Name : _____ 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 **3/26/04**

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

Problem 1 Sinusoidal Waveforms (10 points)

(a) What are the Fourier coefficients of $12\cos(5000t + 30^\circ)$?

a=_____; b=_____

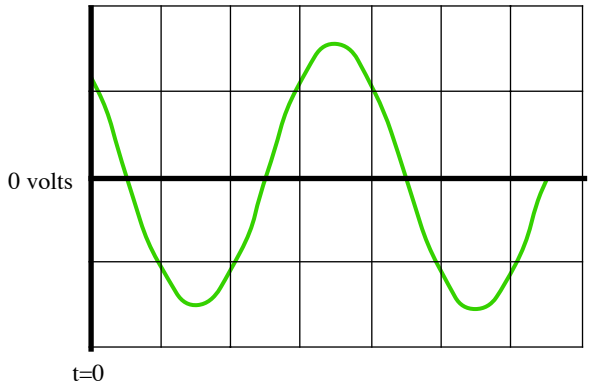
Note: we are looking for numerical answers.

(b) You are in the laboratory and measure the above waveform with your oscilloscope. Assume that t=0 at the left of the screen and that zero volts is in the middle of the screen. The oscilloscope is set to 12 volts/vertical division, and 50 milliseconds per horizontal division. You want to express this waveform mathematically as $v(t) = A\cos(\omega(t - T_s))$. What are the numerical values of A, ω and T_s?

A=_____

ω=_____

Ts=_____



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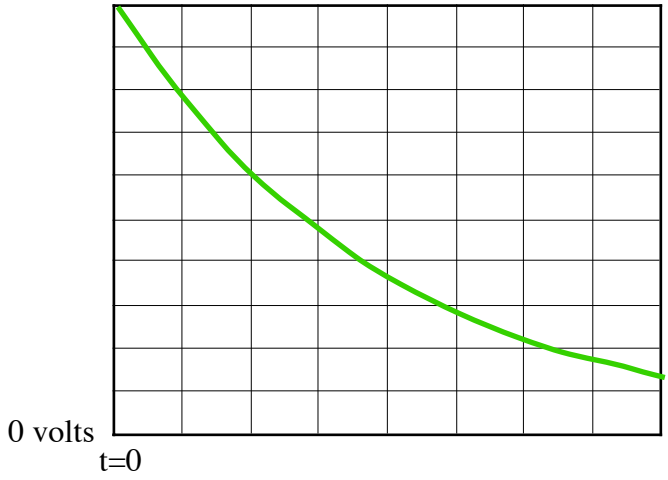
Problem 2 Exponential Waveforms (10 points)

(a) You are in the laboratory measuring an exponential waveform with your oscilloscope. If the units are 20mS/div horizontal and 8 volts/div vertical determine the numerical value of the time constant T_C for the following waveform. Tc=_____



(b) Write a mathematical expression for the above waveform. Assume that t=0 and v=0 at the lower left of the display.

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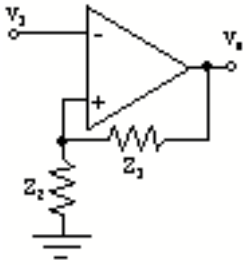
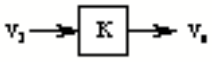
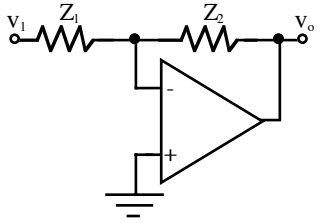
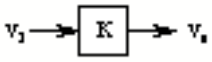
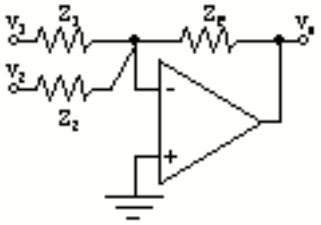
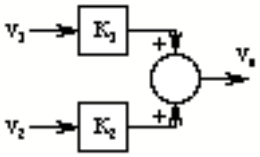
SUPPLEMENTAL DATA

TRIG IDENTITIES:

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

OP AMP CIRCUITS:

CIRCUIT	BLOCK DIAGRAM	GAINS
 Non-inverting amplifier		$K=\frac{Z_1+Z_2}{Z_2}$
 Inverting amplifier		$K=-\frac{Z_2}{Z_1}$
 Summer		$K_1=-\frac{Z_F}{Z_1},\ K_2=-\frac{Z_F}{Z_2}$

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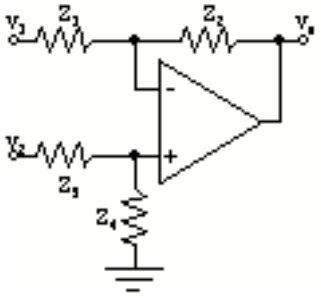
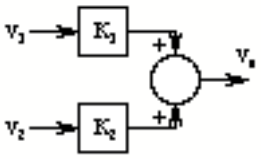
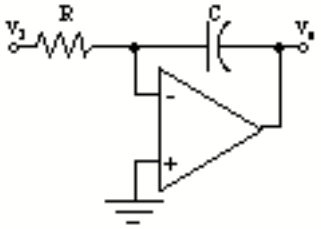
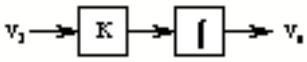
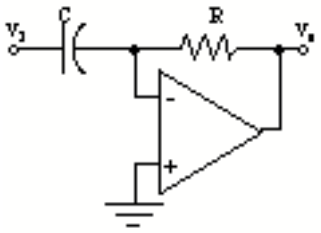
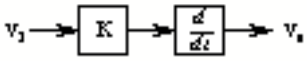
 Subtractor		$K_1 = -\frac{Z_2}{Z_1}$ $K_2 = \left(\frac{Z_1 + Z_2}{Z_1}\right)\left(\frac{Z_4}{Z_3 + Z_4}\right)$,
 Integrator		$K = -\frac{1}{RC}$
 Differentiator		$K = -RC$