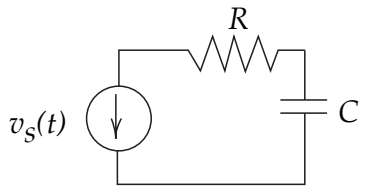
Pre-Lab Problem

Work through this section before going to the lab.

Consider the electrical "*RC* circuit" shown in the illustration. The resistance is $R = 10$ kΩ, and the capacitance is $C = 0.1\mu$F.



Assume that the input voltage source $v_s(t)$ is sinusoidal, with amplitude of 1 volt. That is, $v_s(t) = \sin(\omega t)$. Derive the expression for the steady-state voltage across the capacitor. From this, show the expressions for the amplitude, phase angle, and lag time[1] in terms of the appropriate parameters (e.g. the system time constant, the input frequency, etc.).

For the frequencies given in the table, find numerical values and fill with the calculated values. Also fill in the corresponding frequency values in rad/sec. You will fill in the measured values in the laboratory.

Be sure you understand how the lag time is related to the phase angle.

Laboratory Procedure

Connect the *RC* circuit to the function generator as in the figure. Set the function generator to produce a sine wave, with amplitude of 1 V.

In addition to its connection to the circuit, connect the function generator to LabVIEW Input 1. Connect the voltage across the capacitor to LabVIEW Input 2.

Measure the amplitude and time lag of the voltage across the capacitor for each frequency. Compute the corresponding phase lags from the time lags. Compare your measured values with those previously calculated.

Frequency		**Amplitude** (Volts)		**Lag Time** (seconds)		**Phase Angle** (degrees)	
f Hz	ω radians/sec	Calculated	Measured	Calculated	Measured	Calculated	Computed from measured time lag
50							
100							
200							
500							

[1] The *lag time* is the time, in seconds, by which the output signal "lags" behind the input signal.