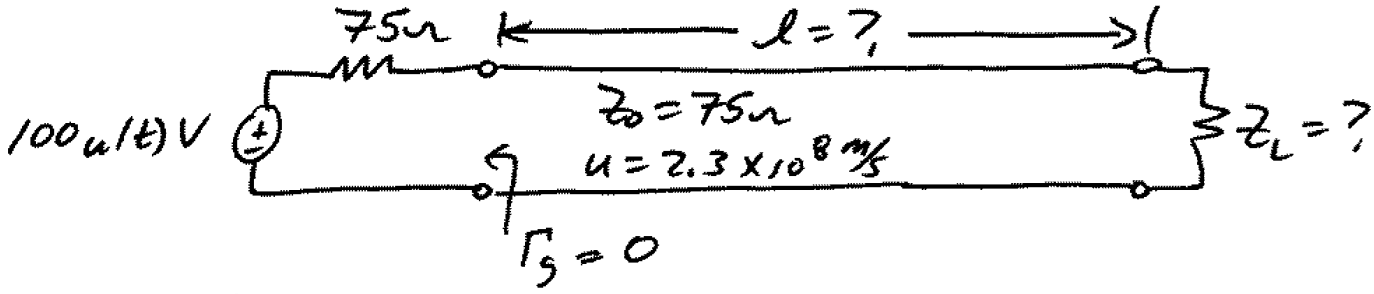
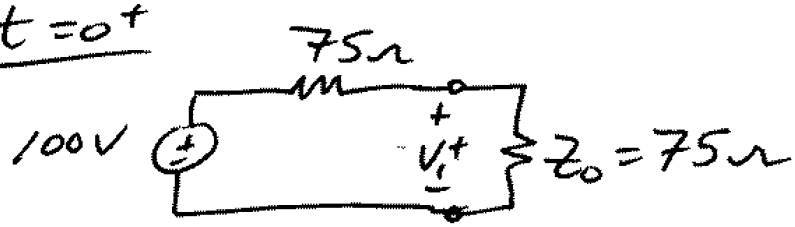
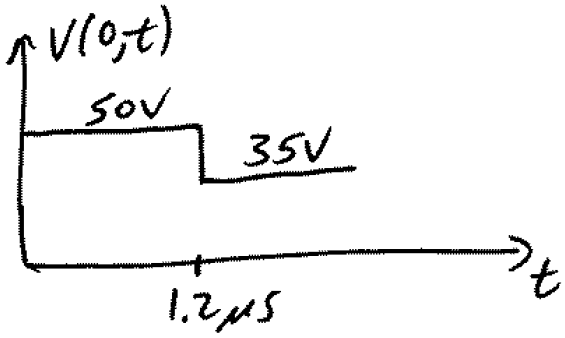
A TDR that has an open circuit voltage of 100 $u(t)$ V and a Thevenin resistance of 75 Ω is connected to a length of lossless transmission line (Z_0 = 75 Ω, $u = 2.3 \times 10^8$ m/s) of unknown length with an unknown resistive load. At the TDR terminals, what voltage would initially be measured? If the voltage measured at the TDR terminals changes to 35 V at 1.2 μs, what is the length of the cable and the load resistance?



@ $t = 0^+$



$$V_{init} = V_1^+ = (100\,V)\frac{75}{75+75} = 50\,V$$

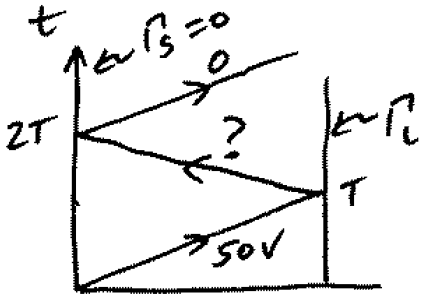


$2T = 1.2\,\mu s$

$T = 0.6\,\mu s = \ell/u$

$\ell = 0.6\,\mu s\,(2.3 \times 10^8\,m/s)$

$\ell = 138\,m$



$$35\,V = 50\,V + \Gamma_L(50\,V) + 0(\Gamma_L)(50\,V) \Rightarrow \Gamma_L = \frac{35-50}{50} = -0.3$$

$$Z_L = Z_0\frac{1+\Gamma_L}{1-\Gamma_L} = 75\,\frac{1-0.3}{1-(-0.3)} = 40.3846\,\Omega$$