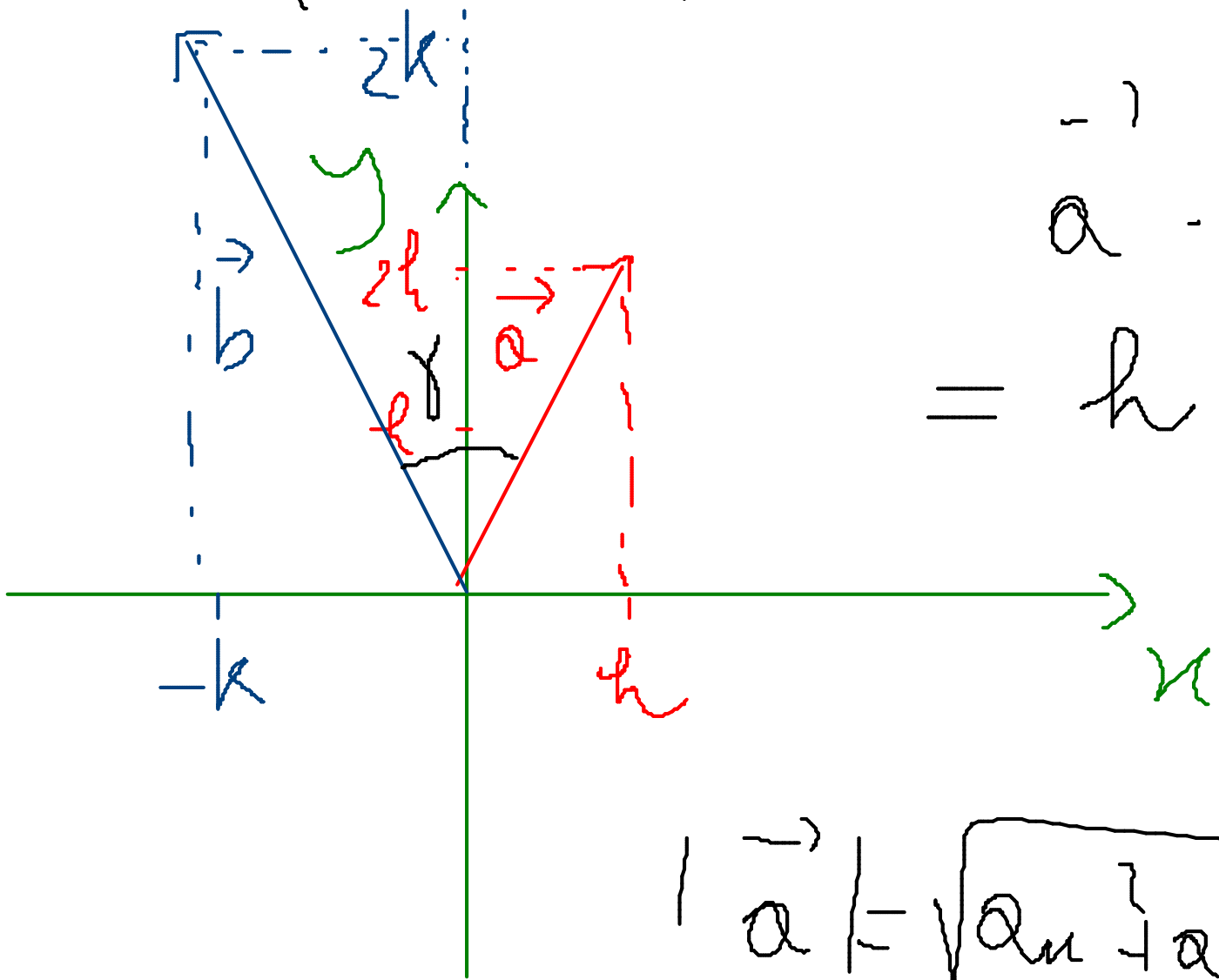


$$\vec{a} = (h, 2h) \quad \vec{b} = (-k, 2k) \quad h, k > 0$$



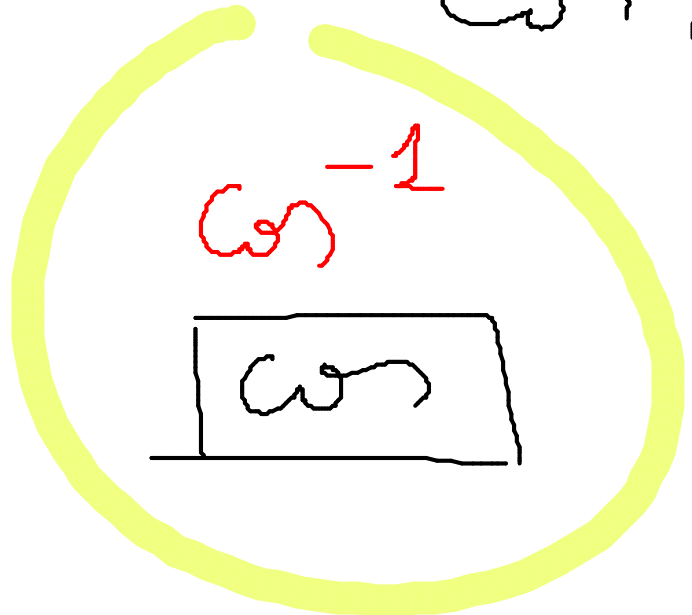
$$\begin{aligned} \vec{a} \cdot \vec{b} &= ab \cos \gamma \\ &= h \cdot (-k) + 2h \cdot 2k \\ &= -hk + 4hk \\ &= 3hk \end{aligned}$$

$$\begin{aligned} |\vec{a}| &= \sqrt{a_1^2 + a_2^2} = \sqrt{h^2 + 4h^2} = h\sqrt{5} \\ |\vec{b}| &= \sqrt{b_1^2 + b_2^2} = k\sqrt{5} \end{aligned}$$

$$ab = h\sqrt{5} \cdot k\sqrt{5} = 5hk$$

$$a^{-1} \cdot b^{-1} = ab \cos \gamma$$

$$\cos \gamma = \frac{a^{-1} \cdot b^{-1}}{ab} = \frac{3hk}{5hk}$$



shift

2nd

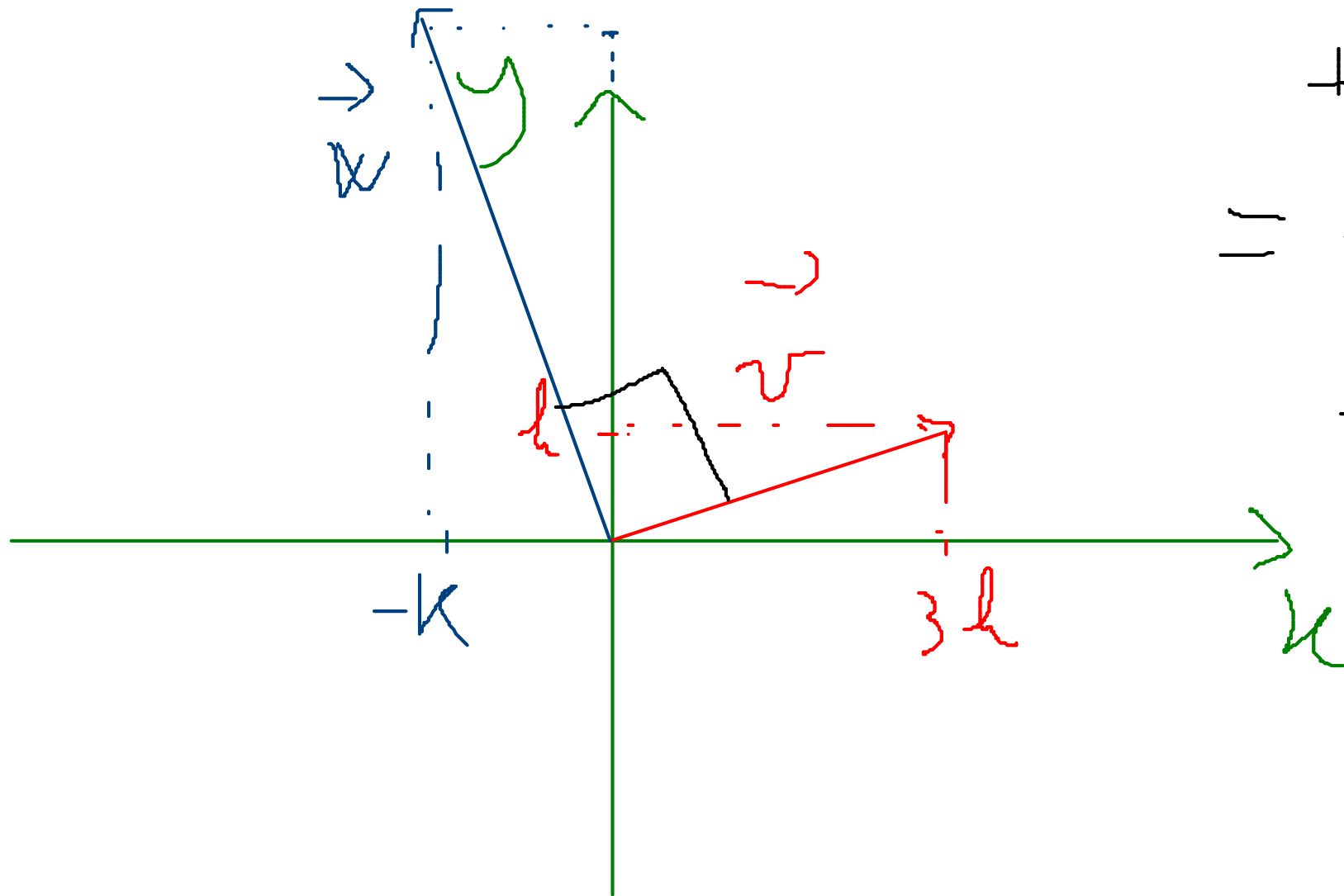
$$= \frac{3}{5} < 1$$

$$\gamma = 53.13^\circ$$

$$\vec{v} = (3h, h)$$
$$\vec{w} = (-k, 3k)$$

$$h, k > 0$$

$$\vec{v} \cdot \vec{w} = 3h \cdot (-k) + h \cdot 3k$$
$$= -3hk + 3hk$$
$$= 0$$

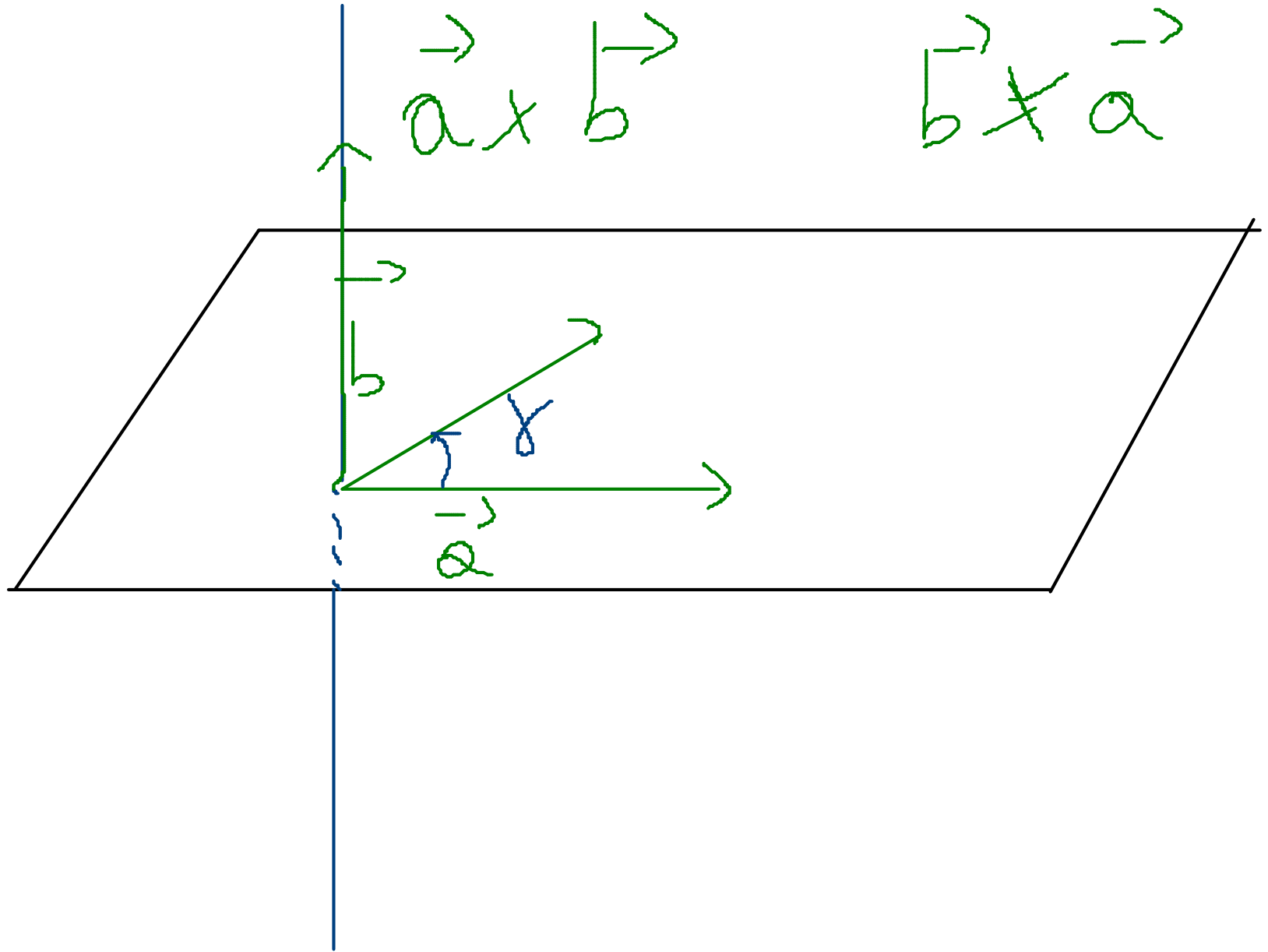
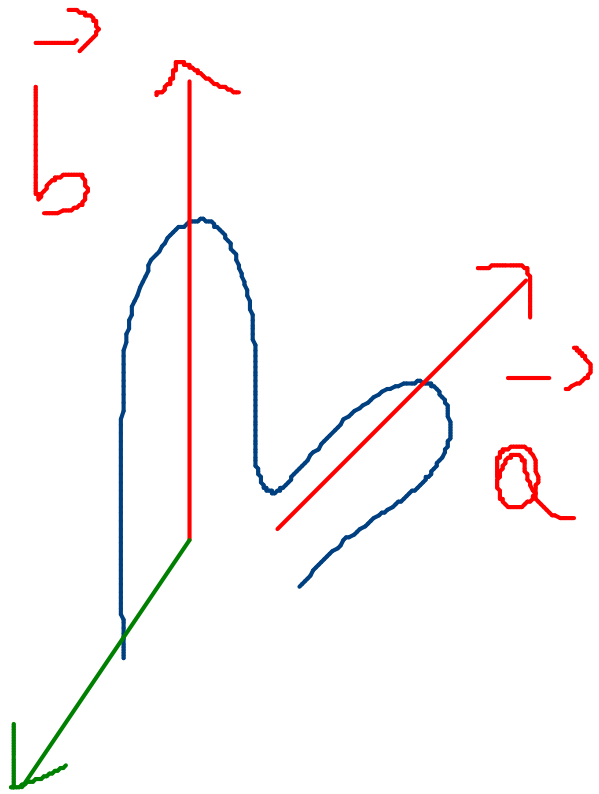


Prodotto vettoriale

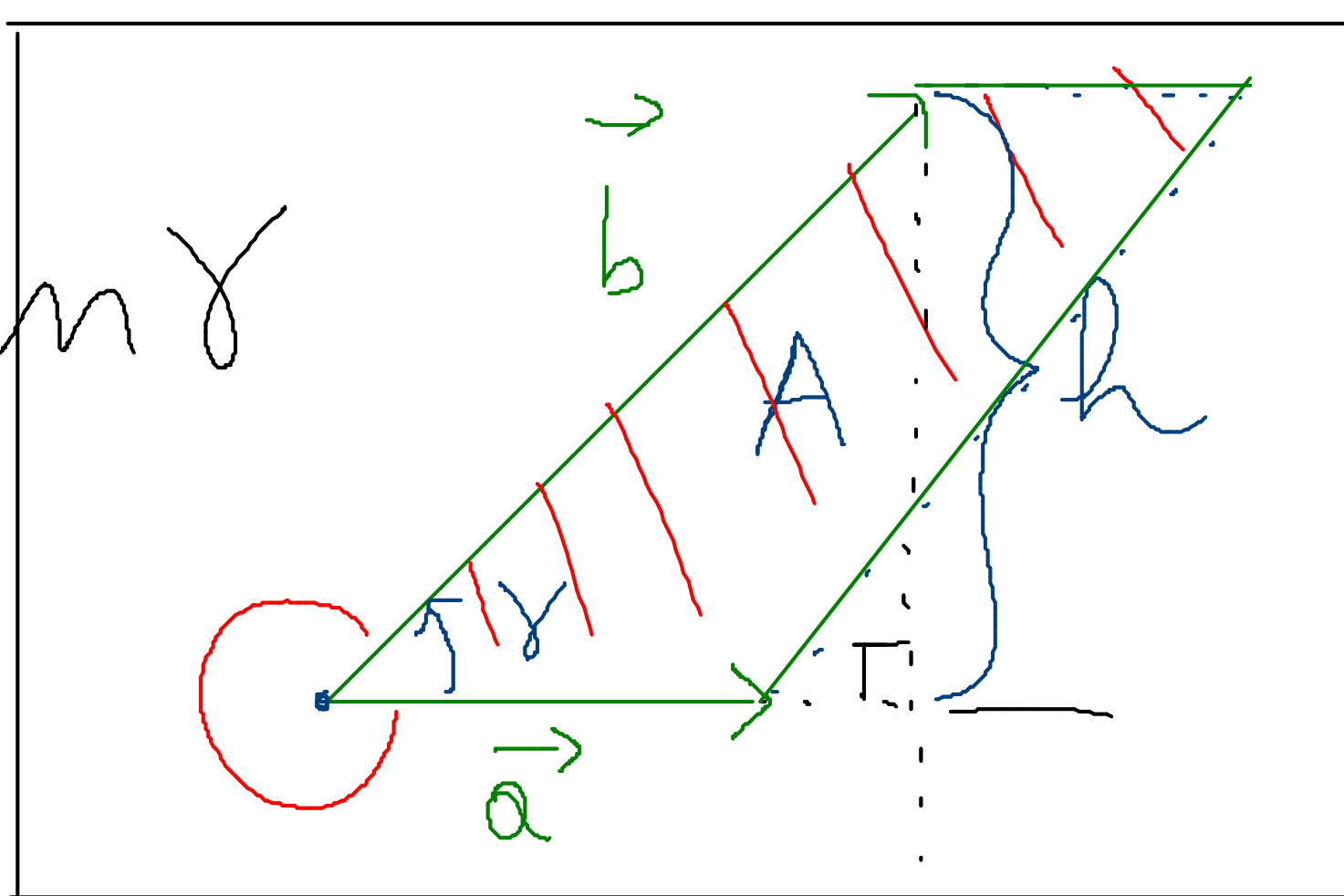
$$\vec{a} \times \vec{b}$$

$$\vec{a} \times \vec{b}$$

$$\vec{b} \times \vec{a}$$



$$h = b \sin \gamma$$



$$\sin 0 = 0$$

$$\sin \frac{\pi}{2} = 1$$

$$\sin \pi = 0$$

$$A = ab \sin \gamma$$

$$\hat{x} \times \hat{x} = 0$$

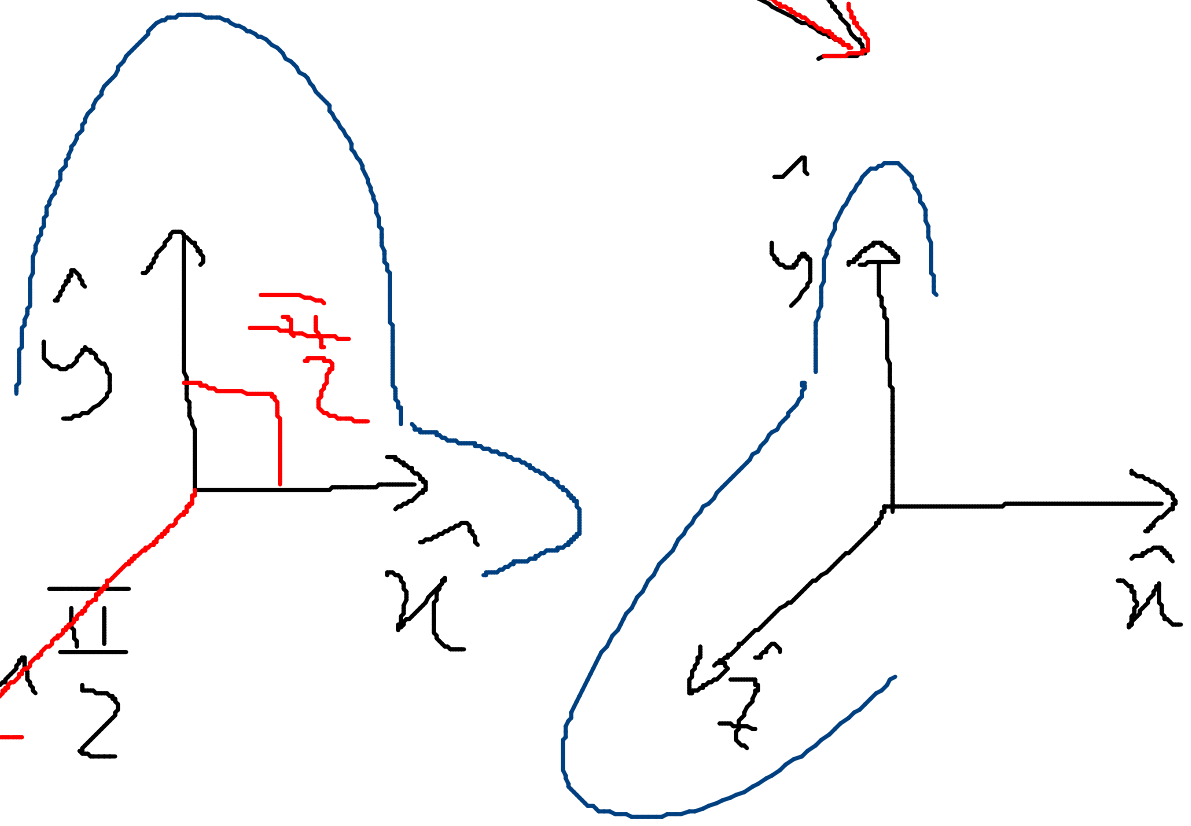
$$\hat{y} \times \hat{y} = 0$$

$$\hat{z} \times \hat{z} = 0$$

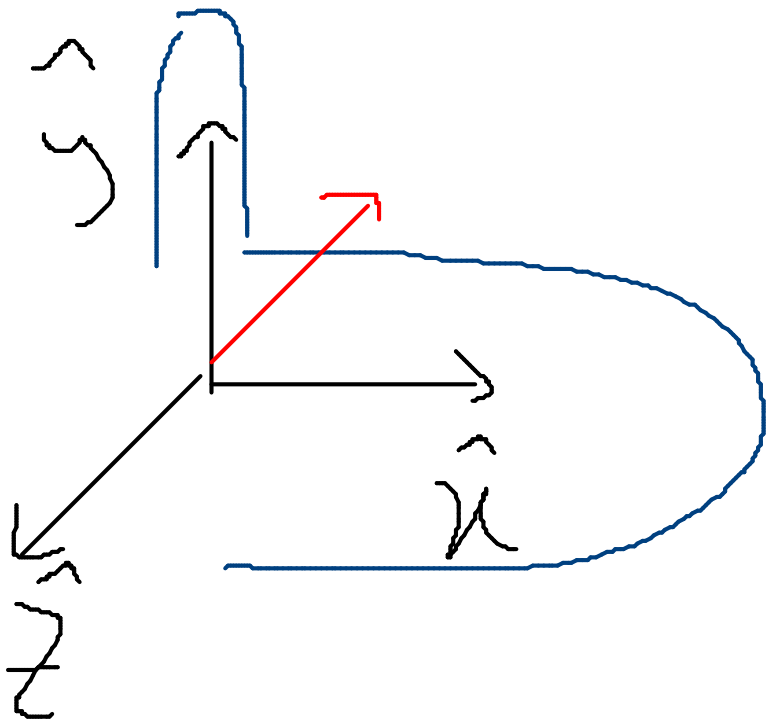
$$\begin{aligned} \hat{x} \times \hat{y} &= \hat{z} \\ \hat{y} \times \hat{z} &= \hat{x} \end{aligned}$$

$$\hat{z} \times \hat{x} = \hat{y}$$

$$\begin{aligned} |\hat{x} \times \hat{y}| &= |\hat{x}| |\hat{y}| \sin \frac{\pi}{2} \\ &= 1 \cdot 1 \cdot 1 = 1 \end{aligned}$$



$$\hat{y} \times \hat{z} = \hat{x}$$



$$\begin{aligned} \hat{y} \times \hat{x} &= -\hat{z} \\ \hat{z} \times \hat{y} &= -\hat{x} \\ \hat{x} \times \hat{z} &= -\hat{y} \end{aligned}$$

\vec{a}, \vec{b}

$$\vec{a} = a_x \hat{x} + a_y \hat{y} + a_z \hat{z}$$
$$\vec{b} = b_x \hat{x} + b_y \hat{y} + b_z \hat{z}$$

$$\vec{a} \times \vec{b} = (a_y b_z - a_z b_y) \hat{x} +$$
$$+ (a_z b_x - a_x b_z) \hat{y} +$$
$$+ (a_x b_y - a_y b_x) \hat{z}$$

$$a = \sqrt{4+0} = \sqrt{4} = 2$$

$$\vec{a} = (2, 0, 0) \quad \vec{c} = \vec{a} \times \vec{b}$$

$$\vec{b} = (0, 3, 0)$$

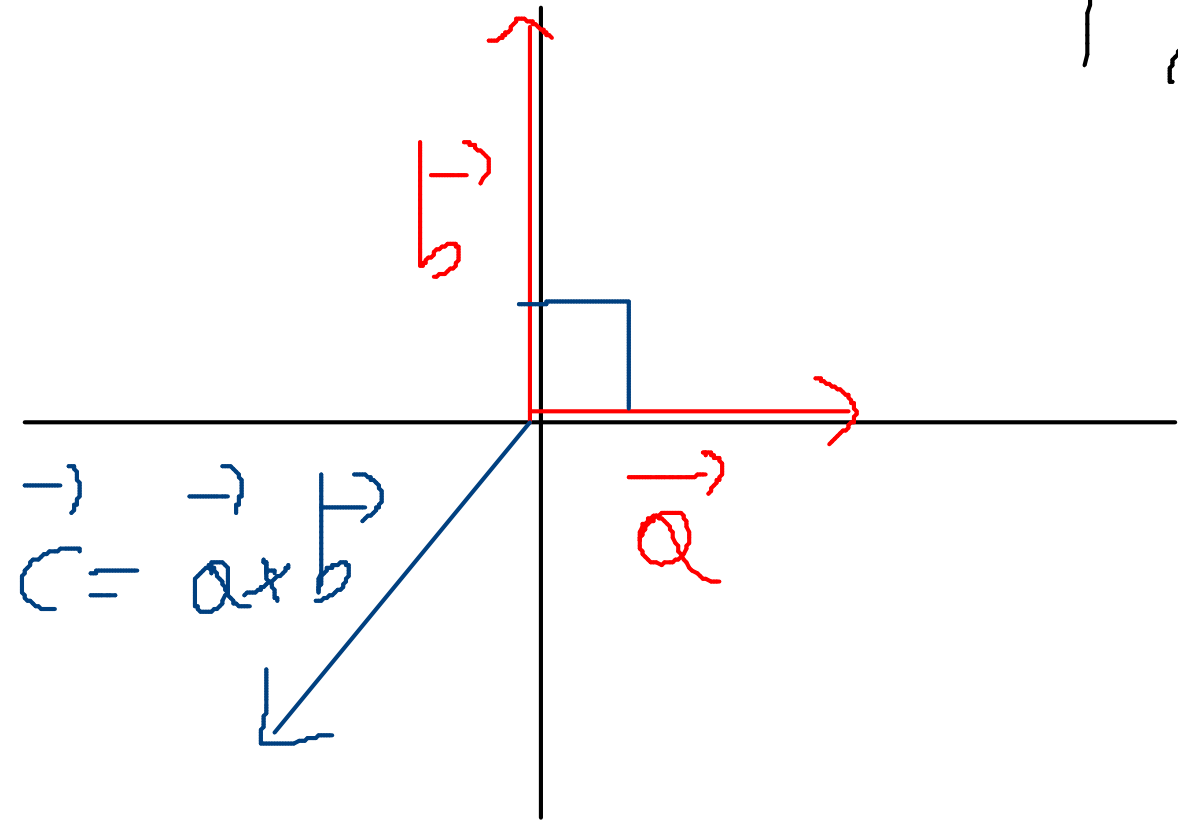
$$|\vec{a} \times \vec{b}| = a \cdot b \cdot \sin \frac{\pi}{2}$$

$$= 2 \cdot 3 \cdot 1 = 6$$

$$c_x = 0$$

$$c_y = 0$$

$$c_z = 6$$



$$\vec{a} = (-2, 0) \quad \vec{b} = (3, 3)$$

$$\vec{v} = (3, 3) \quad \vec{w} = (-2, 2)$$

$$\vec{a} = \left(\frac{1}{2}, -\frac{3}{2}\right) \quad \vec{b} = \left(\frac{3}{2}, \frac{1}{2}\right)$$
