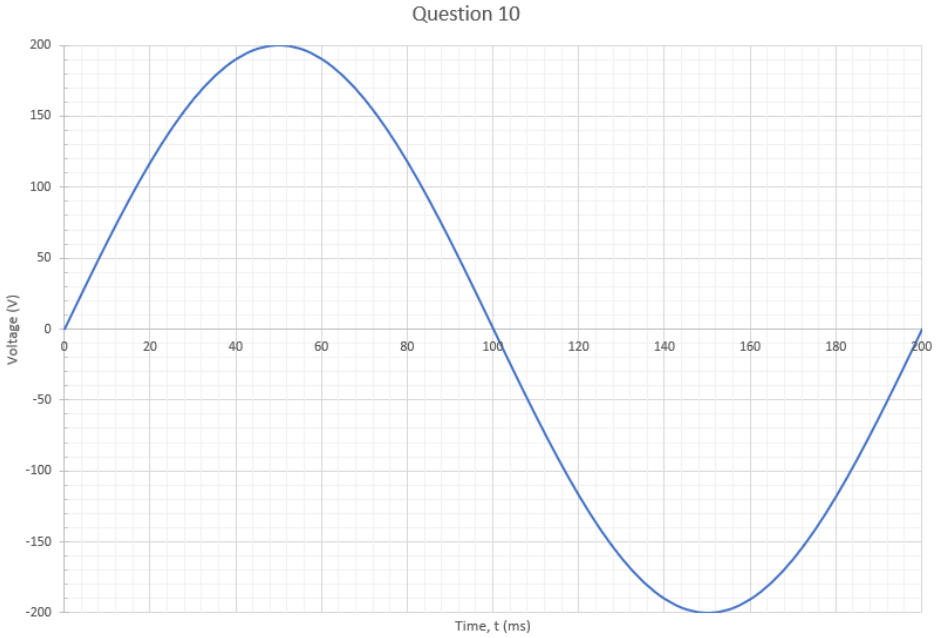
Skyler MacDougall

Homework 1: Due 1/22/2020

10.

1. Draw a waveshape of a sinusoidal voltage having a peak value of 200V and a frequency of 5Hz.



2. If the voltage is zero at $t = 0$, what is the voltage at $t = 5ms$? $75ms$?$150ms$?

Time (t, ms)	Voltage (V)
5	≈ 31
75	≈ 141
150	-200

11. A sinusoidal current has an effective value of 50A. Calculate the peak value of current.

$$50A * \frac{\sqrt{2}}{2} \approx 35A \tag{1}$$

12. A sinusoidal voltage of 120V is applied to a 10Ω resistor. Calculate

1. the effective current through the resistor.

$$\frac{120V}{10\Omega} = 12A \tag{2}$$

2. the peak voltage across the resistor.

$$120V * \sqrt{2} \approx 170V_{RMS} \tag{3}$$

3. the power dissipated by the resistor.

$$120V * 12A = 1440W \tag{4}$$

4. The peak power dissipated by the resistor.

$$170V_{RMS} * (12A * \sqrt{2}) = 2880W \tag{5}$$

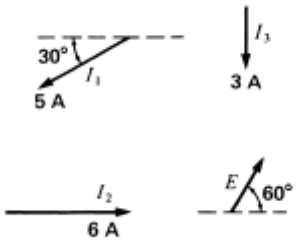
13. A distorted voltage contains an 11^{th} harmonic of 20V, 253Hz. Calcultate the frequency of the fundamental.

$$235Hz * 11^{th} Harmonic \approx 2.6kHz \tag{6}$$

14. The current in a 60Hz single phase motor lags 36 degrees behind the voltage. Calculate the time interval between positive peaks of voltage and current.

$$\frac{1}{\cancel{60Hz}} * \frac{\cancel{360^\circ}\ 6^\circ}{36^\circ} = \frac{1}{6} seconds = 0.1\overline{66} seconds \tag{7}$$

15. Determine the phase angle between the following phasors and, in each case, indicate which phasor is lagging.



1. I_1 and I_3

$$\begin{gathered} \angle I_1 - \angle I_3 = -60^\circ \\ \therefore \\ I_1 lags I_3 by 60^\circ \end{gathered} \tag{8}$$

2. I_2 and I_3

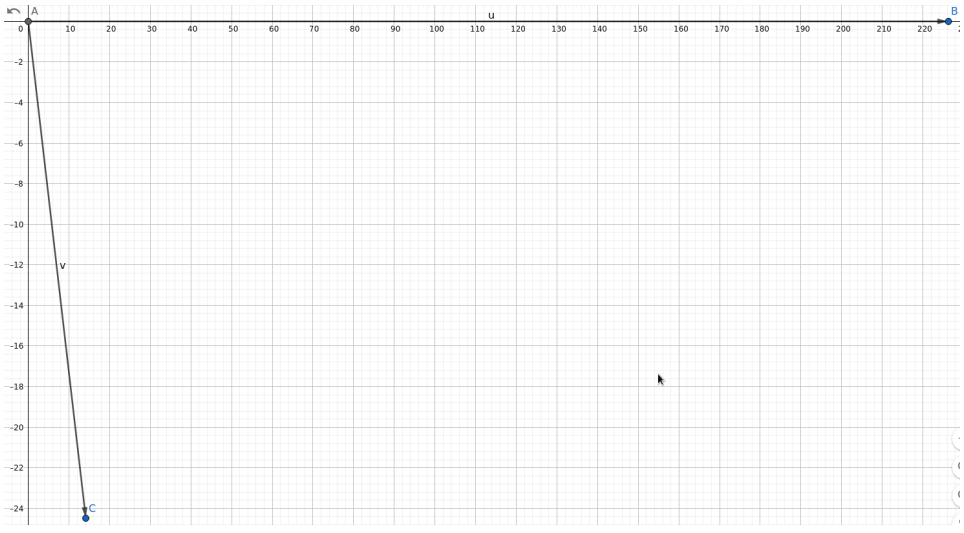
$$\begin{gathered} \angle I_2 - \angle I_3 = -90^\circ \\ \therefore \\ I_2 lags I_3 by 90^\circ \end{gathered} \tag{9}$$

3. E and I_1

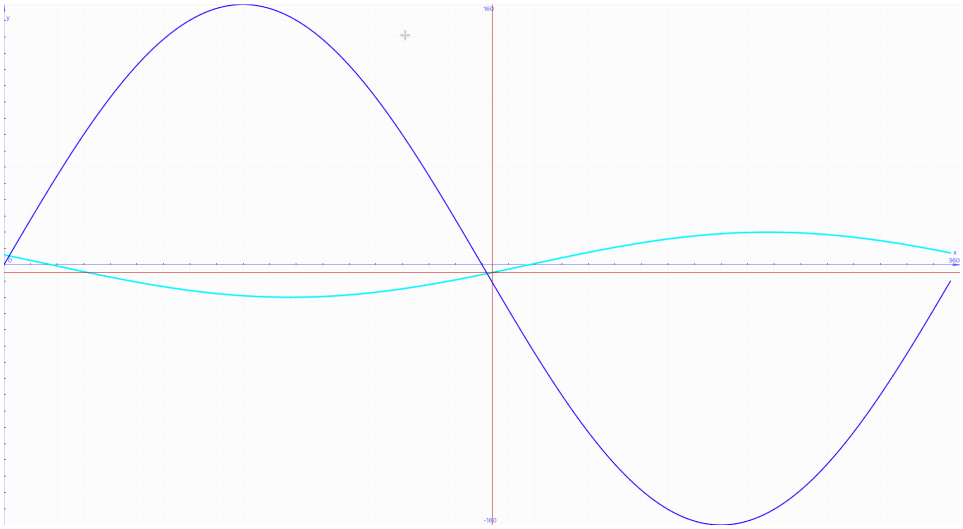
$$\begin{gathered} \angle E - \angle I_1 = -150^\circ \\ \therefore \\ E lags I_1 by 150^\circ \end{gathered} \tag{10}$$

16. The voltage applied to an AC magnet is given by the expression $E = 160sin\phi$, and the current is $I = 20sin(\phi - 60^\circ)$, all angles being expressed in degrees.

1. Draw the phasor diagram for E and I, using effective values.



2. Draw the waveshape of E and I as a function of ϕ.



3. Calculate the peak positive power and the peak negative power in the circuit.