Line L has intercepts a and b on the coordinate axes. When the axes are rotated through a given angle, keeping the origin fixed, the same line L has intercepts p and q, then

(a) $a^2 + b^2 = p^2 + q^2$

(b) $\dfrac{1}{a^2} + \dfrac{1}{b^2} = \dfrac{1}{p^2} + \dfrac{1}{q^2}$

(c) $a^2 + p^2 = b^2 + q^2$

(d) $\dfrac{1}{a^2} + \dfrac{1}{p^2} = \dfrac{1}{b^2} + \dfrac{1}{q^2}$

(b) As L has intercepts a and b on axes, equation of L is

$$\frac{x}{a} + \frac{y}{b} = 1 \qquad\qquad \text{........ (i)}$$

Let x and y axes be rotated through an angle θ in anticlockwise direction.

In new system intercepts are p and q, therefore equation of L becomes

$$\frac{x}{p} + \frac{y}{q} = 1 \qquad\qquad \text{........ (ii)}$$

As the origin is fixed in rotation, the distance of line from origin in both the cases should be same.

$$d = \left| \frac{1}{\sqrt{\dfrac{1}{a^2} + \dfrac{1}{b^2}}} \right| = \left| \frac{1}{\sqrt{\dfrac{1}{p^2} + \dfrac{1}{q^2}}} \right|$$

$$\Rightarrow \quad \frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2} + \frac{1}{q^2}$$

∴ (b) is the correct option.