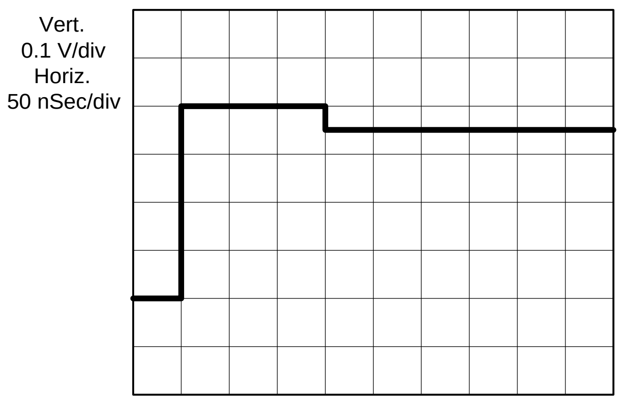
Coaxial Cables

RG #	AWG Material	Insulation	# Shields	Jacket	Nom. O.D. (inch)	Nom. Imp. (Ohms)	Nom. Vel. Of Prop.	Nom. Cap. (pF/ft.)	Nom. Attenuation per 100' MHz	dB	Standard Spool Lengths
14/U	20 Copper	Poly-ethylene	1	Black Vinyl	.420	95	66%	16.0	100 200 400	3.0 4.5 6.0	100, 500
14A/U	20 Copper	Poly-ethylene	1	Black Vinyl	.420	92	66%	16.0	100 200 400	3.5 5.0 7.0	100, 500
16A/U	18 Copper	Cellular Poly-ethylene	1	Black Vinyl	.195	50	78%	30.8	100 200 400	5.0 7.0 9.5	100,500 1000
18/U	18 Copper	Cellular Poly-ethylene	1	Black Vinyl	.280	75	78%	24	100 200 400	2.0 3.0 4.5	100,500 1000

Problem #1) A TDR test was performed on a piece of **RG 16A/U** cable of unknown length, terminated with a purely resistive load. The results of the test are as follows (assume the cable is lossless):

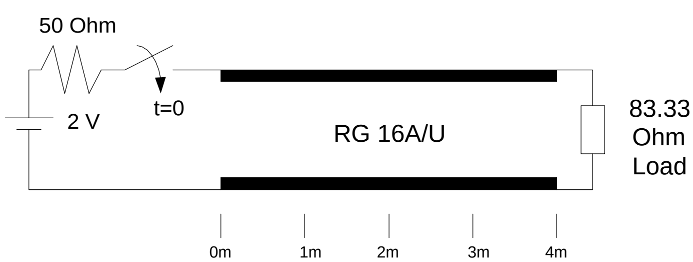


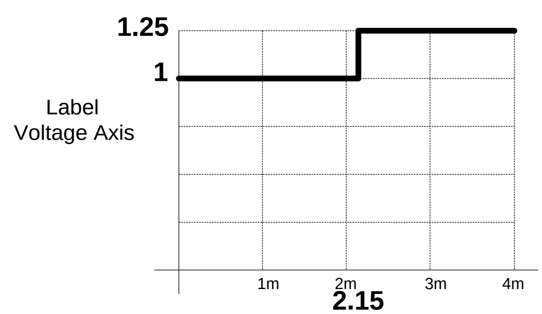
Determine the **length** of the cable in meters and the **load impedance** in ohms.

Length = ______**17.55**___________ (m)

R_{load} = _________**38.9**_____________Ω

Problem #2) Given the system shown below containing a transmission line (due to the short length of the line, you may assume the line is lossless for this problem),
Plot the **voltage** along the line as a function of position at a time of t = 25 nsec.





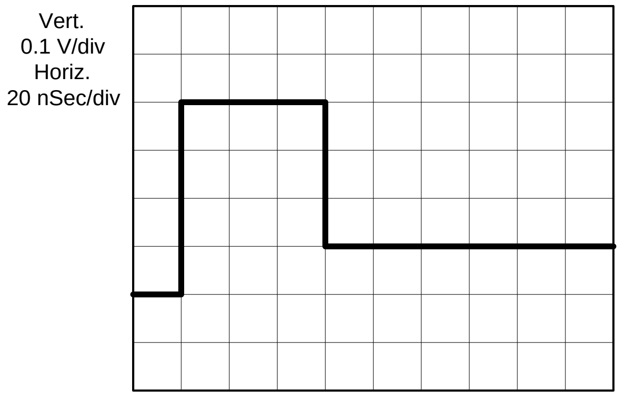
Problem #3) A coaxial cable has an inner-conductor diameter of 0.5mm, an outer diameter of 5mm, and is filled with polyurethane (ε_r = 1.9). Determine the **characteristic impedance** (**Z_o**) of the cable.

Z_o = ___________**100**__________(Ω)

Problem #4) A 6 meter, RG 14/U type coaxial cable is excited by a 450 MHz source. Determine the **electrical length** (L) of the line in wavelengths.

L = ___________**13.636**__________(λ)

Problem #5) A TDR test was performed on a piece of **RG 14A/U** cable of unknown length, terminated with a purely resistive load. The results of the test are as follows (assume the cable is lossless):

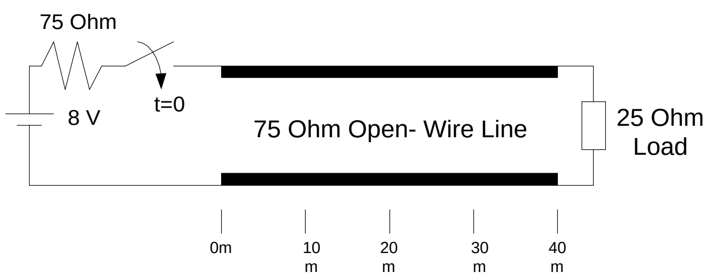


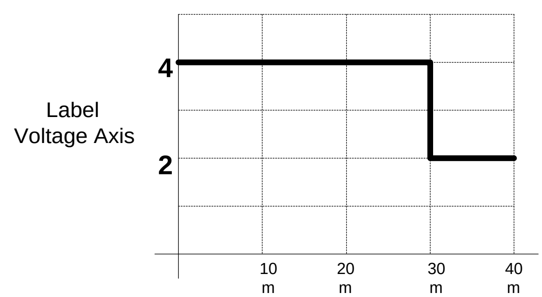
Determine the **length** of the cable in meters and the **load impedance** in ohms.

Length = ________**5.94**__________ (m)

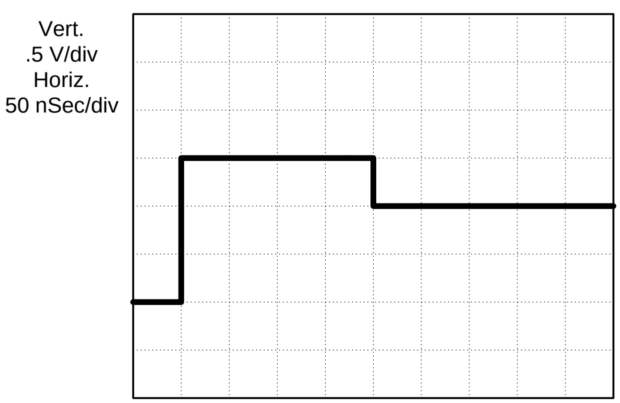
R_{load} = _________**13.14**____________Ω

Problem #6) Given the system shown below containing a lossless line,
Plot the **voltage** along the line as a function of position at a time of t = 167 nsec.





Problem #7) A TDR test was performed on a piece of **RG 16A/U** cable of unknown length, terminated with a purely resistive load. The results of the test are as follows (assume the cable is lossless):

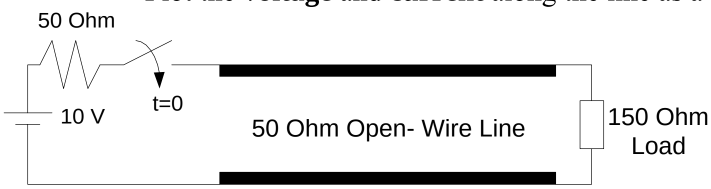


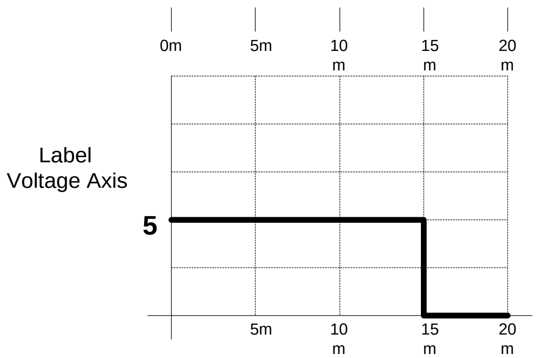
Determine the **length** of the cable in meters and the **load impedance** in ohms.

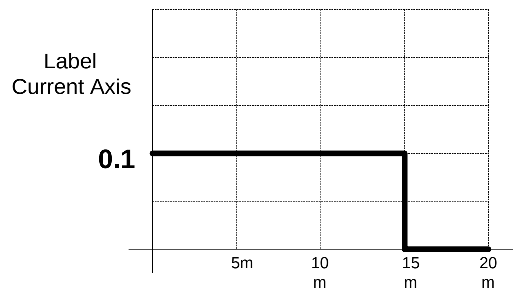
Length = _______**23.4**_______ (m)

R_{load} = _________**25**___________Ω

Problem #8) Given the system shown below containing a lossless line,
Plot the **voltage** and **current** along the line as a function of position at t = 0.05 μsec.







Problem #9) **Define** the "Characteristic Impedance" of a transmission line. (Do NOT provide formulas)

(See textbook)

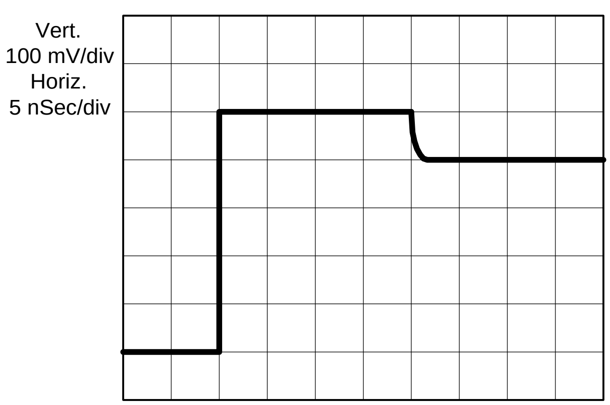
Problem #10) A long piece of **RG 14/U** cable is measured to have an attenuation value of 12.5 dB at 200 MHz.
Determine the unknown **length** of the cable.

Length = ________**277.8**_______ ft.

Problem #11) It is determined that a transient propagates down the entire length of a 200 meter spool of coaxial cable in 1.075 μsec. Assuming a unity relative permeability (μ_r=1) for the cable, determine the **relative permitivity** (ε_r) of the insulation within the cable.

ε_r = _________**2.6**_________________

Problem #12) A TDR test was performed on a piece of RG 16A/U cable terminated with an unknown load. The results of the test are as follows (assume the cable is lossless):



Determine the **length** of the cable in meters and the **load impedance** in ohms.

length = _______**2.34**__________ (m)

Z_R = __________**33.3**____________Ω

Problem #13) A 4 mW r.f. wave is applied to the input of a transmission line with a matched load.

a) **Convert** this value to **dBm**.

b) If the transmission line is a 200' section of RG 14/U and the frequency of the wave is 100MHz, how much r.f. power will reach the **receiving end** of the line (in dBm)

a) P_{in} = _______**6**__________ (dBm)

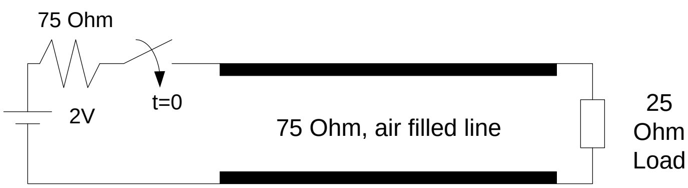
b) P_{out} = _______**0**_________ (dBm)

Problem #14) Determine the attenuation constant and the propagation constant for a section of RG 14A/U at a frequency of 400 MHz. (1 ft = 0.3048 m)

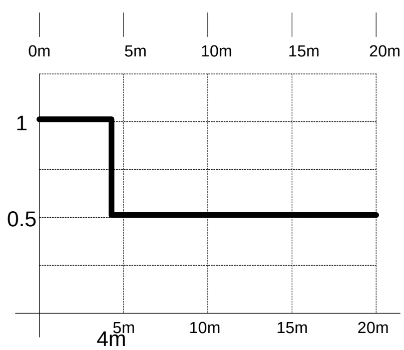
α = _________**0.00805**______(Np/ft)

β = _________**3.86**_______(rad/ft)

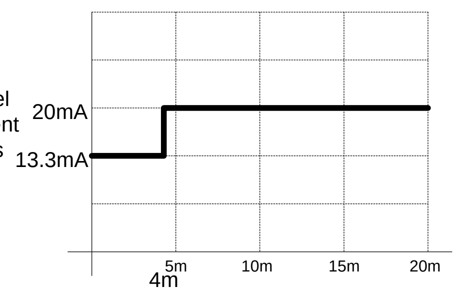
Problem #15) Given the system shown below containing a transmission line (assume the line is lossless), Plot the **voltage** and **current** along the line as a function of position at a time of t = 0.12 μsec after the switch closes.



Label
Voltage
Axis

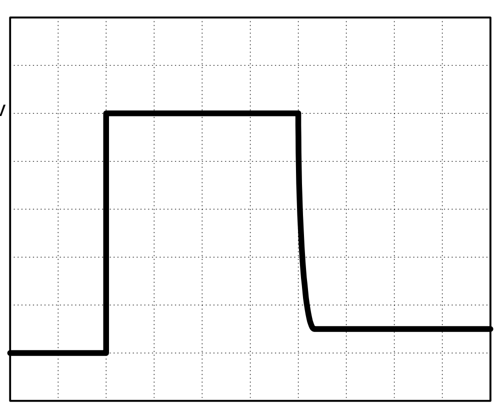


Label
Current
Axis



Problem #16) A TDR test was performed on a piece of RG 18/U cable terminated with an unknown load. The results of the test are as follows (assume the cable is lossless):

Vert.
100 mV/div
Horiz.
500 nSec/div



Determine the **length** of the cable in meters and the **load impedance** in ohms.

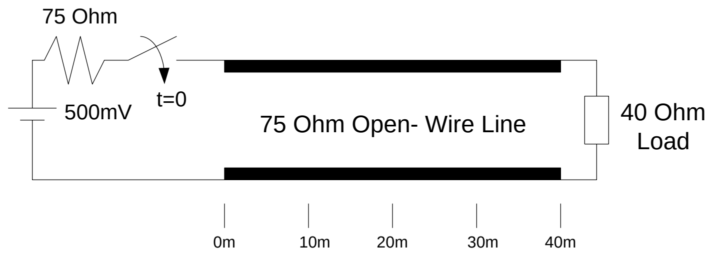
length = _______________________ (m)

Z_R = ___________________________Ω

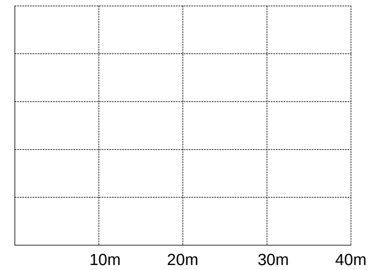
If the cable is not assumed lossless, would your answers change? (circle one)➔ (Yes / No)

Justify your answer in the space below:

Problem #17) Given the system shown below containing a lossless line,
Plot the **voltage** as a function of position at a time of t = 467 nsec after the switch closes.



Label your Voltage values



Problem #18) A 20mW r.f. wave is applied to the input of a transmission line terminated with a matched load.

c) **Convert** this input power value to **dBm**.

d) If the transmission line is a 150' section of **RG 16A/U** and the frequency of the wave is 400MHz, how much r.f. power will reach the **receiving end** of the line (in dBm)

e) **Convert** the dBm output power to its equivalent **milliwatts** value.

c) P_{in} = ____________________ (dBm)

d) P_{out} = ________ _ __________ (dBm)

e) P_{out} = ________ _ __________ (mW)

Problem #19) For each of the following, specify whether or not each of the responses is true by writing either **TRUE** or **FALSE** in the blank preceding each response.

____________ The magnitude of a ***reflection coefficient*** due to a load can never be greater than one.

____________ The ***characteristic impedance*** of a transmission-line defines the ratio of voltage to current of an incident or a reflected waveform.

____________ For normal transmission-lines, the ***permeability*** of the material surrounding the line is assumed to be one.

____________ Given a source connected to a coaxial line; if the source frequency is increased, the ***wavelength*** on the line will also increase.

____________ The ***nominal velocity*** (as given in table 1-3 of the text) defines the velocity of a wave on a coaxial-cable as a percent (%) of the speed of light in "air" (free-space).

____________ When expressed in decibels, ***attenuation*** on a coaxial-cable is linearly proportional to length.

____________ Both the ***attenuation constant*** (α) and the ***phase delay*** (β) may be assumed to be zero on a lossless transmission-line.

Answers to True/False:

False True True False True True True

Last ← First

Additional True/False Problems)

___________ The ***magnitude*** of the ***reflection coefficient*** due to a termination must be less than one.

___________ A ***lossless*** transmission-line will always have a propagation velocity of $3x10^8$ m/sec or less.

___________ Given a source connected to a coaxial line; if the source frequency is increased, the ***wavelength*** on the line will also increase.

___________ When expressed in decibels, ***attenuation*** on a coaxial-cable is linearly proportional to length.

___________ The ***velocity of propagation*** is assumed to be $3x10^8$ m/sec for an air-filled coaxial cable.

___________ The ***attenuation constant*** (α) and the ***phase delay*** (β) must both be non-zero on a lossy transmission line.

___________ For normal coaxial transmission-lines, the ***relative permittivity*** of the material between the conductors is assumed to be one.

Answers to True/False:

False False True True False True False

Last ← First