Diploma of Audio Production Name_____

Analogue Fundamentals

Module 5

AC/DC and the Sine Wave (cont)

Finding the Frequency.

We cannot measure the frequency of a waveform directly on most Scopes unless it's a digital oscilloscope, but we can measure the time using the Scopes calibrated Time Base.
If we know how long it takes for the Trace to "Scan" across the screen then we can measure the time taken for one complete cycle of our viewed waveform.

We use the formula:

$$\text{Frequency} = \frac{1}{\text{Time}}$$

Where time is measured in Seconds and Frequency is measured in Hertz (Cycles per Second).

Example: Lets say a Sine wave takes 10 horizontal Divisions on the scope to complete 1 full cycle and the Time per Division switch is set to 2 milli-seconds then the period is 10 x 2mS = 20 milliseconds.

To find the frequency, simply divide this number into 1.

Eg. $\text{Freq.} = \frac{1}{0.02}$ Seconds
= 50 Hertz.

Also if we know the Frequency we can find the Period.

$\text{Period (Time)} = \frac{1}{\text{frequency}}$	$t = \frac{1}{f}$	$f = \frac{1}{t}$

$$\text{Period (Time)} = \frac{1}{\text{Frequency}}$$

The period of a 1 KHz Waveform is 1 millisecond or 0.001 Seconds. Do we remember multiples and Sub-multiples from the last lesson.

Proving Period $= \frac{1}{\text{frequency}}$

$= \frac{1}{1000\text{Hz}}$

$= 0.001$ Seconds or 1 millisecond

Some problems;

Find either the frequency or the period as required.

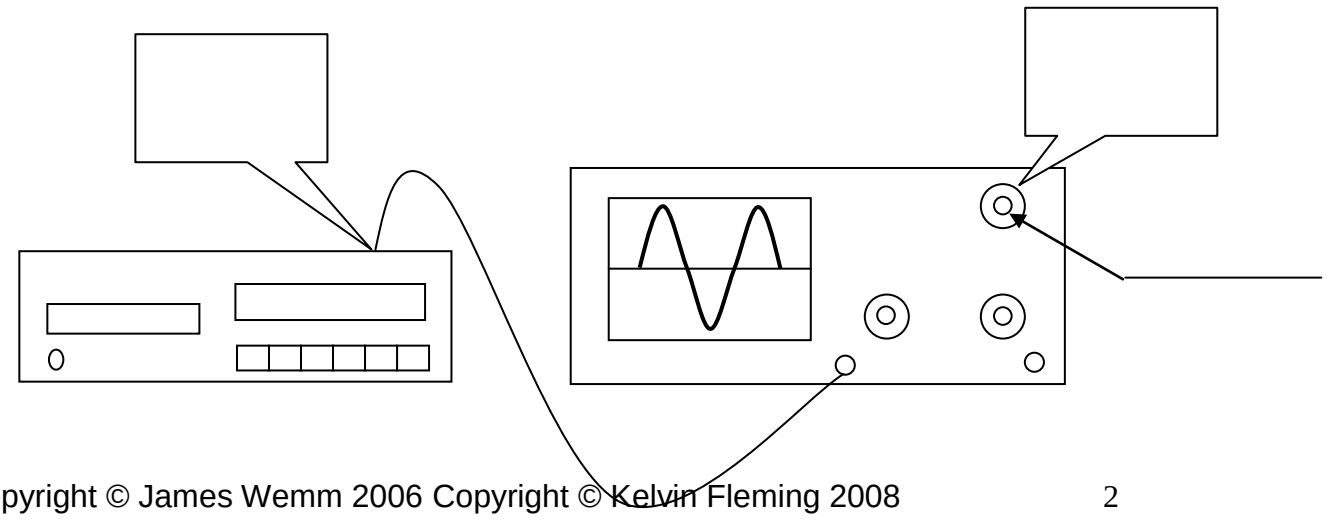
1. 400 Hz
2. 20 Hz
3. 20,000 Hz
4. 0.1 Seconds
5. 100 μ Seconds

Practical Exercise

Aim: To use the Scope to measure the period of some waveforms and to then calculate the frequency.

First up we will use the signal generator set to 1 Khz just to make sure we are on the right track if the Scope tells us that the period of the 1KHz sine wave is 1 millisecond! We will use the same basic hook-up as in the voltage measurements earlier in the lesson.
Next we will use a CD player with some discs with various frequency sine waves recorded on them. Your task is to use the Scope to measure the period of each of the 10 sine waves and then to calculate the respective frequencies.

If you wish you can plug in a pair of headphones into the CD player so you can listen to what's coming out. Sine waves are not very exciting to listen to so hopefully you chose a CD player with a headphone volume control on it!



Record all Results in the table below.

Some room for your Calculations

Track	Period	Frequency

We will need to write some sort of conclusion wont we? Something along the lines of how we can carry out voltages measurements and Time measurements using the Scope.

Conclusion:

_____
_____
_____
_____
_____

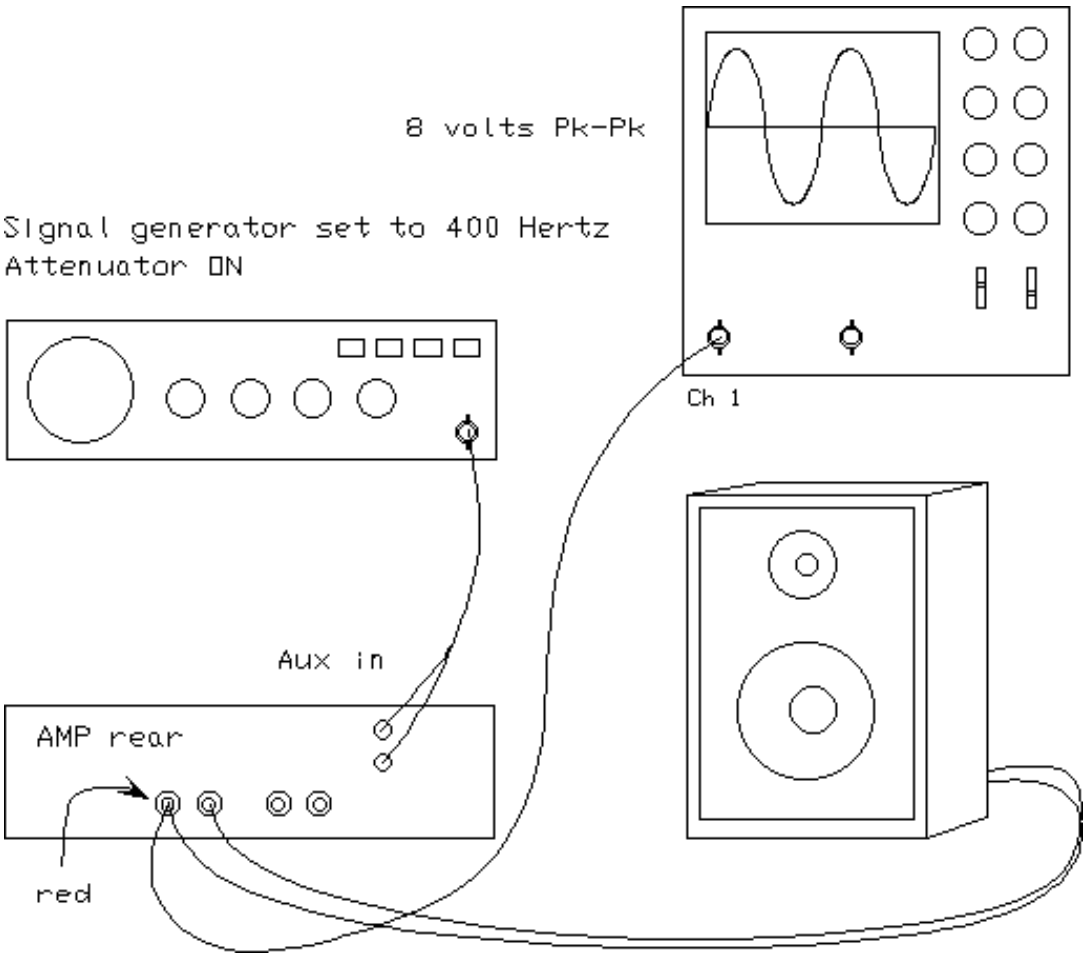
Topic 2: Using the CRO to measure power:

This is a practical exercise to measure power being dissipated into a load or loudspeaker using the CRO.
Always check that the CRO is set to calibrate or “cal” on the vertical & horizontal scales so your readings will be accurate.

As you may recall, we can use the Scope to measure DC Voltages and AC Voltages, we can use to measure event times and from that information we can calculate the frequency of a signal etc.

We can view audio signals to check if we are running out of “Head Room” and therefore the signal is going into “Clipping”.
Electronics service personal use the Scope as an aid to identifying problems in and around electronic apparatus.
We could view the output of our electric guitar, electronic organ, CD player, Audio Mixer output etc.

Basic “Hook-up”



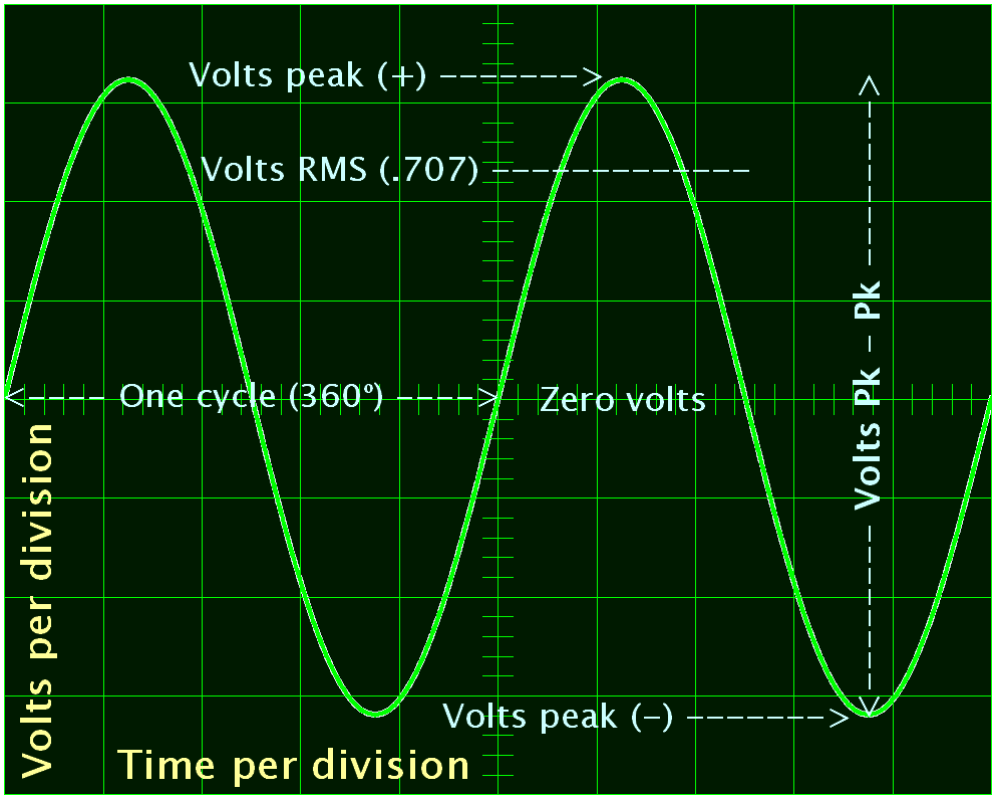
We want to put 1 watt RMS into a speaker or 8Ω load. Using the equation:

$$P = \frac{V^2}{R}$$ we can say that $V^2 = P \times R$, and it follows that $V = \sqrt{PR}$

∴ if we require 1 watt into an 8Ω speaker $V = \sqrt{(1 \times 8)} = \sqrt{8}$

and converting to $V^{pk\text{-}pk} = 2 \times \sqrt{8} \times \sqrt{2}$

$= 2 \times 2.83 \times 1.414 = 8$ Volts $^{pk\text{-}pk}$

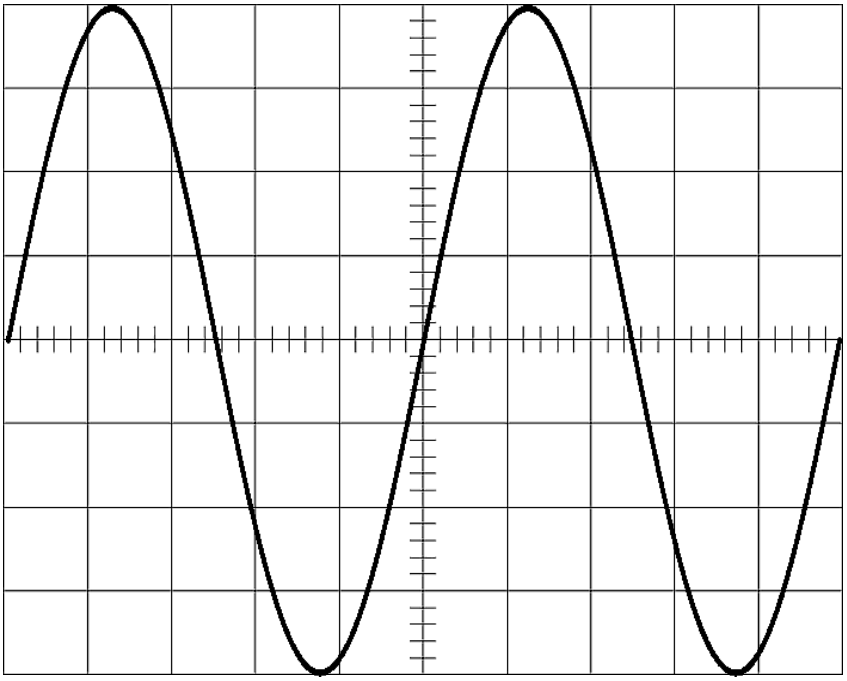


Now repeat the experiment for ½ a watt RMS.

Home work Problems.

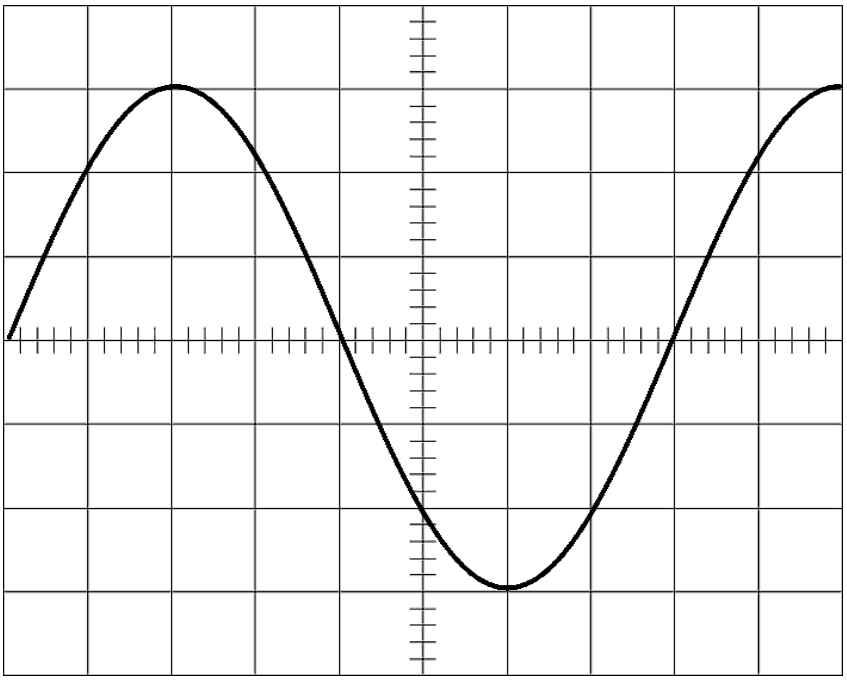
1/. Calculate the RMS voltage and the frequency of the following waveform.

Scope settings, Volts per Division = 1 Volt; Time per division = 1 mS.



2/. Calculate the RMS voltage and the frequency of the following waveform.

Scope settings, Volts per Division = 0.2 Volts; Time per division = 10 µS.



3/. Lastly – a slightly tricky one! Calculate the RMS voltage and the frequency of the following waveform.

Scope settings, Volts per Division = 20mVolts; Time per division = 50 µS.