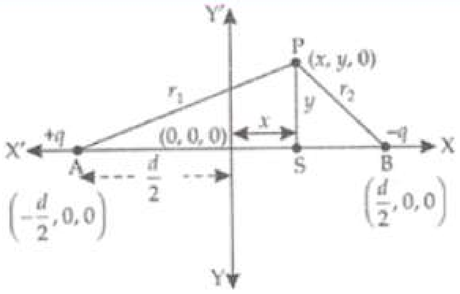
Two-point charges of magnitude +q and -q are placed at (-$\frac{d}{2}$, 0, 0) and ($\frac{d}{2}$, 0, 0) respectively. Find the equation of the equipotential surface where the potential is zero.



Then equipotential surface will pass through S and perpendicular to line joining two chargers or AB.

$r_1^2 = AS^2 + SP^2$

= $\left(x+\frac{d}{2}\right)^2 + y^2$

$r_1 = \sqrt{\left(x+\frac{d}{2}\right)^2 + y^2}$

Similarly, $r_2 = \sqrt{\left(x-\frac{d}{2}\right)^2 + y^2}$

Since the net potential at P = O, we have

$\frac{kq}{r_1} + \frac{k(-q)}{r_2} = 0$ where k = $\frac{1}{4\pi\varepsilon_0}$

$\Rightarrow kq\left[\frac{1}{r_1} - \frac{1}{r_2}\right] = 0$ [$\because$ kq $\neq$ 0]

$\Rightarrow \frac{1}{r_1} - \frac{1}{r_2} = 0$

$\Rightarrow \left(x+\frac{d}{2}\right)^2 + y^2 = \left(x-\frac{d}{2}\right)^2 + y^2$

$\Rightarrow \left(x+\frac{d}{2}\right)^2 = \left(x+\frac{d}{2}\right)^2$

$\Rightarrow x^2 + \frac{d^2}{4} + dx = x^2 + \frac{d^2}{4} - dx$

2dx = 0

2d $\neq$ 0

$\therefore$ x = 0

So equipotential surface will be perpendicular to X-axis passing through x = 0 i.e., origin in Y-Z plane.