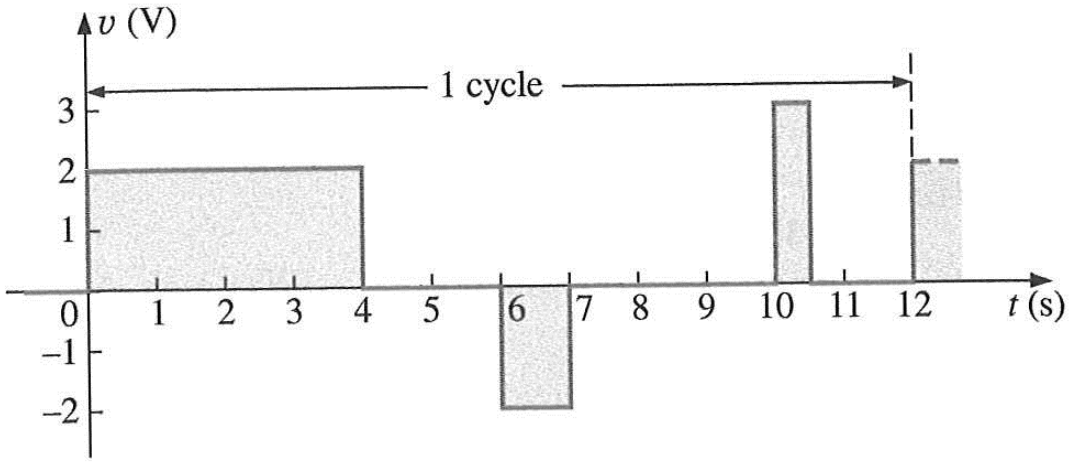
ENGG104 Tutorial 8 Class Questions

Team Name: _____

Question 1 [typical exam question]



(a) Determine the average voltage V_{ave} for the waveform above

$$V_{ave} = \frac{2 \times 4 - 2 \times 1 + 3 \times 0.5}{12} = 0.625V$$

(b) Determine the RMS voltage V_{rms} for the same waveform

$$V_{\text{rms}} = \frac{\sqrt{(2\,\text{V})^2(4\,\text{s}) + (-2\,\text{V})^2(1\,\text{s}) + (3\,\text{V})^2\left(\frac{1}{2}\text{s}\right)}}{12\ \text{s}} = \mathbf{1.43\ V}$$

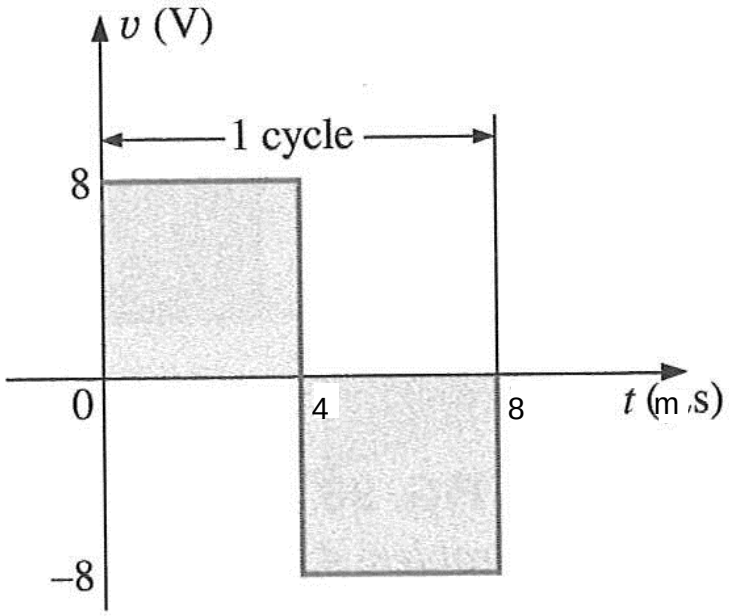
please note that square root is foe the whole number not just the numerator.

(c) Describe the difference between average and RMS values?

The average provides the average or the actual DC value of the waveform. While the RMS provides the ***equivalent DC*** value that will deliver the same ***power***

Question 2 [typical exam question]

Repeat parts (a) and (b) for the following typical (communications) waveform:



$$G = \frac{(8\text{ V})(4\text{ ms}) - (8\text{ V})(4\text{ ms})}{8\text{ ms}} = \frac{0}{8\text{ ms}} = \mathbf{0\text{ V}}$$

$$V_{\text{rms}} = \sqrt{\frac{(8\text{ V})^2(4\text{ ms}) + (-8\text{ V})^2(4\text{ ms})}{8\text{ ms}}} = \mathbf{8\text{ V}}$$

Question 3

The voltage across a 3 Ω resistor is as indicated. Find the sinusoidal expression for the current. In addition, sketch the v and i sinusoidal waveforms on the same axis.

a. $150 \sin 200t$
b. $30 \sin(377t + 20°)$
c. $6 \cos(\omega t + 10°)$
d. $-12 \sin(\omega t + 40°)$

a. $I_m = V_m/R = 150\ \text{V}/3\ \Omega = 50\ \text{A}$, $i = \mathbf{50 \sin 200t}$

b. $I_m = V_m/R = 30\ \text{V}/3\ \Omega = 10\ \text{A}$, $i = \mathbf{10 \sin(377t + 20°)}$

c. $I_m = V_m/R = 6\ \text{V}/3\ \Omega = 2\ \text{A}$, $i = \mathbf{2 \sin(\omega t + 100°)}$

d. $I_m = V_m/R = 12\ \text{V}/3\ \Omega = 4\ \text{A}$, $i = \mathbf{4 \sin(\omega t + 220°)}$

Question 4 please note that the value for L is 2H and not 2 mH.

Determine the inductive reactance (in ohms) of a 2 mH coil for

a. dc

and for the following frequencies:

b. 60 Hz
c. 4 kHz
d. 1.2 MHz

a. **0 Ω**

b. $X_L = 12.56f = 12.56(60\text{ Hz}) = \mathbf{753.6\ \Omega}$

c. $X_L = 12.56f = 12.56(4\text{ kHz}) = \mathbf{50.24\ k\Omega}$

d. $X_L = 12.56f = 12.56(1.2\text{ MHz}) = \mathbf{15.07\ M\Omega}$

Question 5

The current through a 20 Ω inductive reactance is given. What is the sinusoidal expression for the voltage? Sketch the v and i sinusoidal waveforms on the same axis.

a. $i = 5 \sin \omega t$

b. $i = 40 \times 10^{-3} \sin(\omega t + 60°)$

c. $i = -6 \sin(\omega t - 30°)$

a. $V_m = I_m X_L = (5\text{ A})(20\ \Omega) = 100\text{ V}$

$\upsilon = \mathbf{100 \sin(\omega t + 90°)}$

b. $V_m = I_m X_L = (40 \times 10^{-3}\text{ A})(20\ \Omega) = 0.8\text{ V}$

$\upsilon = \mathbf{0.8 \sin(\omega t + 150°)}$

c. $i = 6 \sin(\omega t + 150°),\ V_m = I_m X_L = (6\text{ A})(20\ \Omega) = 120\text{ V}$

$\upsilon = 120 \sin(\omega t + 240°) = \mathbf{120 \sin(\omega t - 120°)}$

Question 6

The voltage across a 2.5 Ω capacitive reactance is given. What is the sinusoidal expression for the current? Sketch the v and i sinusoidal waveforms on the same set of axes.

a. $120 \sin \omega t$

b. $4 \times 10^{-3} \sin(\omega t + 40°)$

a. $I_m = V_m/X_C = 120\ \text{V}/2.5\ \Omega = 48\ \text{A}$

$i = \mathbf{48\ \sin(\omega t + 90°)}$

b. $I_m = V_m/X_C = 4 \times 10^{-3}\ \text{V}/2.5\ \Omega = 0.16\ \text{A}$

$i = \mathbf{1.6 \times 10^{-3}\ \sin(\omega t + 130°)}$