Co-ordinate Geometry

Distance between two points P(x_1, y_1) and Q(x_2, y_2) is given by = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

If a point R (x, y) divides P(x_1, y_1) and Q(x_2, y_2) internally in the ratio of m:n, the coordinates of R i.e. (x,y) are given by = $\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}$

If a point R (x,y) divides P(x_1,y_1) and Q(x_2,y_2) externally in the ratio of m:n, the coordinates of R i.e. (x,y) are given by = $\frac{mx_2-nx_1}{m-n}, \frac{my_2-ny_1}{m-n}$

Concept: The X axis divides the line joining P(x_1, y_1) and Q(x_2, y_2) in the ratio of $y_1 : y_2$

Concept: The Y axis divides the line joining P(x_1, y_1) and Q(x_2, y_2) in the ratio of $x_1 : x_2$

Slope(m) of a line is the tangent of the angle made by the line with the positive direction of the X-Axis.
For a general equation ax + by + c = 0; slope (m) = -a/b. For a line joining two points, P (x_1, y_1) and Q(x_2, y_2), the slope(m) is = $\frac{y_2-y_1}{x_2-x_1}$

Slope(m)	Typeofline	AnglewithX- Axis
> 0(+ive)	Rising	Acute
0	ParalleltoX-Axis	0^0
< 0 (-ive)	Falling	Obtuse
infinite	ParalleltoY-Axis	90^0

Equation of a line parallel to X-axis is y = a {of X-Axis is y = 0}

Equation of a line parallel to Y-Axis is x = a {of Y-Axis is x = 0}

The intercept of a line is the distance between the point where it cuts the X-Axis or Y-Axis and the origin. Y- Intercept is often denoted with the letter 'c'.

Equation of a line

General form: ax + by + c = 0
Slope Intercept Form: Slope is m, y-intercept is c
⇒ y = mx +c

Slope Point Form: Slope is m, point is (x_1, y_1)
⇒ $y - y_1 = m(x - x_1)$

Two Point Form: Two points are (x_1, y_1) and (x_2, y_2)
⇒ $(y - y_1) = \left[\frac{y_2-y_1}{x_2-x_1}\right](x - x_1)$

Two Intercept Form: X-intercept is a, Y-intercept is b.
⇒ $\frac{x}{a} + \frac{y}{b} = \pm 1$ OR bx + ay = ab

Acute angle between two lines with slope m_1 and m_2 is given by
⇒ $\tan\theta = |\frac{m_1-m_2}{1+m_1m_2}|$

⇒ For parallel lines, $\theta = 0°$; $m_1m_2 = 1$

⇒ For perpendicular lines, $\theta = 90°$; $m_1m_2 = -1$

Distance of a point P (x_1, y_1) **from a line** ax + by + c = 0

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

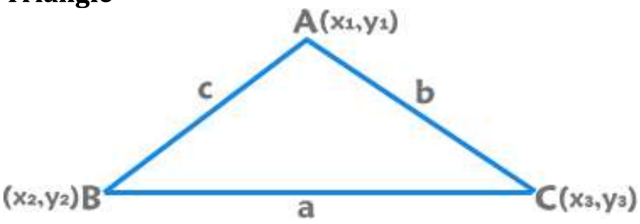
⇒ From origin, $d = |\frac{c}{\sqrt{a^2+b^2}}|$

Distance between two parallel lines, $ax + by + c_1 = 0$ and $ax + by + c_2 = 0$

$\Rightarrow d = \left|\frac{c_1 - c_2}{\sqrt{a^2+b^2}}\right|$

Concept: If we know three points $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ of a parallelogram, the fourth point is given by
$\Rightarrow (x_1 + x_3 - x_2, y_1 + y_3 - y_2)$

Triangle



The vertices are $P(x_1, y_1)$, $Q(x_2, y_2)$ and $R(x_3, y_3)$

Incenter = $\left\{\frac{ax_1+bx_2+cx_3}{a+b+c}, \frac{ay_1+by_2+cy_3}{a+b+c}\right\}$

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

Area = $\frac{1}{2}\left[x_1\left(y_2 - y_3\right) + x_2\left(y_3 - y_1\right) + x_3\left(y_1 - y_2\right)\right]$

Circle
General Equation: $x^2 + y^2 + 2gx + 2fy + c = 0$

$\Rightarrow$ Centre is $(-g, -f)$ and radius= $\sqrt{g^2 + f^2 - c}$

$\Rightarrow$ Centre is (h, k) and radius is r

$\Rightarrow \sqrt{(x-h)^2 + (y-k)^2} = r^2$

Centre is origin and radius is r

$\Rightarrow x^2 + y^2 = r^2$