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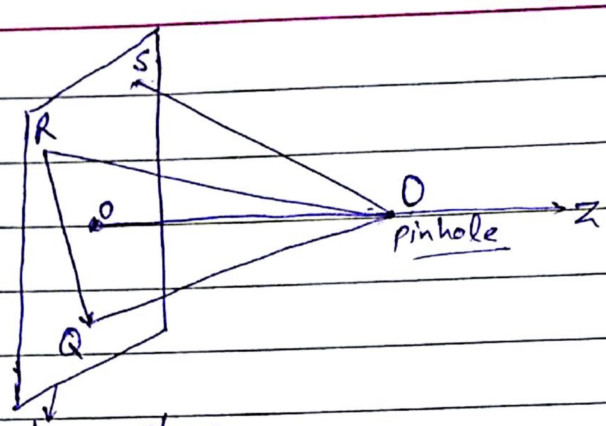
4.



~~Now~~, Since OQ, OR and OS are three mutually perpendicular directions

$\therefore$ we can write $OS^T OR = 0$

$OS^T OQ = 0$

$\Rightarrow OS^T(OR - OQ) = 0$

Hence OS is orthogonal to OR-OQ (XY plane) —— (1.)

Now, Since OR-OQ lie in the image plane, and Oo is along the z-axis

$\therefore$ $Oo^T(OR-OQ) = 0$ ($\because$ they are $\perp$ to each other)

Hence Oo is orthogonal to OR-OQ —— (2.)

Using (1.) and (2.), we can conclude that the plane formed by Oo & OS (OSo) will also be orthogonal to OR-OQ.

therefore, any vector in the plane OSo will be $\perp$ to OR-OQ

Since, oS lie in that plane $\therefore$ OS is perpendicular to OR-OQ = QR.

~~A We can~~ the proof will still be valid

let the three perpendicular lines are not concurrent at O.

Now, we can shift the lines parrallely such that they all become concurrent at O. Since, the vanishing point will not change for a line if we shift it parrallely. So, we can now proceed through above proof to prove the orthocenter theorem.