Class 11 Mathematics – Chapter: Straight Lines

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1. Introduction

- Straight lines are the simplest curves in coordinate geometry.
- They have constant slope and extend infinitely in both directions.

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2. Slope of a Line

- The slope m measures the steepness of the line:

  $$m = \frac{y_2 - y_1}{x_2 - x_1}$$

- Positive slope: line rises from left to right.
- Negative slope: line falls from left to right.
- Zero slope: horizontal line.
- Undefined slope: vertical line.

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3. Various Forms of the Equation of a Line

- Slope-intercept form:

  y=mx+cy = mx + cy=mx+c

where mmm is slope, ccc is y-intercept.

- Point-slope form:

  y−y1=m(x−x1)y - y_1 = m(x - x_1)y−y1=m(x−x1)
- Two-point form:

  y−y1y2−y1=x−x1x2−x1\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}y2−y1y−y1=x2−x1x−x1
- Intercept form:

  xa+yb=1\frac{x}{a} + \frac{y}{b} = 1ax+by=1
- General form:

  Ax+By+C=0Ax + By + C = 0Ax+By+C=0

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4. Distance of a Point from a Line

d=∣Ax1+By1+C∣A2+B2d = \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}d=A2+B2∣Ax1+By1+C∣

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5. Angle Between Two Lines

If slopes of lines are m1m_1m1 and m2m_2m2, then angle θ\thetaθ between them is:

tanθ=∣m1−m21+m1m2∣\tan \theta = \left| \frac{m_1 - m_2}{1 + m_1 m_2} \right|tanθ=1+m1m2m1−m2

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6. Conditions for Parallel and Perpendicular Lines

- Parallel: m1=m2m_1 = m_2m1=m2
- Perpendicular: m1m2=−1m_1 m_2 = -1m1m2=−1

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7. Applications

- Geometry problems
- Coordinate geometry proofs
- Real-world line modeling

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8. Exam Tips

- Memorize all forms of line equations.
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Practice slope calculation and converting between forms.

- Solve problems on distance and angle between lines.
- Understand conditions for parallelism and perpendicularity.