Class 11

Important Formulas

Straight Lines

1. Every first degree equation in x, y represents a straight line.
2. The trigonometrical tangent of the angle that a non-vertical line makes with the positive direction of the x-axis in anticlockwise sense is called the slope or gradient of the line.
3. The slope m of a non-vertical line passing through the points (x_1, y_1) and (x_2, y_2) is given by
$$m = \frac{y_2 - y_1}{m_2 - x_1} = \frac{\text{Difference of ordinates}}{\text{Difference of abscissae}}$$
4. Slope of a horizontal line is zero and slope of a vertical ine is undefined.
5. An acute angle θ between the lines having slopes m_1 and m_2 is given by
$$\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right|, 1 + m_1 m_2 \neq 0$$
6. Two lines are parallel if and only if their slopes are equal.
7. Two lines are perpendicular if and only if the product of their slopes is -1.
8. Three points P, Q and R are collinear if and only if
Slope of PQ = Slope of QR
9. If a straight line cuts x-axis at A and the y-axis at B, then OA and OB are known as the intercepts of the line on x-axis and y-axis respectively.
10. The equation of a line parallel to x-axis at a distance a from it is $y = a$ or $y = -a$ according as it is above or below x-axis.
11. The equation of a line parallel to y-axis at a distance b from it is $x = b$ or $x = -b$ according as it is on the right or on left side of y-axis.
12. The equation of x-axis is $y = 0$.
13. The equation of y-axis is $x = 0$.
14. The equation of a line with slope m and making an intercept c on y-axis is $y = mx + c$.
15. The equation of a line with slope m and passing through the origin is $y = mx$.
16. The equation of the line which passes through the point (x_1, y_1) and has slope m is
$$y - y_1 = m(x - x_1)$$
17. The equation of the line passing through the points (x_1, y_1) and (x_2, y_2) is
$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

18. The equation of the line making intercepts a and b on x and y-axis respectively is $\frac{x}{a}+\frac{y}{b}=1$.

19. The equation of the straight line upon which the length of the perpendicular from the origin is p and the angle between this perpendicular and positive x-axis is α is given by $x\cos\alpha + y\sin\alpha = p$.

20. The equation of the straight line passing through (x_1, y_1) and making an angle θ with the positive direction of x-axis is

$\frac{x-x_1}{\cos\theta}=\frac{y-y_1}{\sin\theta}=r$, where r is the distance of the point (x, y) on the line from the point (x_1, y_1).

The coordinates of any point on the line at a distance r from the point (x_1, y_1) are

$(x_1 \pm r\cos\theta, y_1 \pm r\sin\theta)$

21. The slope of the line $ax + by + c = 0$ is

$$-\frac{a}{b} = -\frac{\text{Coefficient of } x}{\text{Coefficient of } y}$$

Three lines $L_1 \equiv a_1x + b_1y + c_1 = 0$, $L_2 \equiv a_2x + b_2y + c_2 = 0$ and, $L_3 \equiv a_3x + b_3y + c_3 = 0$ are concurrent, if

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$$

Also, these lines are concurrent iff there exist scalars $\lambda_1, \lambda_2, \lambda_3$ such that

$$\lambda_1 L_1 + \lambda_2 L_2 + \lambda_3 L_3 = 0$$

The equation of a line parallel to the line $ax + by + c = 0$ is $ax + by + \lambda = 0$, where λ is a constant.

The equation of a line perpendicular to the line $ax + by + c = 0$ is $bx - ay + \lambda = 0$, where λ is a constant.

The perpendicular distance (d) of a line $ax + by + c = 0$ from a point (x_1, y_1) is given by

$$d = \left|\frac{ax_1 + by_1 + c}{\sqrt{a^2+b^2}}\right|$$

The distance (d) between the parallel lines $ax + by + c_1 = 0$ and $ax + by + c_2 = 0$ is given by $d = \frac{|c_1 - c_2|}{\sqrt{a^2+b^2}}$.

The equations of the lines passing through (x_1, y_1) and making an angle α with the line $y = mx + c$ are given by

$$y - y_1 = \frac{m \pm \tan\alpha}{1 \pm m\tan\alpha}(x - x_1).$$