Name : Solution Section:_____ CWRU e-mail:_____

CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 9 **3/25/05**

PUT ANSWERS IN THE SPACE PROVIDED AND, IF APPROPRIATE, SHOW YOUR WORK. BE SURE TO STATE ANY ASSUMPTIONS

Problem 1 Exponential Waveforms (10 points)

An exponential waveform has $v(0) = 5$ volts (at 0 sec) and $v(2) = 1.25$ volts (at 2 sec).

(a) Determine the numerical value of the time constant T_C for these measurements.
Tc= 1.44 sec

(4) * $\frac{v(t+\Delta t)}{v(t)} = e^{-\Delta t/T_C}$ $\frac{v(2)}{v(0)} = e^{-2/T_C}$ $\frac{1.25V}{5V} = e^{-2/T_C}$

$\Delta t = 2-0 = 2\,sec$ $\ln 0.25 = -\frac{2}{T_C}$ $\boxed{T_C = 1.44\,sec}$

2 for equation * 2 for work and answer

(b) Write a mathematical expression for the exponential waveform corresponding to these measurements. Your answer should not contain any unknown constants.

choose $v(0) = 5V$

$\boxed{v(t) = 5e^{-t/1.44\,sec}}$

(3) either you know it or not

choose $v(2) = 1.25V$

$\boxed{v(t) = 1.25e^{-(t-2)/1.44\,sec}}$

* if your answer is of the form $v(t) = Ae^{-t/1.44}$ you lost 1 point

either answer is correct

(c) Using your answer from (b) what is the value of $v(t)$ at t=4?

$t = 4$ use

$v(t) = 5e^{-t/1.44\,sec}$ (or use

$v(t) = 5e^{-4/1.44\,sec}$

$\boxed{v(4) = 0.312V}$

(3) 2 for work 1 for answer

* if you derived parts b and c correctly for an incorrect T_C in part a, you got full credit for parts b and c

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Problem 2 Sinusoidal Waveforms (10 points)

A sinusoid has a period of 5μs. At t=0 the amplitude is 12 volts. The waveform reaches its first positive peak after t=0 at t=4μs. Assume a sinusoidal waveform of the form $v(t) = A\cos(\omega(t - T_s))$. Using this measured data find the amplitude A, frequency ω, and time shift T_s of the sinusoidal signal.

(4) A= 39.24

(3) ω= 1.26×10^6 rad/sec

(3) Ts= 4μs or −1μs

period $= T_0 = 5\mu s$

$\omega = \frac{2\pi}{T_0} = \frac{2\pi}{5\mu s} = 1.26\times10^6$ rad/sec

$\boxed{\omega = 1.26\times10^6 \text{ rad/sec}}$

$v(t) = A\cos(\omega(t - T_s))$

$\boxed{T_s = 4\mu s \text{ or } -1\mu s}$ from graph below

$12V = A\cos(\omega(0 - T_s))$

$12V = A\cos(1.26\times10^6 \text{ 1/s}(0 - (-1\mu s)))$

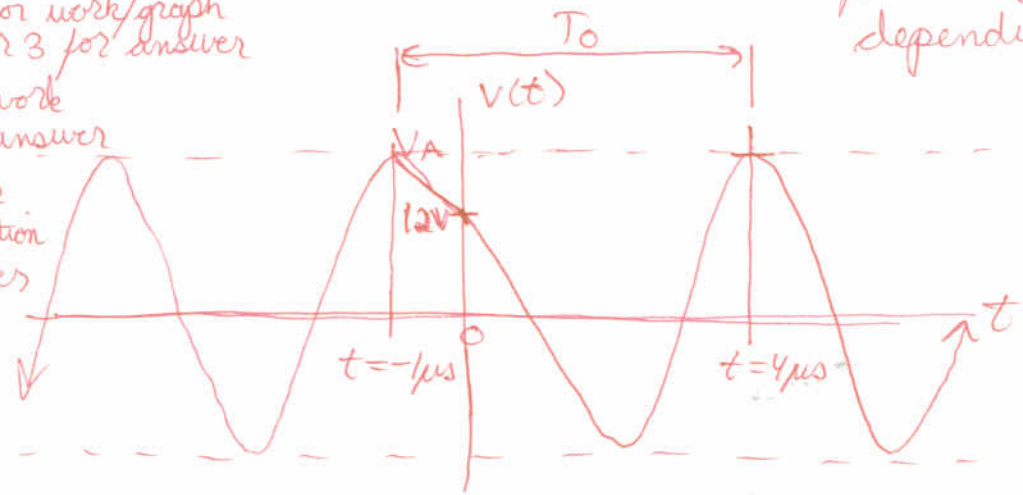
$12V = A(0.305817)$

$\boxed{A = 39.24}$ * your answer may fluctuate a little depending on your T_s

2 for work/graph
1 or 3 for answer

2 for work
1 for answer

2 for work
1 for equation
1 for answers



SUPPLEMENTAL DATA: TRIG IDENTITIES

$\cos(x+y) = \cos x\cos y - \sin x\sin y$	$\sin(2x) = 2\sin x\cos x$	
$\sin(x+y) = \sin x\cos y + \cos x\sin y$	$\cos(2x) = 2\cos^2 x - 1 = 1 - 2\sin^2 x$	