

## Quantitative Aptitude

### Co-ordinate Geometry

A point in the plane is represented as  $(x, y)$  where  $x$  and  $y$  are coordinates.

The plane is divided into four quadrants by the  $x$ -axis and  $y$ -axis.

<b>Distance Formula:</b>	<b>Distance between two points <math>(x_1, y_1)</math> and <math>(x_2, y_2)</math> is:</b> <b>Distance</b> $= \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$
<b>Midpoint Formula:</b>	Midpoint of line segment joining $(x_1, y_1)$ and $(x_2, y_2)$ is: Midpoint $= \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$
<b>Section Formula:</b>	Coordinates of point dividing the segment joining $(x_1, y_1)$ and $(x_2, y_2)$ in ratio $m:n$ : Point $= \left( \frac{m x_2 + n x_1}{m + n}, \frac{m y_2 + n y_1}{m + n} \right)$
<b>Slope of a Line:</b>	<ul style="list-style-type: none"> <li>Slope <math>(m) = \frac{y_2 - y_1}{x_2 - x_1}</math></li> <li>Horizontal line slope <math>= 0</math></li> <li>Vertical line slope <math>=</math> undefined</li> </ul>
<b>Equation of a Line:</b>	<ul style="list-style-type: none"> <li>Slope-Intercept Form: <math>y = mx + c</math></li> <li>Point-Slope Form: <math>y - y_1 = m(x - x_1)</math></li> <li>Two-Point Form: <math>\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}</math></li> <li>General Form: <math>Ax + By + C = 0</math></li> </ul>
<b>Distance of a Point from a Line:</b>	Distance $d$ of point $(x_0, y_0)$ from line $Ax + By + C = 0$ is: $d = \frac{ Ax_0 + By_0 + C }{\sqrt{A^2 + B^2}}$
<b>Area of Triangle Formed by Points:</b>	$\text{Area} = \frac{1}{2}  x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) $
<b>Conditions for Collinearity:</b>	Points $(x_1, y_1)$ , $(x_2, y_2)$ , $(x_3, y_3)$ are collinear if area $= 0$
<b>Reflection of Points</b>	<ul style="list-style-type: none"> <li>Reflection about <math>x</math>-axis: If point is <math>(x, y)</math>, its reflection is <math>(x, -y)</math>.</li> <li>Reflection about <math>y</math>-axis: If point is <math>(x, y)</math>, its reflection is <math>(-x, y)</math>.</li> <li>Reflection about origin: Point <math>(x, y)</math> reflects to <math>(-x, -y)</math>.</li> <li>Reflection about line <math>y = x</math>: Point <math>(x, y)</math> reflects to <math>(y, x)</math>.</li> <li>Reflection about line <math>y = -x</math>: Point <math>(x, y)</math> reflects to <math>(-y, -x)</math>.</li> </ul>
<b>Circle Concept</b>	<p><b>A circle is the set of all points equidistant from a fixed point called the center.</b></p> $(x - h)^2 + (y - k)^2 = r^2$ <b>Circle with center at origin <math>(0, 0)</math>:</b> $x^2 + y^2 = r^2$ <b>Radius Formula:</b> $r = \sqrt{[(x - h)^2 + (y - k)^2]}$ <b>General form of circle:</b> $x^2 + y^2 + 2gx + 2fy + c = 0$ <b>Center:</b> $(-g, -f)$ <b>Radius:</b> $\sqrt{g^2 + f^2 - c}$ <b>Tangent to a circle:</b> If tangent touches circle at $(x_1, y_1)$ : $(x - h)(x_1 - h) + (y - k)(y_1 - k) = r^2$

## System of Linear Equations

For two variables  $x$  and  $y$ , a system of two linear equations can be written as:

$$a_1x + b_1y = c_1$$

$$a_2x + b_2y = c_2$$

where  $a_1, b_1, c_1, a_2, b_2, c_2$  are constants.

### Types of Solutions:

#### 1. Unique Solution:

- The two lines intersect at exactly one point.
- Equations are consistent and independent.
- Occurs when  $\left(\frac{a_1}{a_2}\right) \neq \left(\frac{b_1}{b_2}\right)$ .

#### 2. No Solution:

- The lines are parallel and never intersect.
- Equations are inconsistent.
- Occurs when  $\left(\frac{a_1}{a_2}\right) = \left(\frac{b_1}{b_2}\right) \neq \left(\frac{c_1}{c_2}\right)$ .

#### 3. Infinite Solutions:

- The lines coincide (are the same line).
- Equations are consistent and dependent.
- Occurs when  $\left(\frac{a_1}{a_2}\right) = \left(\frac{b_1}{b_2}\right) = \left(\frac{c_1}{c_2}\right)$ .

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