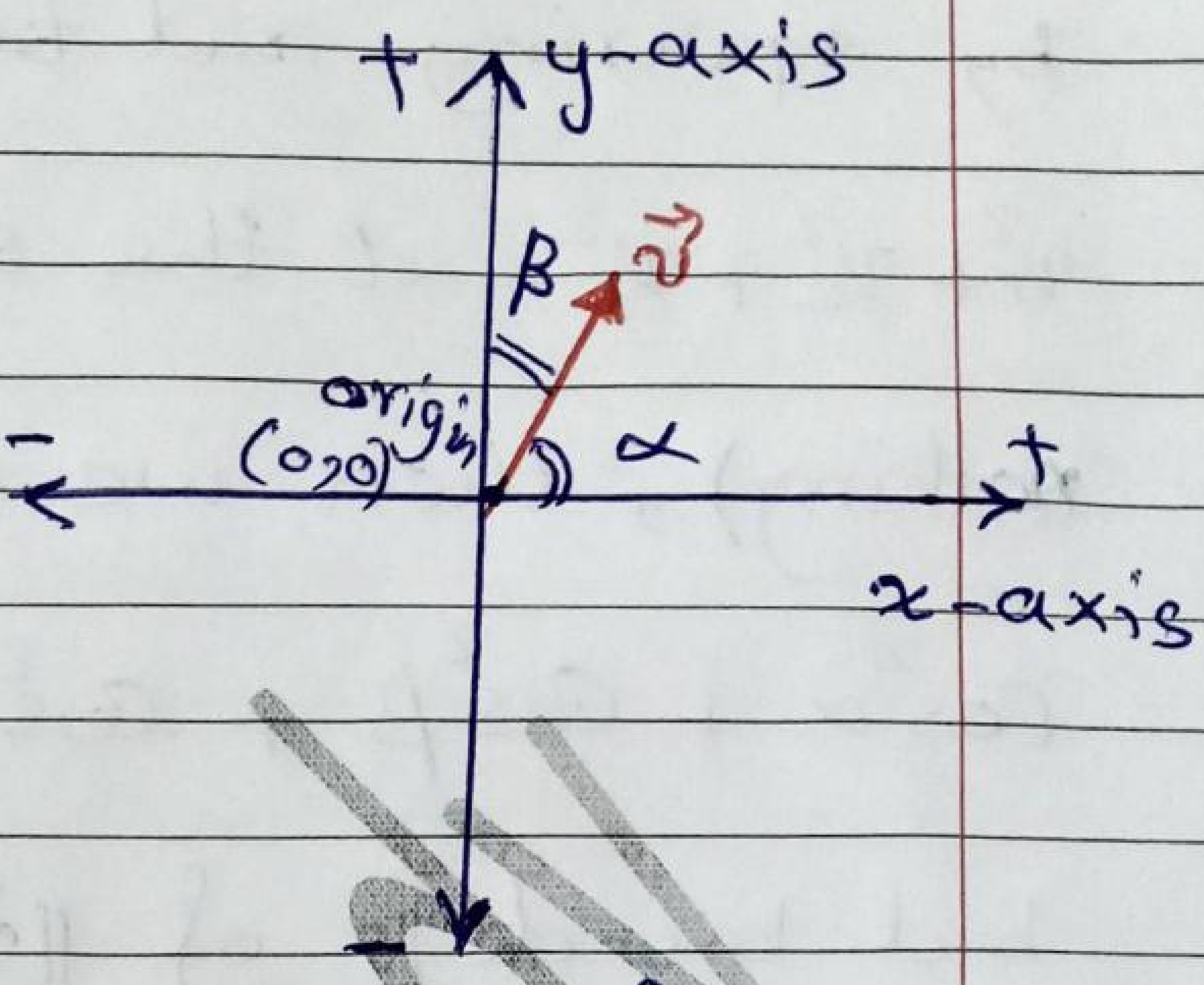
$$\Rightarrow \cos\alpha = \frac{v_1 + 0}{\|\vec{v}\|(1)} = \frac{v_1}{\|\vec{v}\|}$$

$$\& \cos\beta = \frac{v_2}{\|\vec{v}\|}$$



Theorem: The direction cosines of a non-zero vector $\vec{v} = v_1 i + v_2 j + v_3 k = (v_1, v_2, v_3)$

are:

$$\cos\alpha = \frac{v_1}{\|\vec{v}\|}, \cos\beta = \frac{v_2}{\|\vec{v}\|} \ \& \cos\gamma = \frac{v_3}{\|\vec{v}\|}$$

then, $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$

Proof:

$$\cos^2\alpha + \cos^2\beta + \cos^2\gamma =$$

$$\left(\frac{v_1}{\|\vec{v}\|}\right)^2 + \left(\frac{v_2}{\|\vec{v}\|}\right)^2 + \left(\frac{v_3}{\|\vec{v}\|}\right)^2 =$$

$$\frac{v_1^2}{\|\vec{v}\|^2} + \frac{v_2^2}{\|\vec{v}\|^2} + \frac{v_3^2}{\|\vec{v}\|^2} = \frac{v_1^2 + v_2^2 + v_3^2}{\|\vec{v}\|^2}$$