



**Arab Academy for Science & Technology and Maritime Transport**  
**College of Engineering and Technology**

**Department** : Electronics and Communications

**Course** : Electronic Measurements

**Course Code:** EC410

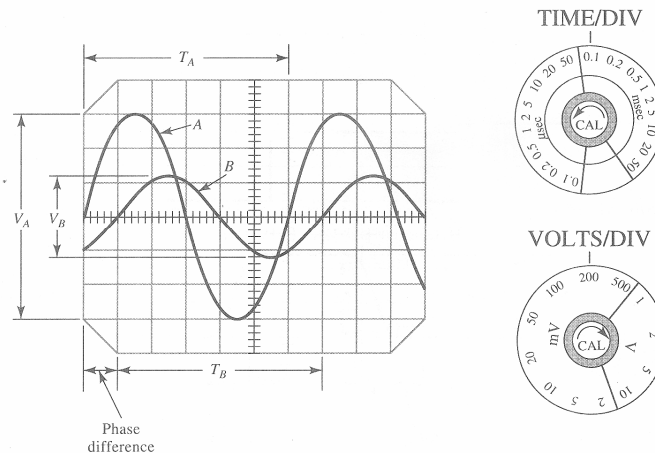
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## Problem Set #2

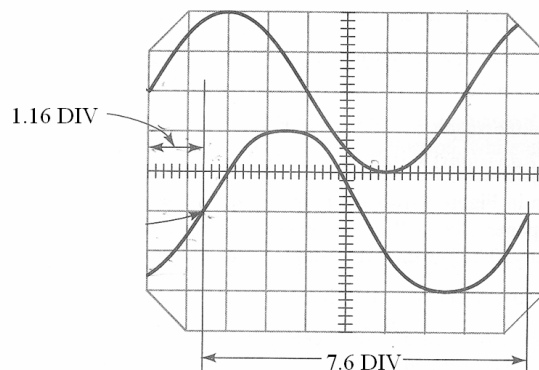
### Measurements of Voltage, Frequency and Phase

1-Determine the peak to peak voltage and the frequency for each of the two waveforms shown in Fig. 1. Also, determine the phase difference (phase shift) between them.



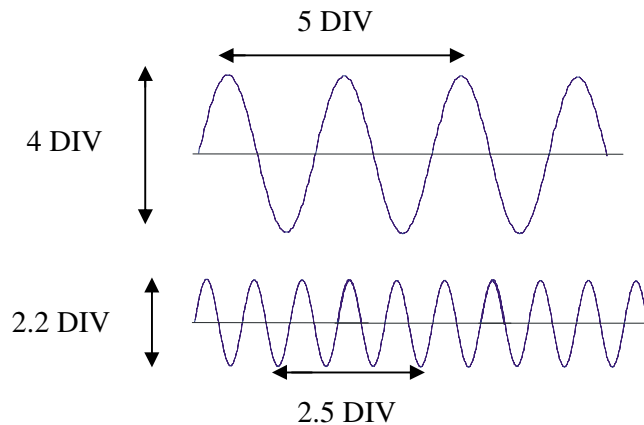
**Fig. 1.**

2- Determine the peak voltage and the phase difference for the two signals shown in Fig. 2. Given that the TIME/DIV control is set to 0.6 ms and the VOLTS/DIV control is set to 15 mv.



**Fig. 2.**

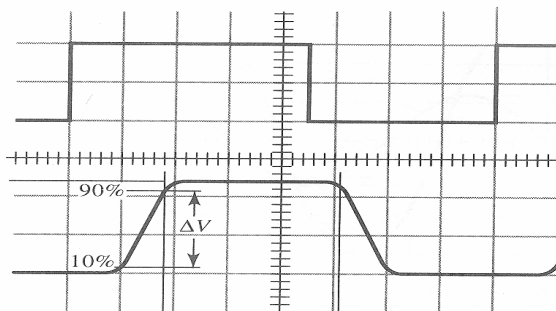
**3-** The two signals shown in Fig. 3 are displayed on an oscilloscope. The oscilloscope TIME/DIV control is set to  $20\mu s$  and its VOLTS/DIV control is set to 10 mv. Determine the root mean square values and the frequencies of the displayed signals.



**Fig. 3.**

**4-** A pulse waveform is fed into a circuit. The input and output signals are displayed as shown in Fig. 4. The TIME/DIV control is set to  $1\mu s$  and the VOLTS/DIV control is set to 0.5 mv. The delay time, rise time and fall time correspond to 0.95, 0.85 and 0.9 divisions respectively.

- (a)** Determine (i) The PA (pulse amplitude), the period and the frequency of the input signal. (ii) The PW (pulse width) and SW (space width) of the input signal. (iii) The delay time, rise time and fall time of the output signal.
- (b)** Indicate all parameters on the plot.



**Fig. 4.**

**5-** Sketch the oscilloscope display that occurs with two synchronized vertical and horizontal sine waves inputs with same frequency when the two inputs:

- (a) are in phase (assume same amplitude).
- (b) are in phase with  $V_p$  of the horizontal input greater than  $V_p$  of the vertical input.
- (c) are in phase with  $V_p$  of the vertical input greater than  $V_p$  of the horizontal input.
- (d) are in antiphase (assume same amplitude).
- (e) have a phase difference of  $90^\circ$  (assume same amplitude).
- (f) have a phase difference greater than  $0^\circ$  and less than  $90^\circ$  (assume same amplitude).
- (g) have a phase difference greater than  $90^\circ$  and less than  $180^\circ$  (assume same amplitude).

**6-** Sketch the oscilloscope display that occurs with two synchronized vertical and horizontal sine waves inputs with different frequencies when:

- (a) the horizontal frequency is twice the vertical frequency ( $f_x = 2 f_y$ ).
- (b) the vertical frequency is twice the horizontal frequency ( $f_y = 2 f_x$ ).
- (c) the ratio of the vertical frequency to the horizontal frequency is 3 ( $f_y / f_x = 3$ ).
- (d) the ratio of vertical frequency to horizontal frequency is  $1/3$  ( $f_y / f_x = 1/3$ ).