



# BAAP OF ALL FORMULA LISTS



FOR IIT JEE

STRAIGHT LINE

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SL#	FORMULA
1	<b>Distance Between Two Points</b> $d = AB =  x_2 - x_1  =  x_1 - x_2 $
2	<b>Dividing a Line Segment in the Ratio</b> $\lambda x_0 = \frac{x_1 + \lambda x_2}{1 + \lambda}, \lambda \frac{AC}{CB}, \lambda \neq -1.$
3	<b>Midpoint of a Line Segment</b> $x_0 = \frac{x_1 + x_2}{2}, \lambda = 1.$
4	<b>Distance Between Two Points</b> $d = AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
5	<b>Distance Between Two Points in Polar Coordinates</b> $d = AB = \sqrt{r_1^2 + r_2^2 - 2r_1r_2 \cos(\phi_2 - \phi_1)}$
6	<b>Converting Rectangular Coordinates to Polar Coordinates</b> $x = r \cos \phi, y = r \sin \psi.$
7	<b>Converting Polar Coordinates to Rectangular Coordinates</b> $r = \sqrt{x^2 + y^2}, \tan \phi = \frac{y}{x}.$
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8	<b>General Equation of a straight Line</b> $Ax + By + C = 0$
9	<b>Normal Vector to a Straight Line The Vector</b> $\vec{A}, \vec{B}$ is normal to the line $Ax + By + C = 0$

10	<b>Explicit Equation of a straight Line (Slope -Intercept Form)</b> $y = kx + b.$
11	<b>Gradient of a Line</b> $k = \tan \alpha = \frac{y_2 - y_1}{x_2 - x_1}$
12	<b>Equation of a line given a point and the Gradient</b> $y = y_0 + k(x - x_0)$ , where <b>k</b> is the gradient, $P(x_0, y_0)$ is a point on the line.
13	<b>Equation of a Line That Passes Through Two Points</b> $\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1} \text{ or } \begin{vmatrix} x & y & 1 \\ x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \end{vmatrix} = 0$
14	<b>Intercept Form</b> $\frac{x}{a} + \frac{y}{b} = 1$
15	<b>Normal Form</b> $x \cos \beta + y \sin \beta - p = 0$
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16	<b>Point Direction Form</b> $\frac{x - x_1}{X} = \frac{y - y_1}{Y},$ where $(X, Y)$ is the direction of the line and $P_1(x_1, y_1)$ lies on the line.
17	<b>Vertical Line</b> $x = a$
18	<b>Horizontal Line</b> $y = b$
19	<b>Vector equation of a Straight Line</b> $\vec{r} = \vec{a} + t\vec{b}$ , where <b>O</b> is the origin of the coordinates, <b>X</b> is any variable point on the line, $\vec{a}$ is the position vector of a known point <b>A</b> on the line, $\vec{b}$ is a known vector of direction, parallel to the line, <b>t</b> is a parameter, $\vec{r} = \vec{OX}$ is the position vector of any point <b>X</b> on the line.
20	<b>Straight Line in Parametric Form</b> $\begin{cases} x = a_1 + tb_1 \\ y = a_2 + tb_2 \end{cases}$ where $(x, y)$ are the coordinates of any unknown point on the line,

$(a_1, a_2)$  are the coordinates of a known point on the line,

$(b_1, b_2)$  are the coordinates of a vector parallel to the line,

$t$  is a parameter.

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#### Distance From a Point To a Line

The distance from the point  $P(a, b)$  to line  $Ax + By + C = 0$  is

$$d = \frac{|Aa + Bb + c|}{\sqrt{A^2 + B^2}}$$

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#### Parallel Lines Two lines

$y = k_1x + b_1$  and  $y = k_2x + b_2$  are parallel if

$$k_1 = k_2.$$

Two lines  $A_1x + B_1y + C_1 = 0$  and  $A_2x + B_2y + C_2 = 0$  are parallel if

$$\frac{A_1}{A_2} = \frac{B_1}{B_2}.$$

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#### Perpendicular Lines

##### Two Lines

$y = k_1x + b_1$  and  $y = k_2x + b_2$  are perpendicular if

$$k_2 = -\frac{1}{k_1} \text{ or, equivalently, } k_1k_2 = -1.$$

Two lines  $A_1x + B_1y + C_1 = 0$  and  $A_2x + B_2y + C_2 = 0$  perpendicular if

$$A_1A_2 + B_1B_2 = 0$$



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Angle Between Two Lines  $\tan \phi = \frac{k_2 - k_1}{1 + k_1k_2}$ ,  $\cos \phi = \frac{A_1A_2 + B_1B_2}{\sqrt{A_1^2 + B_1^2} \cdot \sqrt{A_2^2 + B_2^2}}$

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#### Intersection of Two Lines

If two lines  $A_1x + B_1y + C_1 = 0$  and  $A_2x + B_2y + C_2 = 0$  intersect, the intersection point has coordinates

$$x_0 = \frac{-C_1B_2 + C_2B_1}{A_1B_2 - A_2B_1},$$

$$y_0 = \frac{-A_1C_2 + A_2C_1}{A_1B_2 - A_2B_1}$$



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