Name: Chandra Shekhar
College: IIT Gandhinagar
Subject: Math
Weightage: Regular
Title: Straight Line

1 Straight Lines

Distance Between Two Points

For $P(x_1, y_1)$ and $Q(x_2, y_2)$:

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Section Formula

Point R divides line segment PQ in ratio $m : n$:

$$R = \left(\frac{mx_2 + nx_1}{m + n}, \frac{my_2 + ny_1}{m + n} \right)$$

Valid for both internal and external division.

Area of Triangle

Given vertices (x_1, y_1), (x_2, y_2), (x_3, y_3):

$$\text{Area} = \frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$$

Centroid of a Triangle

Given vertices $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$:

$$G = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$$

2 Straight Line Forms

- **Slope-Intercept:** $y = mx + c$
- **Intercept Form:** $\frac{x}{a} + \frac{y}{b} = 1$
- **Point-Slope:** $y - y_1 = m(x - x_1)$

- **Two-Point Form:** $\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$
- **Normal Form:** $x \cos \alpha + y \sin \alpha = p$
- **Parametric:** $x = h + r \cos \theta, \quad y = k + r \sin \theta$

Distance from a Point to a Line

Line: $ax + by + c = 0$, Point: (x_1, y_1):

$$\text{Distance} = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$$

Foot of Perpendicular and Image

Same formula helps derive coordinates of foot of perpendicular and reflection of a point across a line.