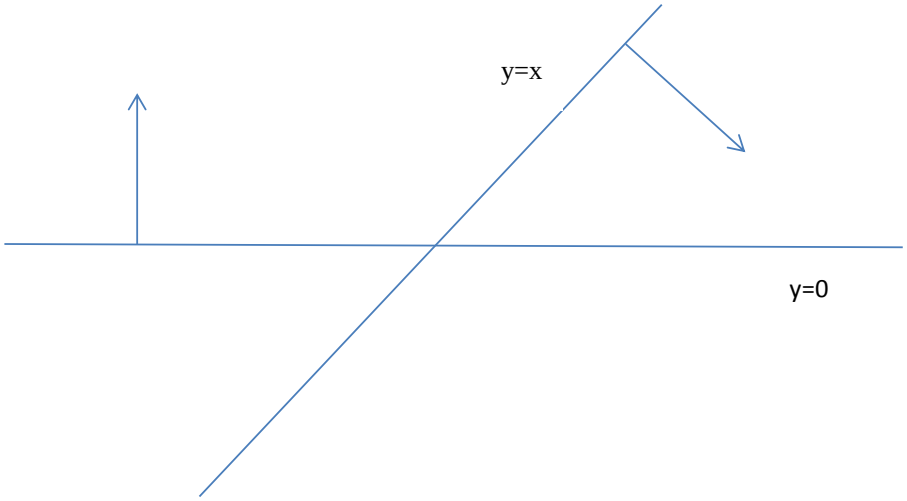
If line with y=0 is moving with velocity vĴ and line y=x is moving with velocity (v/√2)*(i^ - Ĵ), then find speed of intersection point of two lines. (here i^ means i cap and Ĵ means j cap)



Equation of the first line ($y = y_0 + vt,\ y_0 = 0$):

$y - vt\ = 0$

Equation of the second line ($y = y_0 - \frac{v}{\sqrt{2}}t, x = x_0 + \frac{v}{\sqrt{2}}t,\ x_0 = y_0$) :

$y + \frac{v}{\sqrt{2}}t = x - \frac{v}{\sqrt{2}}t$

The system of equations allowing to find intersection point:

$$\begin{cases} y - vt\ = 0 \\ y + \frac{v}{\sqrt{2}}t = x - \frac{v}{\sqrt{2}}t \end{cases}$$

or:

$$\begin{cases} y = vt \\ x = y + \sqrt{2}vt \end{cases} \Rightarrow \begin{cases} y = vt \\ x = (1+\sqrt{2})vt \end{cases}$$

Therefore, its speed:

$$V = \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2} = v\sqrt{\left(1+\sqrt{2}\right)^2 + 1^2} = v\sqrt{4+2\sqrt{2}}$$

Answer: $v\sqrt{4+2\sqrt{2}}$