

!

$$f(x) = x^2$$

función de prueba

$$f'(x) = \frac{-f(x+2h) + 4f(x+h) - 3f(x)}{2h}$$

$$\lim_{h \rightarrow 0} \frac{-(x+2h)^2 + 4(x+h)^2 - 3x^2}{2h}$$

$$= \lim_{h \rightarrow 0} \frac{(x+2h)(x+2h) + 4x^2 + 4h^2 + 8xh - 3x^2}{2h}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{x^2} + 4xh + 4h^2 + 4x^2 + 4h^2 + 8xh - \cancel{3x^2}}{2h}$$

$$= \lim_{h \rightarrow 0} \frac{2 \cancel{4xh}}{2h}$$

$$= \lim_{h \rightarrow 0} 2x = 2x$$

$$f'(x) = 2x \quad \checkmark \text{ es consistente}$$

$$f''(x) = \frac{f(x+h) - 2f(x) + f(x-h)}{h^2}$$

$$\lim_{h \rightarrow 0} \frac{(x+h)^2 - 2x^2 + (x-h)^2}{h^2}$$

$$\lim_{h \rightarrow 0} \frac{\cancel{x^2} \cancel{+ 2xh} \cancel{+ h^2} - 2x^2 + \cancel{x^2} \cancel{- 2xh} \cancel{+ h^2}}{h^2}$$

$$\lim_{h \rightarrow 0} \frac{2h^2}{h^2} = \lim_{h \rightarrow 0} 2 = 2$$

$$f''(x) = 2$$

$$f(x) = \sin(x)$$

2da función
prueba

$$f'(x) = \frac{-f(x+2h) + 4f(x+h) - 3f(x)}{2h}$$

$$\lim_{h \rightarrow 0} \frac{-\sin(x+2h) + 4\sin(x+h) - 3\sin x}{2h}$$

$$\stackrel{!}{=} \lim_{h \rightarrow 0} \frac{-\left(\sin(x+2h)\right)' + \left[4\sin(x+h)\right]' - 3\left[\sin x\right]'}{[2h]}'$$

$$\stackrel{!}{=} \lim_{h \rightarrow 0} \frac{-2\cos(x+2h) + 4\cos(x+h)}{2}$$

$$= \lim_{h \rightarrow 0} -\cos(x+2h) + 2\cos(x+h)$$

$$= -\cos(x) + 2\cos(x)$$

$$= \cos(x) \quad \checkmark$$

$$f''(x) = \frac{f(x+h) - 2f(x) + f(x-h)}{h^2}$$

$$\lim_{h \rightarrow 0} \frac{\sin(x+h) - 2\sin x + \sin(x-h)}{h^2}$$

$$\lim_{h \rightarrow 0} \frac{\cos(x+h) - \cos(x-h)}{2h}$$

$$= \lim_{h \rightarrow 0} \frac{-\sin(x+h) - (-\sin(x-h))}{2}$$

$$= \lim_{h \rightarrow 0} \frac{-\sin(x+h) - \sin(x-h)}{2}$$

$$\frac{-\sin(x) - \sin(x)}{2}$$

$$\frac{-\cancel{x} \sin(x)}{\cancel{x}}$$

$$-\sin(x)$$

$$f''(x) = -\sin x \quad \checkmark$$

es consistente

$$3. \quad c = 3 \times 10^8 \text{ m/s}$$

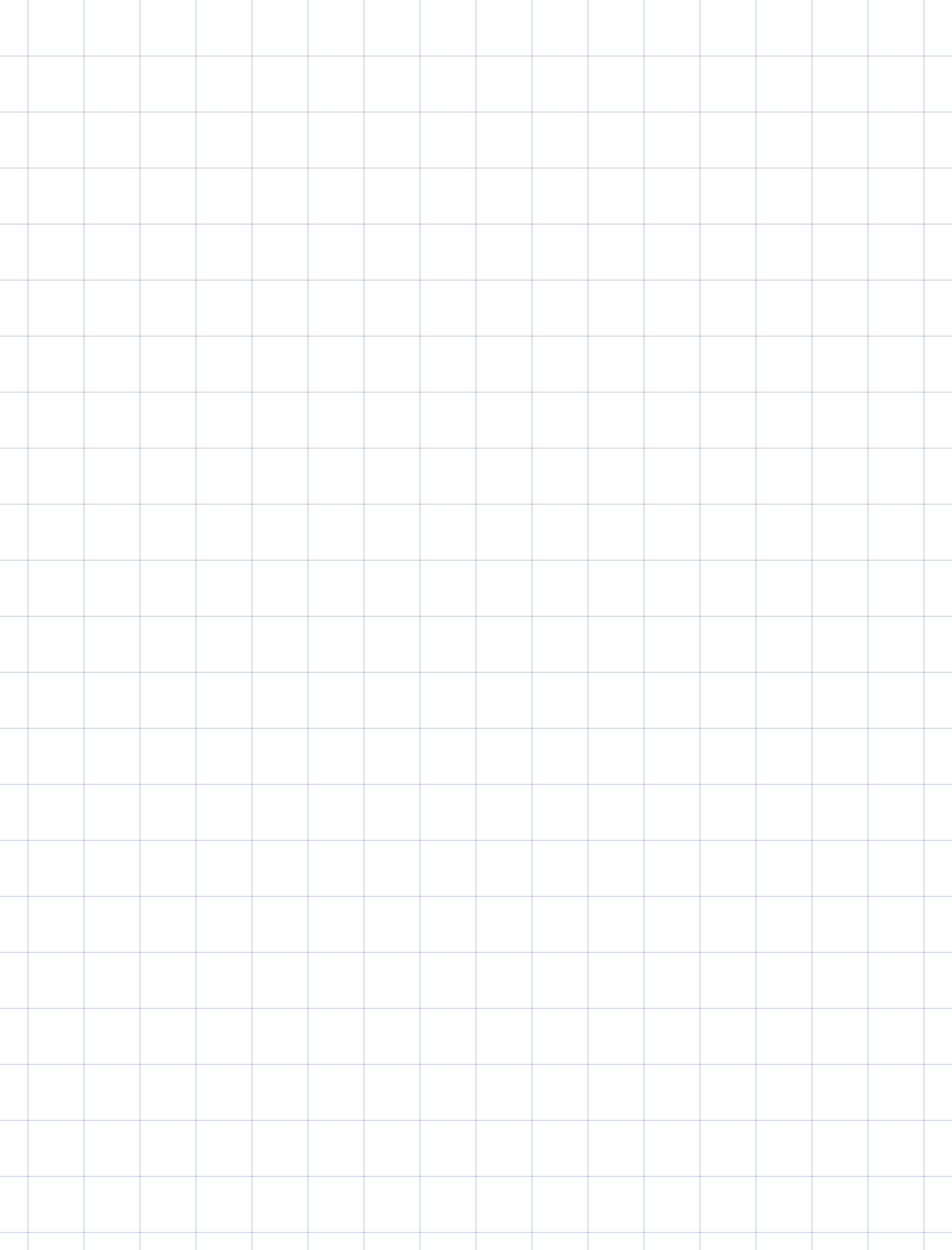
$$l_{au} = 1.496 \times 10^{11} \text{ m}$$

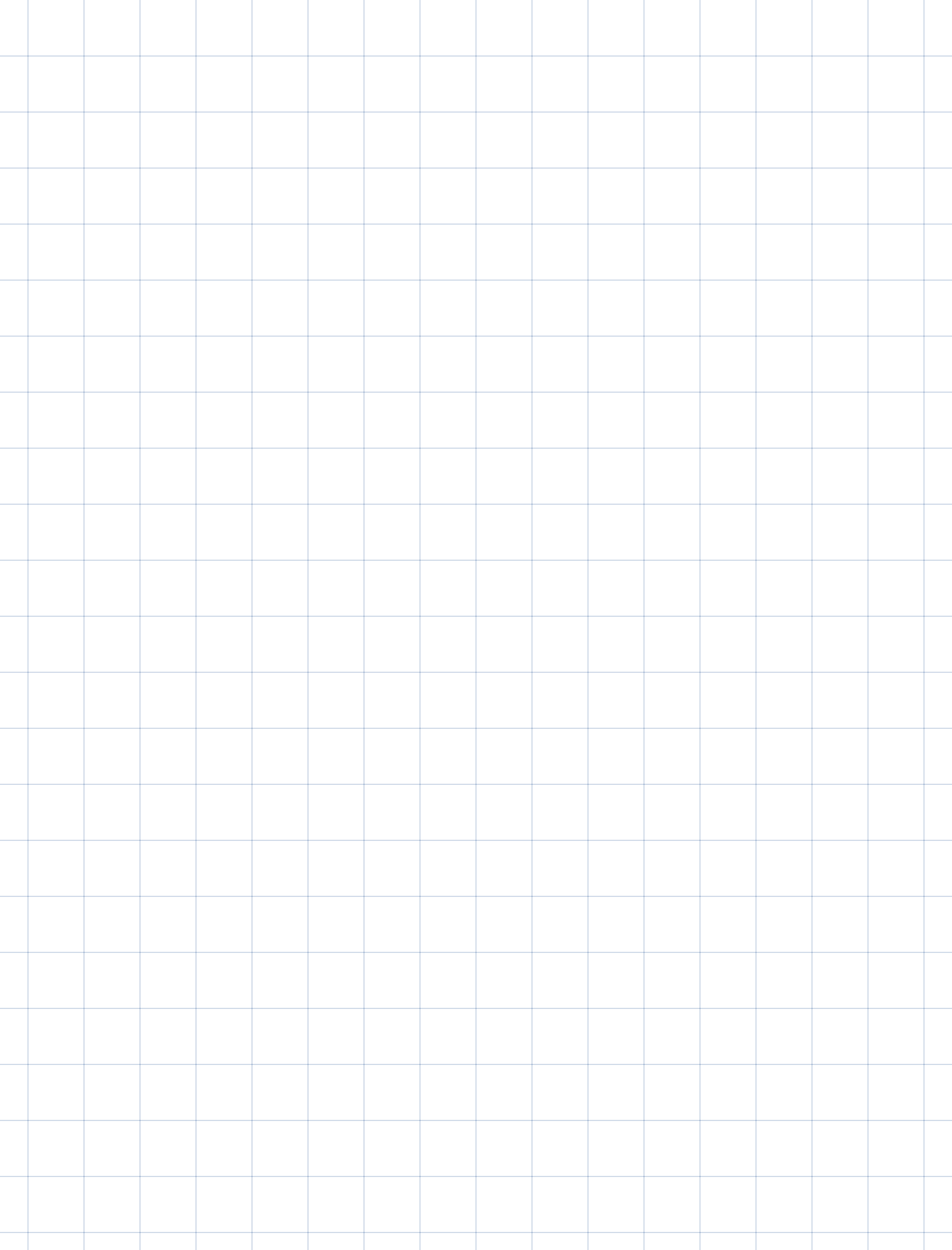
$$1 \text{ día} = 86400 \text{ s}$$

$$1 \text{ año} = 365 \text{ días}$$

$$c = 3 \times 10^8 \frac{\text{m}}{\text{s}} \left(\frac{l_{au}}{1.496 \times 10^{11} \text{ m}} \right) \left(\frac{86400 \text{ s}}{1 \text{ día}} \right) \left(\frac{365 \text{ días}}{1 \text{ año}} \right)$$

$$c = 63,240 \text{ ua/año}$$





5.

$$v_0(0) = v_0$$

$$\frac{\delta v}{\delta t} = \alpha v$$

$$\delta v = \alpha v \delta t$$

$$\Delta v = \alpha v_0 \Delta t$$

$$v_1 = v_0 + \Delta v$$

$$v_1 = v_0 + \alpha v_0 \Delta t$$

$$v_1 = v_0 (1 + \alpha \Delta t)$$

$$v_k = v_{k-1} (1 + \alpha \Delta t)$$

$$U_k = (U_{k-2}(1 + \alpha \Delta t))(1 + \alpha \Delta t)$$

$$U_k = U_{k-k} \left[\prod_{i=1}^k (1 + \alpha \Delta t) \right]$$

$$U_k = U_0 (1 + \alpha \Delta t)^k$$

Si $\alpha < 0$:

$$1 + \alpha \Delta t = 1 - |\alpha| \Delta t$$

Si $\Delta t > \frac{1}{|\alpha|}$

$$\Delta t > \frac{1}{|\alpha|}$$

$$|\alpha| \Delta t > 1$$

$$0 > 1 - |\alpha| \Delta t$$

$$1 - |\alpha| \Delta t < 0$$

$$1 + \alpha \Delta t < 0$$

$$\rightarrow \forall n \in \mathbb{N}:$$

$$k = 2n \Leftrightarrow (1 + \alpha \Delta t)^k > 0$$

$$k = 2n + 1 \Leftrightarrow (1 + \alpha \Delta t)^k < 0$$

$$\therefore v_k = v_0 (1 \mp \alpha \Delta t)^k$$

oscila de positivo
a negativo en cada
punto

