10.7 Length of perpendicular

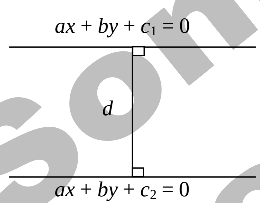
(1) **Distance of a point from a line :** The length p of the perpendicular from the point (x_1, y_1) to the line $ax + by + c = 0$ is given by $p = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$.

- Length of perpendicular from origin to the line $ax + by + c = 0$ is $\left|\frac{c}{\sqrt{a^2 + b^2}}\right|$.

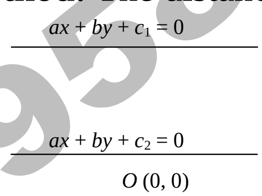
- Length of perpendicular from the point (x_1, y_1) to the line $x\cos\alpha + y\sin\alpha = p$ is $|x_1\cos\alpha + y_1\sin\alpha - p|$.

(2) **Distance between two parallel lines :** Let the two parallel lines be $ax + by + c_1 = 0$ and $ax + by + c_2 = 0$.

First Method: The distance between the lines is $d = \frac{|c_1 - c_2|}{\sqrt{(a^2 + b^2)}}$.



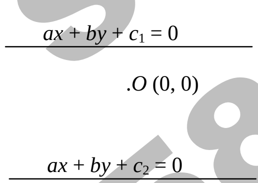
Second Method: The distance between the lines is $d = \frac{\Delta}{\sqrt{(a^2 + b^2)}}$,



where (i) $\Delta = |c_1 - c_2|$, if they be on the same side of origin.

(ii) $\Delta = |c_1| + |c_2|$, if the origin O lies between them.

Third method : Find the coordinates of any point on one of the given line, preferably putting $x = 0$ or $y = 0$. Then the perpendicular distance of this point from the other line is the required distance between the lines.



Distance between two parallel lines $ax + by + c_1 = 0$, $kax + kby + c_2 = 0$ is $\frac{\left|c_1 - \frac{c_2}{k}\right|}{\sqrt{a^2 + b^2}}$. Distance between two non parallel lines is always zero.