\times22}$ = 28 cm
∴ radius =28cm
A is true.

Reason(R): Circumference = 2π × radius.
R is true.
both Assertion and reason are correct and reason is correct explanation for assertion

SECTION - B

Section B consists of 5 questions of 2 marks each
S21. Ans.
Sol.
A cone has been reshaped in the sphere
Height of cone is 24 cm and the radius of the base is 6 cm
Volume of sphere = volume of cone
Volume of cone = $\frac{1}{3}\pi r^2 h$
Plugging the values in the formula we get
Volume of cone = $\frac{1}{3}\pi r^2 h$
Plugging the values in the formula we get
Volume of cone = $\frac{1}{3}\pi(6)^2(24) = 288\pi\ cm^3$
Let the radius of sphere be r
Volume of sphere = $\frac{4}{3}\pi r^3$
Since , the volume of cone = volume of sphere
Volume of sphere = $288\pi\ cm^3$
So , $288\pi = \frac{4}{3}\pi r^3$
$\Rightarrow 288 = \frac{4}{3}r^3$
$\Rightarrow r^3 = 216$
$\Rightarrow r = 6\ cm$
Hence , radius of reshaped sphere is 6 cm.

S22. Ans.
Sol. Area of shaded region = Area of quadrant OPBQ – Area of square OABC
Area of square
Side of square = 20 cm
Area of square = $(side)^2$
$= 20^2$
$= 20 \times 20$
$= 400\ cm^2$
Area of quadrant
We need to find radius
Joining OB
Also , all angles of square are 90°
$\therefore \angle BAO = 90°$

Hence , $\Delta\ OBA$ is a right angled triangle
Using Pythagoras theorem in $\Delta\ OBA$
$(Hypotenuse)^2 = (Height)^2 + (Base)^2$
$(OB)^2 = (AB)^2 + (OA)^2$
$(OB)^2 = 20^2 + 20^2$
$(OB)^2 = 400 + 400$
$(OB)^2 = 800$
$OB = 20\sqrt{2}$ cm
Now area of quadrant = $\frac{1}{4} \times area\ of\ circle$
$= \frac{1}{4} \times 3.14 \times \left(20\sqrt{2}\right)^2$
$= \frac{1}{4} \times 3.14 \times 800$
$= 628\ cm^2$
Now , area of shaded region = 628 – 400 = 228 cm^2

S23. Ans.
Sol.

If $cosec\ \theta = 2$,
To prove : $\left\{\cot\theta + \frac{\sin\theta}{1+\cos\theta}\right\} = 2$
Proof : If $cosec\ \theta = 2$, $\sin\ \theta\ = \frac{1}{2}$
By pyathagoras theorem :
$(Hypotenuse)^2 = (perpendicular)^2 + (Base)^2$
$(2)^2 = 1^2 + b^2$
$b = \sqrt{4-1} = \sqrt{3}$
$\cos\theta = \frac{\sqrt{3}}{2}$, $\cot\theta = \sqrt{3}$
Now , $\cot\theta + \frac{\sin\theta}{1+\cos\theta} = \sqrt{3} + \frac{\frac{1}{2}}{1+\frac{\sqrt{3}}{2}} = \sqrt{3} + \frac{1}{2+\sqrt{3}} = \frac{\sqrt{3}(2+\sqrt{3})+1}{2+\sqrt{3}} = \frac{2\sqrt{3}+3+1}{2+\sqrt{3}} = \frac{2\sqrt{3}+4}{2+\sqrt{3}} = 2$
Hence proved.

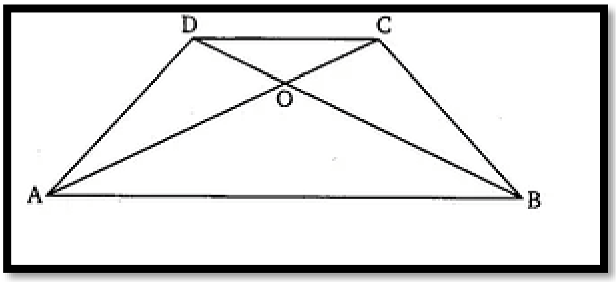
S24. Ans.
Sol.

Let P(-6, A) Divide AB in ratio K:1. K:1 Here, m_1 = K and m_2 = 1 And,
A (-3 , -1) and B (-8 , 9) Here, x_1 = -3 , y_1 = -1 and x_2 = -8 , y_2 = 9 Then , By sectional formula , the coordinates of P are :
$P\left(\frac{m_1x_2+m_2x_1}{m_1+m_2}, \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$
$P\left(\frac{K(-8)+1(-3)}{K+1}, \frac{K(9)+1(-1)}{K+1}\right)$
$P\left(\frac{-8K-3}{K+1}, \frac{9K-1}{k+1}\right)$
But the coordinates of point P is P(-6, a) Therefore, $\frac{-8K-3}{K+1} = -6$, $\frac{9K-1}{k+1} = a \Rightarrow -8K - 3 = -6(K+1)$
$\Rightarrow -8K - 3 + 6K + 6 = 0$
$\Rightarrow -2K + 3 = 0$
$\Rightarrow K = \frac{3}{2}$
Hence, required ratio is 3:2.
$\Rightarrow \frac{9K-1}{k+1} = a$

$\Rightarrow a = \frac{9\times\frac{3}{2}-1}{\frac{3}{2}+1} = \frac{\frac{27}{2}-1}{\frac{5}{2}} = \frac{25}{5} = 5$

Or

The ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides.
Let's construct a diagram according to the given question.



In trapezium ABCD,
AB is parallel to CD and AB = 2 CD ---------- (1)
Diagonals AC and BD intersect at 'O'
In ΔAOB and ΔCOD,
∠AOB = ∠COD (vertically opposite angles)
∠ABO = ∠CDO (alternate interior angles)
⇒ ΔAOB ~ ΔCOD (AA criterion)
⇒ Area of ΔAOB / Area of ΔCOD = $\frac{AB^2}{CD^2}$
$\frac{(2CD)^2}{(CD)^2} = \frac{4}{1}$ [From equation (1)]
Thus, Area of ΔAOB : Area of ΔCOD = 4:1

S25. Ans.
Sol. Sum of the first n terms of an AP is given by S_n = n/2 [2a + (n - 1) d] or S_n = n/2 [a + l], and the nth term of an AP is a_n = a + (n - 1)d
Here, a is the first term, d is the common difference and n is the number of terms and l is the last term.
Given,
Sum of first 7 terms, S_7 = 49
Sum of first 17 terms, S_{17} = 289
We know that sum of n terms of AP is S_n = n/2 [2a + (n - 1) d]
S_7 = 7/2 [2a + (7 - 1)d]
49 = 7/2 [2a + 6d]
a + 3d = 7 ... (i)
S_{17} = 17/2 [2a + (17 - 1) d]
289 = 17/2 [2a + 16d]
a + 8d = 17 ... (ii)
Subtracting equation (i) from equation (ii),
a + 8d - (a + 3d) = 17 - 7
5d = 10
d = 2
From equation (i),
7 = a + 3 × 2
7 = a + 6
a = 1
S_n = n/2 [2a + (n - 1) d]
= n/2 [2 × 1 + (n - 1) 2]
= n/2 [2 + 2n - 2]
= n/2 × 2n
= n^2

Or

Which term of the AP 3 , 8 , 13 , 18 , ... is 88
nth term of a A.P.
$a_n = a + (n - 1)d$
$88 = 3 + (n - 1)(5)$
$88 = 3 + 5n - 5$
$88 = -2 + 5n$
$5n = 90$
$n = 18$

SECTION C

Section C consists of 6 questions of 3 marks each

S26. Ans.

Sol. Here a_1 = m+2 a_2 = 4m-6 a_3 = 3m – 2 Now .we know that in consecutive ap $a_2 - a_1 = a_3 - a_2$ so, 4m - 6 – m - 2 = 3m – 2 - 4m + 6 3m – 8 = 4 – m 3m + m = 4 + 8 4m=12 m = 3

S27. Ans.

Sol. Let D be the discriminant of the given equation
We have a = k + 4,b = k +1,c = 1
∴D = $b^2 - 4ac = (k + 1)^2 - 4(k + 4)$
⇒D = k^2 – 2k – 15 = (k–5)(k+3)
If the roots of the given equation are real, then
D = (k – 5)(k + 3) = 0
⇒k = 5,–3

S28. Ans.

Sol. Let the speed of the boat in still water be x km/hr and the speed of the stream but y km/hr.
Then,
Speed upstream =(x – y)km/hr
Speed downstream =(x + y) km/hr
Now, Time taken to cover 32km upstream = $\frac{32}{x-y}$ hrs
Time taken to cover 36 km downstream = $\frac{36}{x+y}$ hrs
But, total time of journey is 7 hours.
∴$\frac{32}{x-y} + \frac{36}{x+y}$ =7 ..(i)
Time taken to cover 40km upstream = $\frac{40}{x-y}$

Time taken to cover 48 km downstream = $\frac{48}{x+y}$

In this case, total time of journey is given to be 9 hours.

∴$\frac{40}{x-y} + \frac{48}{x+y}$ =9..... (ii)

Putting $\frac{1}{x-y} = u$ and $\frac{1}{x+y} = v$ in equations (i) and (ii), we get
⇒32u+36v=7
⇒32u–36v–7=0 ..(iii)
⇒ 40u+48v=9
⇒40u–48v–9=0 ..(iv)
Solving these equations (iii) ,(iv) ,we get

$\Rightarrow u = \frac{1}{8}$ and $v = \frac{1}{12}$
Now, $u = \frac{1}{8}$
$\Rightarrow \frac{1}{x-y} = \frac{1}{8}$
$\Rightarrow x - y = 8$ ..(v)
and, $v = \frac{1}{12}$
$\Rightarrow \frac{1}{x+y} = \frac{1}{12}$
$\Rightarrow x + y = 12$ ..(vi)
Solving equations (v) and (vi), we get x=10 and y=2
Hence, Speed of the boat in still water =10 km/hr
and Speed of the stream =2km/hr.

Or

Let the numerator be 'a' and denominator be 'b' Given,
If the numerator of a fraction is multiplied by 2 and the denominator is reduced by 5 the fraction becomes 6/5
$\Rightarrow \frac{2a}{b-5} = \frac{6}{5}$
$\Rightarrow 10a = 6b - 30$
$\Rightarrow 5a = 3b - 15$ ---------- (1)
Also, If the denominator is doubled and the numerator is increased by 8, the fraction becomes 2/5
$\Rightarrow \frac{a+8}{2b} = \frac{2}{5}$
$\Rightarrow 5a + 40 = 4b$ -------- (2)
Subtracting eq2 from eq1
$\Rightarrow 5a - 5a - 40 = 3b - 15 - 4b$
$\Rightarrow b = 25$
Thus, $5a = 75 - 15 \Rightarrow a = 12$
Fraction is 12/25

S29. Ans.

Sol. To prove : $\sqrt{\frac{\sec A-1}{\sec A+1}} + \sqrt{\frac{\sec A+1}{\sec A-1}} = 2\ cosec\ A$

Take L.H.S

$\sqrt{\frac{\sec A-1}{\sec A+1}} + \sqrt{\frac{\sec A+1}{\sec A-1}}$

Take L.C.M to the denominator

$= \frac{(\sqrt{\sec A-1})(\sqrt{\sec A-1}) + (\sqrt{\sec A+1})(\sqrt{\sec A+1})}{(\sqrt{\sec A+1})(\sqrt{\sec A-1})}$

$= \frac{(\sqrt{\sec A+1})^2 + (\sqrt{\sec A-1})^2}{(\sqrt{\sec A+1})(\sqrt{\sec A-1})}$

Applying (a+ b)(a-b) formula to the denominator
$(a+b)(a-b) = a^2-b^2$

$= \frac{\sec A+1 \sec A-1}{\sqrt{(\sec A)^2-1^2}}$

$= \frac{2\sec A}{\sqrt{(\sec A)^2-1^2}}$

We know that from Trigonometric identities ,
$\sec^2 A - \tan^2 A = 1$
$\sec^2 A - 1 = \tan^2 A$

$= \frac{2\sec A}{\sqrt{\tan^2 A}}$

$= \frac{2\sec A}{\tan A}$

From trigonometric relations ,

Sec A = 1/cos A
tan A = sin A/cos A

$= \frac{\frac{2}{\cos A}}{\frac{\sin A}{\cos A}}$

$= \frac{2}{\sin A} = 2cosec\ A$

From trigonometric relations ,
Sin A = 1/csc A
$= 2cosec\ A$
Hence proved

S30. Ans.

Sol. As we know the formula of sum of an A.P is $S_n = \frac{n}{2}(2a + (n-1)d)$
where n is the number of terms, a is the first term and d is the common difference.
And it is given that the sum of the first 9 terms of an A.P is 81.
$\Rightarrow S_9 = \frac{9}{2}(2a + (9-1)d)$
$\Rightarrow 81 = \frac{9}{2}\ (2a + (9-1)d)$
Now simplify the above equation we have, ⇒2a+8d=18…………………. (1) Now it is also given that the sum of the first 20 terms of an A.P is 400.
$\Rightarrow S_{20} = 400 = \frac{20}{2}\ (2a + (20-1)d)$
Now simplify the above equation we have ,
$\Rightarrow 2a\ + 19d = 40$ ……..(2)
Now subtract equation (2) from equation (1) we have ,
$\Rightarrow 2a\ + 19d - 2a - 8d = 40 - 18$
$\Rightarrow 11d = 22$
$\Rightarrow d = 2$
Now substitute this value in equation (1) we have ,
$\Rightarrow 2a + 8(2) = 18$
$\Rightarrow 2a = 18 - 16 = 2$
$\Rightarrow a = 1$

Or

The given AP is
3,8,13,18….
Here first term is 3 and the common difference is
$d = 8 - 3 = 5$
The nth term of an AP is
$a_n = a + (n-1)d$
$a_{20} = 3 + (20-1)5$
$a_{20} = 3 + 18 \times 5$
$a_{20} = 98$
The 20th term of AP is 98.
55 more than its 20th term is
$a_{20} + 55 = 98 + 55 = 153$
Now, calculate which term of the AP is 153.
$153\ = 3 + (n-1)5$
$153 - 3 = (n-1)5$
$n = 31$
Therefore, 31th term is 55 more than its 20th term.

S31. Ans.

Sol. present age be x
age of Archana 5 years later be x+5

age of Archana 8 years ago be x-8
now the product is 30
so
(x + 5)(x -8) = 30
x^2 - 8x + 5x – 40 =30
x^2 - 3x – 70 = 0
x^2 - 10x + 7x – 70 = 0
x(x - 10) + 7(x - 10) = 0
(x + 7)(x - 10) = 0
x = 10
Now , her present age = 10 years

SECTION D

Section D consists of 4 questions of 5 marks each

S32. Ans.

Sol. Given, the weekly income of 600 families.
We have to find the median income.

Weekly income (in Rs)	Number of families (f)	Cumulative frequency (cf)
0 - 1000	250	250
1000 - 2000	190	250 + 190 = 440
2000 - 3000	100	440 + 100 = 540
3000 - 4000	40	540 + 40 = 580
4000 - 5000	15	580 + 15 = 595
5000 - 6000	5	595 + 5 = 600

Median = l + [(n/2 - cf)/f]h
Where, l is lower limit of the median class
n is the number of observations
h is the class size
cf is the cumulative frequency of the class preceding the median class
f is the frequency of the median class
From the table,
n/2 = 600/2 = 300
The observation lies in the class 1000 - 2000
Lower limit of the class, l = 1000
Class size, h = 1000
Cumulative frequency of the class preceding the median class, cf = 250
Frequency of the median class, f = 190
Median = 1000 + [(300 - 250)/190](1000)
= 1000 + [(50/190)(1000)]

= 1000 + [5(1000)/19]
= 1000 + 263.15
= 1263.15
Therefore, the median is 1263.15

Or

Volume of ice cream = Volume of hemisphere + Volume of cone $= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$
Radius of hemisphere = Radius of cone Since height of hemisphere is 5 cm, then height of cone will be 10 – 5 = 5cm ∴ Volume of ice cream = $\frac{2}{3}\pi(5)^3 + \frac{1}{3}\pi(5)^2 \times 5$ =125π=392.85 $\frac{1}{6}th$ of ice cream= $\frac{392.85}{6} = 65.475$
Volume of required portion of ice cream = 392.85 − 65.47=327.375 cm^3

S33. Ans.
Sol. A box contains 25 cards numbered from 1 to 25. A card is drawn from the box at random. Find the probability of getting the card with
(a) a two-digit number
Total possible outcomes n(S) = 25
Total favourable outcomes n(E) (10 ,11 , 12 , ... , 25) = 16
Probability = P(E) = $\frac{n(E)}{n(S)} = \frac{16}{25}$
(b) a perfect square number
Total possible outcomes n(S) = 25
Total favourable outcomes n(E) (1 , 4 , 9 , 16 ,25) = 5
Probability = P(E) = $\frac{n(E)}{n(S)} = \frac{5}{25} = \frac{1}{5}$
(c) a number divisible by 5.
Total possible outcomes n(S) = 25
Total favourable outcomes n(E) (5 , 10 , 15 , 20 ,25) = 5
Probability = P(E) = $\frac{n(E)}{n(S)} = \frac{5}{25} = \frac{1}{5}$
(d) a number divisible by 2 or 3.
Total possible outcomes n(S) = 25
Total favourable outcomes n(E) (2 , 3 ,4 , 6 ,8 ,9 ,10 , 12 , 14 , 15 , 16 , 18 , 20 , 21 , 22 , 24) = 16
Probability = P(E) = $\frac{n(E)}{n(S)} = \frac{16}{25}$
(e) a number divisible by 2 and 3.
Total possible outcomes n(S) = 25
Total favourable outcomes n(E) (6 ,12 , 18 , 24) = 4
Probability = P(E) = $\frac{n(E)}{n(S)} = \frac{4}{25}$

Or

Class	500-520	520-540	540-560	560-580	580-600	600-620
Frequency	14	9	5	4	3	5

Mean

Class	500 – 520	520 - 540	540 -560	560 - 580	580 - 600	600 -620	
Mid - point(x_i)	510	530	550	570	590	610	
Frequency (f_i)	14	9	5	4	3	5	$\sum f_i = 40$
$f_i x_i$	7140	4770	2750	2280	1770	3050	$\sum x_i f_i = 21760$

Mean = $\frac{\sum f_i x_i}{\sum f_i} = \frac{21760}{40} = 544$

Class	500 -520	520 - 540	540 - 560	560 - 580	580 - 600	600 - 620	
Frequency (f_i)	14	9	5	4	3	5	$\sum f_i = 40$
C.f	14	23	28	32	35	40	

Median = $l + \left\{h \times \frac{\left(\frac{N}{2} - cf\right)}{f}\right\}$

Here , $\frac{N}{2} = \frac{40}{2} = 20$

c.f is greater than 20 is 23

c.f.=c.f. of preceding class i.e 14

Median class = 520 - 540

So , $l = 540$, $h = 20, f = 9$

Median = $540 + \left\{20 \times \frac{(20-14)}{9}\right\} = 540 + \left\{20 \times \frac{6}{9}\right\} = 540 + 20 \times \frac{2}{3} = 253.33$

S34. Ans.

Sol. Let take Δ ACD and Δ ABD

$\Rightarrow AD = AD$ (common side)

$AC = AB$ (Given)

$\angle ADC = \angle ADB$ (Right angle)

So , $\Delta\, ADC \cong \Delta$ ADB

As per C.P.C.T

$\Rightarrow DC = BD$

$\Rightarrow \angle CAD = \angle BAD$

So , $\angle CAD + \angle BAD = 120°$

$\Rightarrow 2\angle CAD = 120°$

$\Rightarrow \angle CAD = \angle BAD = 60°$

In right angle triangle CAD

$\sin A = \frac{CD}{CA}$

$\sin 60° = \frac{CD}{18}$

$CD = \frac{\sqrt{3}}{2} \times 18$

$CD = 9\sqrt{3}$ cm

In right angle triangle BAD

$\cos A = \frac{AD}{BA}$

$\cos 60° = \frac{AD}{18}$

$AD = \frac{18}{2}$

$AD = 9$ cm

$CB = 2CD$

$CB = 2 \times 9\sqrt{3}$

$= 18\sqrt{3}$ cm

Area of triangle = $\frac{1}{2} \times b \times h$

$= \frac{1}{2} \times CB \times AD$

$= \frac{1}{2} \times 18\sqrt{3} \times 9$

$= 81\sqrt{3} cm^2$

Or

Radius of hemispheres = $\frac{56}{2}$ = 28 m

Area of flower beads =2× $\frac{\pi r^2}{2}$

$\pi r^2 = \frac{22}{7} \times (28)^2 = 2464$

Area of lawn = $a^2 = (56)^2 = 3136$

The sum of the areas of the lawn and the flower beds =2464 + 3136 = $5600m^2$

S35. Ans.

Sol. Let the Height of the Tree = AB + AD

and given that BD = 8 m

Now, when it breaks a part of it will remain perpendicular to the ground (AB) and remaining part (AD) will make an angle of 30° Now, in △ABD cos30° = $\frac{BD}{AD}$

$\Rightarrow BD = \frac{\sqrt{3}}{2} AD$

$\Rightarrow AD = \frac{2\times 8}{\sqrt{3}}$

also, in the same Triangle

$\tan 30° = \frac{AB}{BD}$

$\Rightarrow AB = \frac{8}{\sqrt{3}}$

∴ Height of tree = AB + AD = $(\frac{16}{\sqrt{3}} + \frac{8}{\sqrt{3}})$m = $\frac{24}{\sqrt{3}}$ m = $8\sqrt{3}$m

SECTION E

Case study based questions are compulsory

S36. Ans.

Sol. (i)For any quadratic polynomial $ax^2 + bx + c$; $a \neq 0$ and a , b , c are real numbers.

(ii) If roots are equal then D = $b^2 - 4ac = 0$

(iii)Let p(x) = $2x^2 - x + 8k$

Since α *and* $\frac{1}{\alpha}$ are the zeores of p(x)

Product of zeores = $\frac{c}{a}$

$\Rightarrow \alpha \times \frac{1}{\alpha} = \frac{8k}{2}$

$\Rightarrow 1 = \frac{8k}{2}$

$\Rightarrow k = \frac{1}{4}$

Or

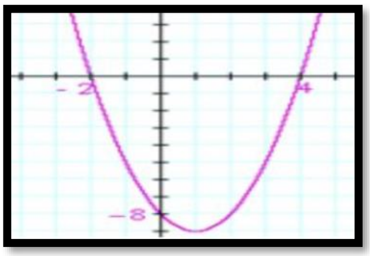
(i) The shape of the poses shown is parabola.

(ii) For a quadratic polynomial $ax^2 + bx + c$ .Here a can never be 0 .

And if $a < 0$, then graph opens downwards.

e.g . $-2x^2 + 2$

(iii)



number of times parabola intersects the x – axis
∴ Number of zeroes = 2

S37. Ans.

Sol. (i) To find the angle of elevation,

$= \tan\theta = \frac{Height\ of\ the\ tower}{Distance\ from\ the\ tower} = \frac{42}{42} = 1$

$= \tan\theta = 1$

$= \theta = \tan^{-1}(1) = 45°$

(ii) To find the distance , $\tan 60° = \frac{Height\ of\ the\ tower}{Distance} = \frac{42}{Distance}$

$$\sqrt{3} = \frac{42}{Distance}$$

$$\text{Distance} = \frac{42}{\sqrt{3}} = 24.64\ m$$

(iii)To find the height of the vertical tower , $\tan 60° = \frac{Height\ of the\ tower}{Distance}$

$$\sqrt{3} = \frac{Height\ of\ the\ tower}{20}$$

$$\text{Height of the tower} = 20\sqrt{3}\ m$$

Or

(i)
In right ΔFGA we have,
⇒ ∠F AG = 30°
⇒ AG = DI = (1937/2) km.
So,
⇒ cos 30° = AG / AF
⇒ (√3/2) = (1937/2) / AF
⇒ √3AF = (1937/2) * 2
⇒ AF = (1937/1.73) = 1139.4 km
(ii) now, In right ΔFHP we have,
⇒ ∠FPH = 60°
⇒ HP = IS = (1937/2) km.
So,
⇒ cos 60° = HP / FP
⇒ (1/2) = (1937/2) / FP
⇒ FP = (1937/2) * 2
⇒ FP = 1937 km
(iii) ⇒tan 30° = FG/AG
⇒ (1/√3) = FG/(1937/2)
⇒ √3FG = (1937/2)
⇒ FG = (1937√3/6)
⇒ FG = 569.7 km ------------------- Eqn.(1)
now,
⇒ FI = FG + GI
⇒ FI = FG + AD
putting value from Eqn.(1),
⇒ FI = 569.7 + 7816
⇒ FI = 569.7 km + 7816m
⇒ FI = 569.7 + 7.816
⇒ FI = 577.52 km

S38. Ans.

Sol. (i)Radius of circle representing red region = $\frac{22}{2} = 11\ cm$ [Since ,Diameter = 22 cm(given)]

(ii) rea of r region = $\pi r^2 = \frac{22}{7} \times 11 \times 11 = 380.28\ cm^2$

(iii) Radius of circle formed by combining red and silver region = Radius of red region + width of silver sign = (11 + 10.5) cm = 21.5 cm

Or

(i)Area of suare ABCD $= 42 \times 42 = 1764\ cm^2$

(ii) Area of quadrant BCD $= \frac{1}{4} \times \frac{22}{7} \times 42 \times 42 = 1386\ cm^2$

(iii)Area of Δ CEF $= \frac{1}{2} \times CE \times CF = \frac{1}{2} \times 7 \times 7 = 24.5\ cm^2$