2.b IC: $u(x,0) = f(x)$

Since $u_n(x,t) = \cos\left(\frac{(2n-1)x\cdot\pi}{2L}\right) \cdot C_n \cdot e^{-\left(\frac{\pi}{2L}(2n-1)\right)^2 p t}$

PDE & BC are linear & homogeneous.

General solution is:

$$u(x,t) = \sum_{n=1}^{\infty} \cos\left(\frac{(2n-1)x\cdot\pi}{2L}\right) \cdot C_n \cdot e^{-\left(\frac{\pi}{2L}(2n-1)\right)^2 \cdot p \cdot t}$$

For $u(x,0)$ we have:

$$u(x,0) = \sum_{n=1}^{\infty} \cos\left(\frac{(2n-1)x\pi}{2L}\right) C_n = f(x)$$