$$\begin{cases} x(t) = 2\cos\left(\frac{\pi}{2}t\right) \\ y(t) = 4\sin\left(\frac{\pi}{2}t\right) \\ z(t) = 0 \end{cases}$$

$$\begin{cases} x^2(t) = 2^2\cos^2\left(\frac{\pi}{2}t\right) \\ y^2 = 4^2\sin^2\left(\frac{\pi}{2}t\right) \end{cases} \Rightarrow \begin{cases} \frac{x^2}{2^2} = \cos^2\left(\frac{\pi}{2}t\right) \quad (1) \\ \frac{y^2}{4^2} = \sin^2\left(\frac{\pi}{2}t\right) \quad (2) \end{cases}$$

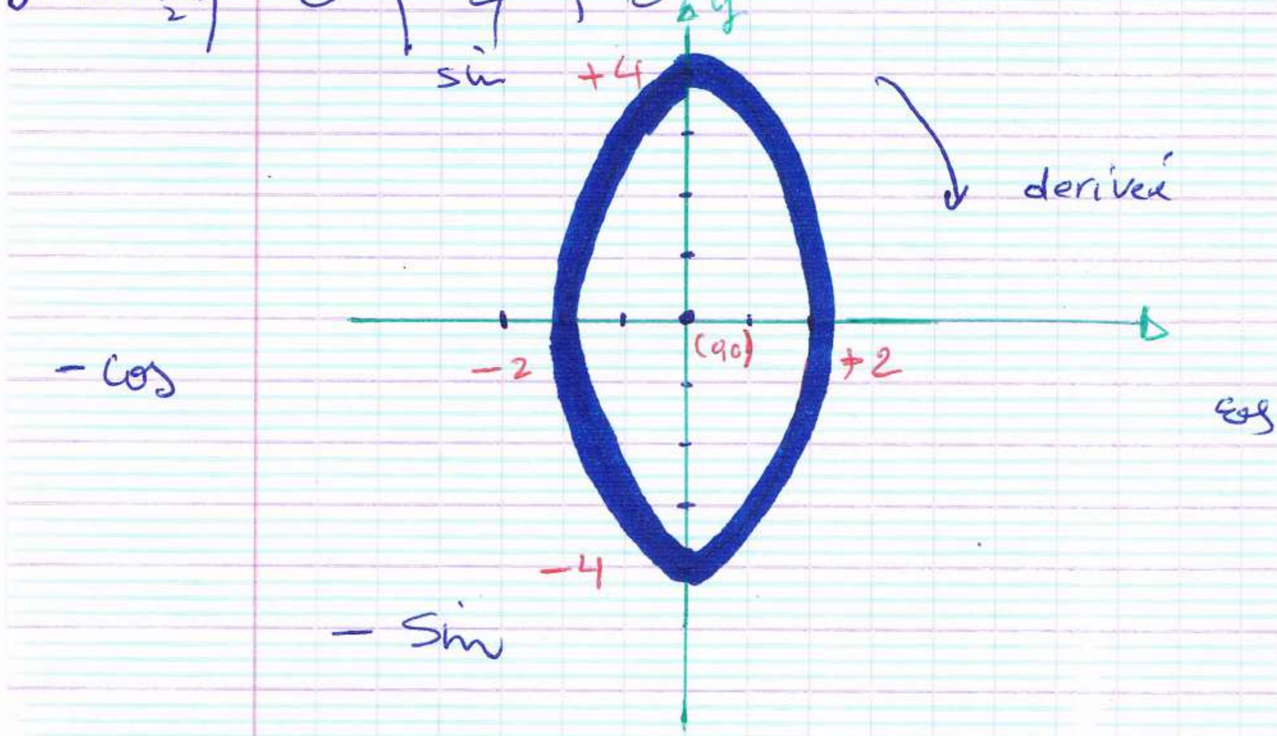
$(1) + (2) \Rightarrow$

$$\boxed{\frac{x^2}{2^2} + \frac{y^2}{4^2} = 1}$$ ellipse trajectory

NB $$\boxed{\frac{(x-x_0)^2}{a^2} + \frac{(y-y_0)^2}{b^2} = 1}$$

$$\frac{(x-0)^2}{2^2} + \frac{(y-0)^2}{4^2} = 1 \quad \Big\} \text{ centre } (0,0)$$

t	0	1	2
$x = 2\cos\frac{\pi}{2}t$	2	0	-2
$y = 4\sin\frac{\pi}{2}t$	0	4	0



3/ the expression of the position vector $\vec{OM}$:

$$\boxed{\vec{OM} = \left[2\cos\left(\frac{\pi}{2}t\right)\right]\vec{i} + \left[4\sin\left(\frac{\pi}{2}t\right)\right]\vec{j}}$$

4/ the velocity vector $\vec{V}$ and the acceleration vector $\vec{a}$

$$\vec{V} = \frac{d\vec{OM}}{dt} = \left[-\cancel{2}\frac{\pi}{\cancel{2}}\sin\left(\frac{\pi}{2}t\right)\right]\vec{i} + \left[\cancel{4}\left(\frac{\pi}{\cancel{2}}\right)\cos\left(\frac{\pi}{2}t\right)\right]\vec{j}$$

$$\boxed{\vec{V} = \left[-\pi\sin\left(\frac{\pi}{2}t\right)\right]\vec{i} + \left[2\pi\cos\left(\frac{\pi}{2}t\right)\right]\vec{j}}$$

$$\vec{a} = \frac{d\vec{V}}{dt} = \left[-\pi\left(\frac{\pi}{2}\right)\cos\left(\frac{\pi}{2}t\right)\right]\vec{i} + \left[-\cancel{2}\pi\left(\frac{\pi}{\cancel{2}}\right)\sin\left(\frac{\pi}{2}t\right)\right]\vec{j}$$

$$\left[\pi^2\sin\frac{\pi}{2}t\right]\vec{j}$$

$$\vec{a} = \left[-\frac{\pi^2}{2}\cos\left(\frac{\pi}{2}t\right)\right]\vec{i} - \left[\right.$$