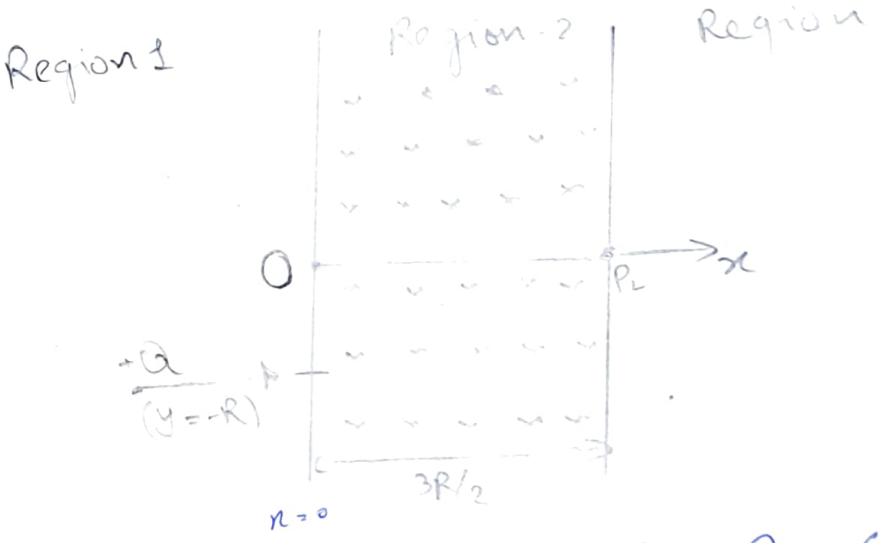
NIPUN VINOD P M
2022177 TS (B3a)

A uniform magnetic field B exists in the region between $x = 0$ and $x = 3R/2$ (Region 2 in the figure) pointing normally into the plane of the paper. A particle with charge $+Q$ and momentum p directed along x-axis enters region 2 from region 1 at point $P_1 (y = -R)$.



what is the min. value of B such that particle re enters region 1.

Ans: As the particle enters with angle 90° with the boundary; it will also ~~leave~~ re enter ~~the boundary~~ ~~the~~ region-1 with an angle 90° with the boundary.

The Radius of the circle formed by the particle will be $\frac{mv}{qB}$.

because; the ~~centrifugal~~ centripetal force is provided by magnetic lorentz force.

$$\frac{mv^2}{r} = (V \times B)q = VBq$$

$r = \frac{mv}{qB}$ => here we are given with the momentum, P which is mv.

$$r = \frac{P}{QB}.$$

So as to particle recenter the r should always be less than $3R/2$ or equal to $3R/2$

i.e., $3R/2 \geq \frac{P}{QB}$ => $B \geq \frac{2P}{3RQ}$

So the min value of $B = \frac{2P}{3RQ}$