CBSE Class 9 Maths Notes Chapter 6: In Chapter 6 of CBSE Class 9 Maths, we learn about "Lines and Angles." This chapter helps us understand the basics of lines and angles. We explore different types of angles like complementary, supplementary, adjacent, and vertically opposite angles.

We also learn about different kinds of lines such as parallel, perpendicular, and intersecting lines, along with their properties. Through examples and exercises, we practice solving problems related to lines and angles. This helps us become better at understanding and using geometric concepts in mathematics.

CBSE Class 9 Maths Notes Chapter 6 Lines and Angles Overview

These notes, created by the Physics Wallah team of subject experts, provide a comprehensive overview of CBSE Class 9 Maths Chapter 6, "Lines and Angles." These notes are written in simple English, they aim to make the concepts accessible and easy to understand for students. With a focus on clarity and effectiveness, these notes cover the fundamental principles of lines and angles, including types of angles, properties of lines, and their relationships.

By studying these notes, students can build a strong foundation in geometry and develop the skills needed to tackle more advanced mathematical problems.

CBSE Class 9 Maths Notes Chapter 6 PDF

The PDF linked below has easy-to-understand notes for CBSE Class 9 Maths Chapter 6, “Lines and Angles.”

By studying these notes, students can grasp the core principles of Lines and Angles and how they are applied in solving mathematical problems.

CBSE Class 9 Maths Notes Chapter 6 PDF

CBSE Class 9 Maths Notes Chapter 6 Lines and Angles

Point

- A point is a precise location in space, often represented by a dot.
- It has no length, width, or thickness but defines a specific position.
- Points are denoted by capital letters like A, B, C, O, etc.

Line Segment

- A line segment, represented as $\overline{AB}$, is a straight path connecting two points, A and B.
- It has a defined length and two endpoints, but no width or thickness.

Ray

- A ray is a portion of a line that starts at a particular point (called the endpoint) and extends infinitely in one direction.
- It is represented by a line segment with an arrowhead at one end.

Line

- A line is formed when a line segment is extended infinitely in both directions.
- It has no endpoints and continues indefinitely in both directions.

Collinear Points

- Collinear points are points that lie on the same straight line.
- For example, if points A, B, and C are on the same line, they are said to be collinear.
- In a plane, any two distinct points determine a unique line, and three or more points can be collinear if they all lie on the same line.

Non-collinear Points

- Non-collinear points are points that do not lie on the same straight line.
- In other words, if you cannot draw a single straight line passing through all the points, they are non-collinear.
- For example, points A, B, C, D, and E are non-collinear.

Intersecting Lines

- Intersecting lines are two lines that meet or cross each other at a common point.
- This common point is called the point of intersection.
- Each line has an infinite number of points, but only one of those points is shared by both lines.

Concurrent Lines

- Concurrent lines are lines that intersect or meet at the same point.

- This point of intersection is common to all the lines.
- In a plane, if two or more lines share a common point of intersection, they are concurrent.

Plane

- A plane is a flat surface that extends infinitely in all directions.
- It is defined by any three non-collinear points or a line and a point not on the line.
- Examples of planes include the surface of a smooth wall, a piece of paper, or a tabletop.
- Any two points within a plane can be connected by a straight line, and any line segment lying entirely in the plane can be extended indefinitely to form a line.

Angles

Angles are geometric figures formed by two rays or two line segments that share a common endpoint, known as the vertex of the angle. Here's a detailed explanation:

Vertex: The common endpoint of the two rays or line segments forming the angle.

Arms: The two rays or line segments that form the angle.

Types of Angles:

- **Acute Angle:** An angle whose measure is greater than 0° and less than 90°.
- **Right Angle:** An angle whose measure is exactly 90°.
- **Obtuse Angle:** An angle whose measure is greater than 90° and less than 180°.
- **Straight Angle:** An angle whose measure is exactly 180°.
- **Reflex Angle:** An angle whose measure is greater than 180° and less than 360°.
- **Full Angle:** An angle whose measure is exactly 360°.

Adjacent Angles: Two angles that share a common arm and a common vertex, but do not overlap.

1. **Complementary Angles:** Two angles whose measures add up to 90°.
2. **Supplementary Angles:** Two angles whose measures add up to 180°.
3. **Vertical Angles:** Two angles formed by intersecting lines, where each angle's arms are opposite rays. They are congruent to each other.

Understanding angles is fundamental in geometry and helps in solving various geometric problems and proofs.

Bisector of an Angle

The bisector of an angle is a line, ray, or line segment that divides the angle into two equal parts.

BOˆC = COˆA
and,

BOˆC + COˆA=AOˆB
and.

AOˆB=2BOˆC=2COˆA

Parallel Lines

Parallel lines are two coplanar lines that never meet, even when extended indefinitely in both directions. They maintain the same distance apart from each other at all points. However, it's essential to note that not all non-intersecting lines are parallel; some lines, called skew lines, do not intersect but are not in the same plane.

Skew lines are lines that do not lie on the same plane and do not intersect. For example, lines AE and HG are skew lines.

Transversal

When a line intersects two or more coplanar lines at different points, it is known as a transversal. In the image, lines l and m are parallel, and line t intersects them at points A, B, C, and D. Line t is the transversal.

Interior Angles which are on the same side of the Transversal

The intersection of a transversal with parallel lines creates various angles. There are eight angles formed, and some of these angles have special names based on their positions and relationships with each other, such as corresponding angles, alternate interior angles, alternate exterior angles, and consecutive interior angles. Understanding these angle relationships is crucial for solving geometry problems involving parallel lines and transversals.

Alternate Angles

Alternate angles, also known as alternate interior angles, are pairs of angles formed by a transversal intersecting two lines. They have specific characteristics:

1. Both angles are internal angles, meaning they are located between the two lines.

2. They are located on opposite sides of the transversal.
3. Alternate angles are not adjacent to each other; they are positioned on different lines.

- $\angle 4$ and $\angle 6$ ($A\hat{Q}R$ and $Q\hat{R}D$) form one pair of alternate angles.
- $\angle 3$ and $\angle 5$ ($B\hat{Q}R$ and $Q\hat{R}C$) form another pair of alternate angles.

Corresponding Angles

Corresponding angles are pairs of angles formed by a transversal intersecting two lines. They have specific characteristics:

1. One angle is an interior angle, located between the two lines, while the other is an exterior angle, located outside the two lines.
2. Corresponding angles are positioned in the same transverse plane.
3. They are not adjacent angles, meaning they do not share a common vertex or side.

- $\angle 1$ and $\angle 5$ ($A\hat{Q}P$ and $C\hat{R}Q$) form one pair of corresponding angles.
- $\angle 4$ and $\angle 8$ ($A\hat{Q}R$ and $C\hat{R}E$) form another pair of corresponding angles.
- $\angle 3$ and $\angle 7$ ($B\hat{Q}R$ and $D\hat{R}E$) form the third pair of corresponding angles.

Parallel Lines - Theorem 1

Theorem 1: Each pair of alternate angles is equal when a transversal intersects two parallel lines.

Given:

- Triangle ABC, with side BC extended to point D, forming exterior angle ACD.
- Lines AB and CD are parallel.
- Transversal EFGH intersects AB and CD.

To Prove:

- $A\hat{F}D=F\hat{G}D$ (One pair of interior alternate angles)
- $B\hat{F}G=F\hat{G}C$ (Another pair of interior alternate angles)

Proof:

- $A\hat{F}G=E\hat{F}B$ (Vertically opposite angles)
- $E\hat{F}B=F\hat{G}D$ (Corresponding angles)
- Therefore, $A\hat{F}G=F\hat{G}D$
- $B\hat{F}G+A\hat{F}G=180^\circ$ (Linear Pair)
- $F\hat{G}C+F\hat{G}D=180^\circ$ (Linear Pair)
- $B\hat{F}G+A\hat{F}G=F\hat{G}C+F\hat{G}D$
- $A\hat{F}G=F\hat{G}D$ (Proved)
- Therefore, $B\hat{F}G=F\hat{G}C$

Converse of Theorem 1

Given:

- Transversal EFGH intersects lines AB and CD such that a pair of alternate angles are equal (AFˆD=FGˆD).

To Prove:

- Lines AB and CD are parallel.

Proof:

- AFˆG=FGˆD (Given)
- But AFˆG=EFˆB (Vertically opposite angles)
- Therefore, EFˆB=FGˆD (Corresponding angles)
- Hence, AB | | CD (Corresponding angles axiom)

Theorem 2: Consecutive Interior Angles

Given:

- Lines AB and CD are parallel, with transversal EFGH.

To Prove:

- BFˆG+FGˆD=180◦
- AFˆG+FGˆC=180◦

Proof:

- EFˆB+BFˆG=180◦ (Linear Pair)
- But EFˆB=FGˆD (Corresponding angles axiom)
- Therefore, BFˆG+FGˆD=180◦ (Substitute FGˆD for EFˆB)
- Similarly, AFˆG+FGˆC=180◦

Converse of Theorem 2

Given:

- Transversal EFGH intersects lines AB and CD at F and G such that BFˆG and FGˆD are supplementary (BFˆG+FGˆD=180◦).

To Prove:

- Lines AB and CD are parallel.

Proof:

- $E\hat{F}B + B\hat{F}G = 180^\circ$ (Linear pair, as ray FB stands on EFGH)
- $B\hat{F}G + F\hat{G}D = 180^\circ$ (Given)
- $E\hat{F}B + B\hat{F}G = B\hat{F}G + F\hat{G}D$
- Therefore, $E\hat{F}B = F\hat{G}D$ (Subtract $B\hat{F}G$ from both sides)
- Since these are corresponding angles, AB | | CD

Interior and Exterior Angles of a Triangle

When we talk about an angle in a triangle, we're referring to the angle formed by the two sides. These angles are located within the triangle's interior and are known as its inner angles.

Now, let's extend one of the triangle's sides. In the diagram, side $\overline{XZ}$ is extended to point O, forming angle OXZ. Next, $\overline{XZ}$ is further extended to point P, forming angle YZP. Similarly, side $\overline{ZY}$ is extended to point M, forming angle MYX. These angles OXZ, YZP, and MYX are called the exterior angles of triangle ABC.

For each exterior angle, there are interior opposite angles. For instance, at vertex X, the exterior angle OXZ has interior opposite angles XYZ and XZY.

Triangles - Theorem 1

Statement:

If a side of a triangle is extended, the exterior angle formed is equal to the sum of the interior opposite angles.

Given:

In triangle ΔABC, side BC is extended to point D, forming exterior angle $A\hat{C}D$. The interior opposite angles are $A\hat{B}C$ and $B\hat{A}C$.

To Prove:

$A\hat{C}D = A\hat{B}C + B\hat{A}C$

Proof:

$A\hat{B}C + B\hat{A}C + A\hat{C}B = 180^\circ$ (Theorem)

$A\hat{C}B + A\hat{C}D = 180^\circ$ (Linear pair)

From equations (i) and (ii), we deduce:

$A\hat{B}C + B\hat{A}C + A\hat{C}B = A\hat{C}B + A\hat{C}D$

Subtracting $A\hat{C}B$ from both sides, we get:

$A\hat{B}C + B\hat{A}C = A\hat{C}D$

Angle Sum Property

Three line segments connect three non-collinear points to form a triangle, which is a closed geometric figure in a plane.

Triangles - Theorem 2:

Statement:

The sum of the three angles of a triangle is 180 degrees.

Given:

A triangle MNS.

To Prove:

$\hat{M} + \hat{N} + \hat{S} = 180$ degrees

Construction:

Draw a line $\overleftrightarrow{AB}$ through vertex M parallel to the base $\overline{NS}$.

Proof:

Since $\overline{NS} \parallel \overleftrightarrow{AB}$, MN is a transversal.

Therefore, $A\hat{M}N = M\hat{N}S$ (1) - Alternate angles

Similarly, since $\overleftrightarrow{AB} \parallel \overline{NS}$ and MN,

$B\hat{M}S = M\hat{S}N$ (2) - Alternate angles

From the figure,

$A\hat{M}N + N\hat{M}S + B\hat{M}S = 180$ degrees

Since AB←→ is a straight line, the sum of the angles at M is 180 degrees.

From equations (1) and (2),

MNˆS + NMˆS + MSˆN = 180 degrees

By substituting MNˆS and MSˆN,

Thus, it is proved that the sum of the measures of the three angles of a triangle is equal to 180 degrees or two right angles.

Benefits of CBSE Class 9 Maths Notes Chapter 6 Lines and Angles

- Conceptual Understanding: These notes provide a clear and comprehensive explanation of the concepts related to lines and angles, helping students build a strong foundation in geometry.
- Simplified Language: The notes are written in simple and easy-to-understand language, making it accessible to students of all levels of understanding.
- Quick Revision: Organized in a structured manner, these notes serve as a handy reference guide for students to revise the chapter quickly before exams or assessments.
- Exam Preparation: By covering the entire syllabus of Chapter 6, these notes help students prepare comprehensively for their CBSE Class 9 Mathematics exams, ensuring they are well-equipped to answer questions related to lines and angles confidently.
- Self-Study Resource: Students can use these notes for self-study purposes, enabling them to learn at their own pace and reinforce their understanding of the topic outside of the classroom.