Space Constant Practice Problems

1)Let r_{m1} and c_{m1} being the membrane resistance and capacitance of axon 1 and r_{m2} and c_{m2} be those of axon 2, respectively.If $r_{m2}=2r_{m1}$and $c_{m1}=c_{m2}$, then what are the relationship between the space constant of the two membrane λ_1 and λ_2 and the time constant τ_1 and τ_2. Given $r_{i2}=r_{i1}$

2)Consider two axons with similar membrane composition and size. The cytoplasm of 1 axon has a resistance that is twice that of other, $r_{i2}=r_{i1}$. How did length constant λ_1 and λ_2 will compare ? Given $r_{m1}=r_{m2}$

4)Consider 2 long myelinated axons with these parameters: λ_1=3 mm and λ_2 =30 mm
RMP(resting membrane potential) = - 65 mV, Threshold for AP generation are Th1 =- 53 mV (for axon 1) and Th2 = - 51 mV (for axon 2)
Length of internode = 1.5 mm ,length of node = 21 μm .the steady state voltage curve was obtained by stimulating the cells in the centre and recording a different nodes

a)Which axon is better in terms of nerve pulse conduction?Why?
b) consider a case in which 2 internodes degenerate due to multiple sclerosis in both the axons. If AP is generated at the centre of the axons, which axon will be able to propagate AP through the demyelinated patch? Give calculations to support your answer. Assume that demyelinated segment contains leaky channels only and no Na^+ and K^+ channels

b)Repeat the above question if 8 internodes have been generated