\[ C = \frac{\text{capacitance}}{\text{length}} \quad RF/cm \quad C_m \mu F/cm^2 \]
\[ R_i = \text{cm resistance} \quad R_m = \text{cm nue of cm} \]

Lossless core, Ohm's law 
\[ \Delta V = R_i \Delta X \Delta t \]

derivative 
\[ \frac{dV}{dx} = R_i \Delta t \]

take derivative 
\[ \frac{d^2V}{dx^2} = R_i \frac{dL_{long}}{dx} = R_i C_m \frac{dV}{dt} + \frac{V}{R_m} \]

Loss thru mem 
\[ \frac{dL_{mem}}{dx} = \frac{dL_{mem}}{x} = C_m = C_m \frac{dV}{dt} + \frac{V}{R_m} \]

Substitute 4 into 3 
\[ \frac{d^2V}{dx^2} = \sqrt{\frac{R_i}{R_m}} + \frac{R_i C_m dV}{dt} \]

Rearrange 
\[ V = \frac{R_m C_m}{R_i} \frac{dV}{dx} - \frac{R_i C_m}{\omega} \frac{dV}{dt} \]

outside resistor 

solve holding \( t \to \infty \) 

space constant 

solve for \( x = 0 \) 

time constant 

change res ninja units 

\[ \lambda = \sqrt{\frac{R_i}{R_m}} = \sqrt{\frac{R_{\text{res}}/\pi a^2}{a R_4}} = \sqrt{\frac{a R_m}{2 R_4}} \]

change units 

\[ T = R_m C_m = \frac{(R_m/2\pi a)(2\pi a C_m)}{C_m} = R_m C_m \]

time constant independent of radius