STRAIGHT LINES

Slope of a line

The slope of a line is the $'tan'$ of the angle the line makes with the positive direction of the x-axis. If θ is the angle then, slope $= tan\theta$.

The slope of a line passing through two points (x_1, y_1) and (x_2, y_2) is $\frac{y_2-y_1}{x_2-x_1}$

- The slope of the x-axis is zero and that of the y-axis is not defined.
- Parallel lines have the same slope.
- The product of the slopes of perpendicular lines is -1.
- The slope is positive if $\theta < 90°$. The slope is negative if $\theta > 90°$.
- If three points A, B, and C are collinear, then AB and BC have the same slope.
- If m_1 and m_2 be slopes of two lines then, θ the angle between is given by $tan\theta = |\frac{m_2-m_1}{1+m_1m_2}|, 1 + m_1m_2 \neq 0$

Equation of a line

- Equation of x-axis is $y = 0$.
- Equation of y-axis is $x = 0$.
- The equation of a horizontal line is $y = a$. If $'a'$ is positive then the line is above the x-axis and if negative it will be below the x-axis.
- The equation of a vertical line is $x = a$. If $'a'$ is positive then the line is to the right of the x-axis and if negative it will be to the left of the x-axis.

Point-slope form

$y - y_1 = m(x - x_1)$, where $'m'$ is the slope and (x_1, y_1) is a point on the line.

Two-Point form

$y - y_1 = \frac{y_2-y_1}{x_2-x_1}(x - x_1)$ where (x_1, y_1) and (x_2, y_2) are two point on the line.

Slope intercept form

1. y = mx + c, where m is the slope and c is the y-intercept. 2. y = m(x - d), where m is the slope and d is the x-intercept.

Intercept form

$\frac{x}{a} + \frac{y}{n} = 1$, where a and b are x and y intercept respectively.

Normal form

$xcos\theta + ysin\theta = p$, where p is the length of the normal from the origin to the line and θ is the angle the normal makes with the positive direction of the x-axis.

General Equation of a line

General equation of a Line: $ax + by + c = 0$, where a, b and c are real constants.

- Slope of the line $ax + by + c = 0$ is $\frac{-a}{b}$
- Parallel lines differ in constant term, i.e; a line parallel to $ax + by + c = 0$ is $ax + by + k = 0$.
- A line perpendicular to $ax + by + c = 0$ is $bx - ay + k = 0$.
- The equation of the family of lines passing through the intersection of the lines $a_1x+b_1y+c_1 = 0$ and $a_2x+b_2y+c_2 = 0$ is of the form $a_1x+b_1y+c_1+k(a_2x+b_2y+c_2) = 0$.
- The perpendicular distance of a point (x_1, y_1) from the line $ax + by + c = 0$ is $|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}|$
- The distance between the parallel lines $ax + by + c = 0$ and $ax + by + k = 0$ is $|\frac{c-k}{\sqrt{a^2+b^2}}|$
- Normal form of the equation $ax + by + c = 0$ is $xcos\theta + ysin\theta = p$; where $cos\theta = \pm\frac{a}{\sqrt{a^2+b^2}}$: $sin\theta = \pm\frac{b}{\sqrt{a^2+b^2}}$ and $p = \pm, \frac{c}{\sqrt{a^2+b^2}}$