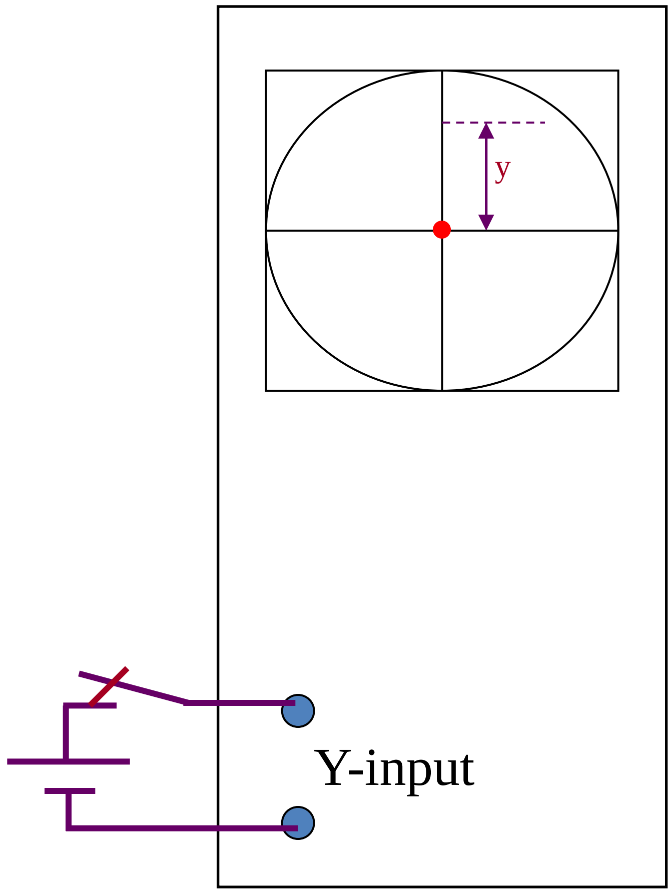
Uses of c.r.o.

- Measure potential difference
  - d.c.
  - a.c.
- Display waveforms of alternating p.d.
- Measure short intervals of time, and
- Compare frequencies

Measuring d.c. Potential Difference

- switch off the time-base
- a spot will be seen on the c.r.o. screen
- d.c. to be measured is applied to the Y-plates
- spot will either deflected upwards or downwards
- deflection of the spot is proportional to the d.c. voltage applied

Measuring d.c. Potential Difference



If the Y-gain control is set at 2 volts/division

And the vertical deflection, y, is 1.5

Then d.c. voltage

= 1.5 x 2

= 3.0 V

Measuring a.c. voltage

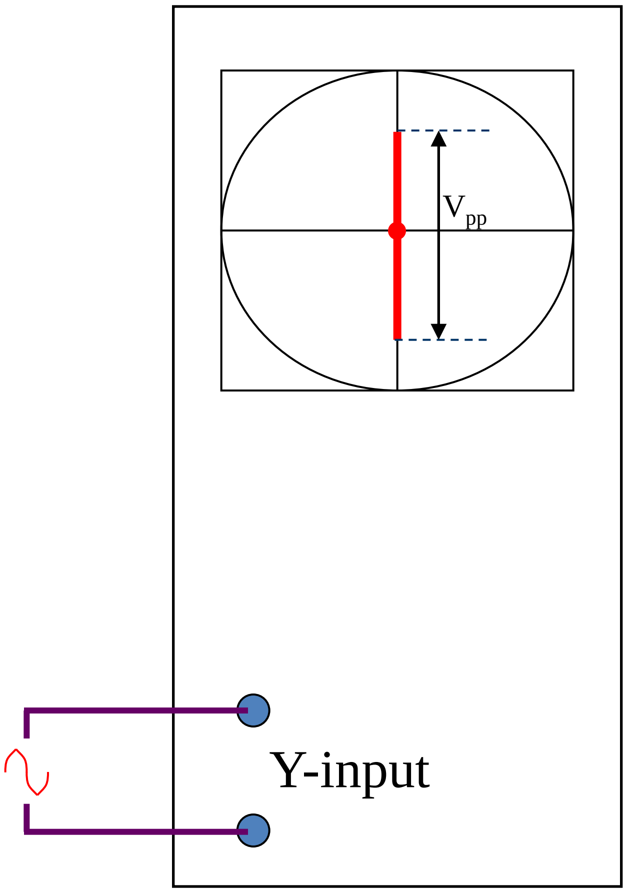
- switch off the time-base
- a spot will be seen on the c.r.o. screen
- a.c. to be measured is applied to the Y-plates
- spot will move up and down along the vertical axis at the same frequency as the alternating voltage
  - spot moves to the top when the voltage increases to its maximum (positive)
  - spot moves to the bottom when the voltage decreases to its lowest (negative)

Measuring a.c. voltage

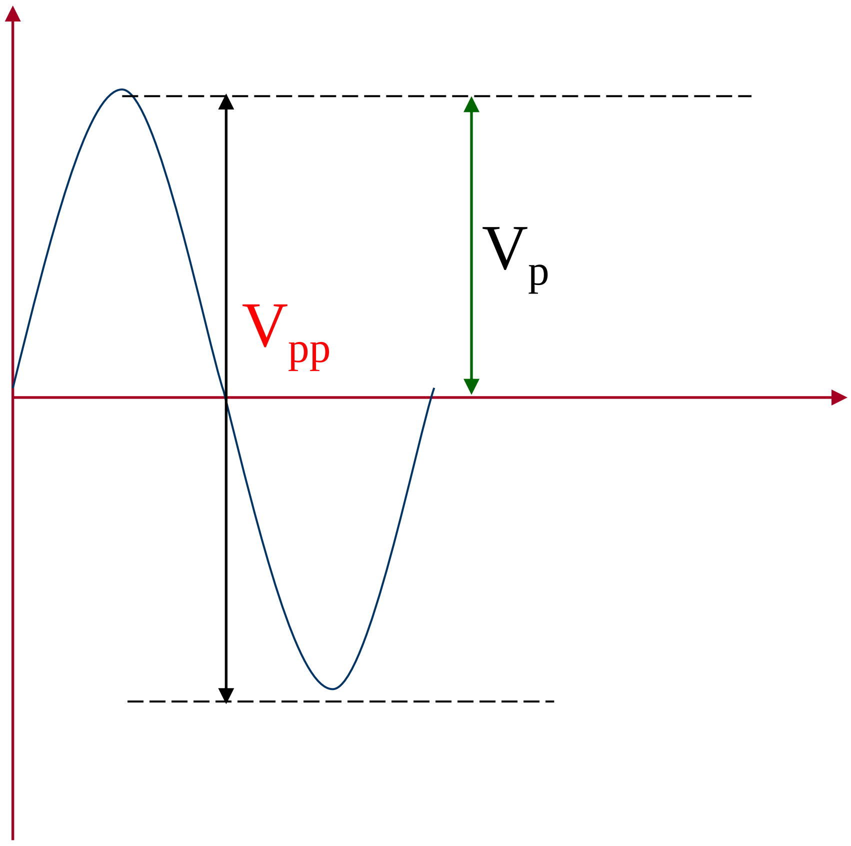
- When the frequency is high
  - the spot will move so fast that a vertical line is seen on the screen
- Length of the vertical line gives the peak-to-peak voltage (V_{pp}) applied to the Y-plate
- The peak voltage (V_p) is

$$= \quad V_{pp}/2$$

Measuring a.c. voltage



Measuring a.c. voltage



$$V_p = V_{pp}/2$$

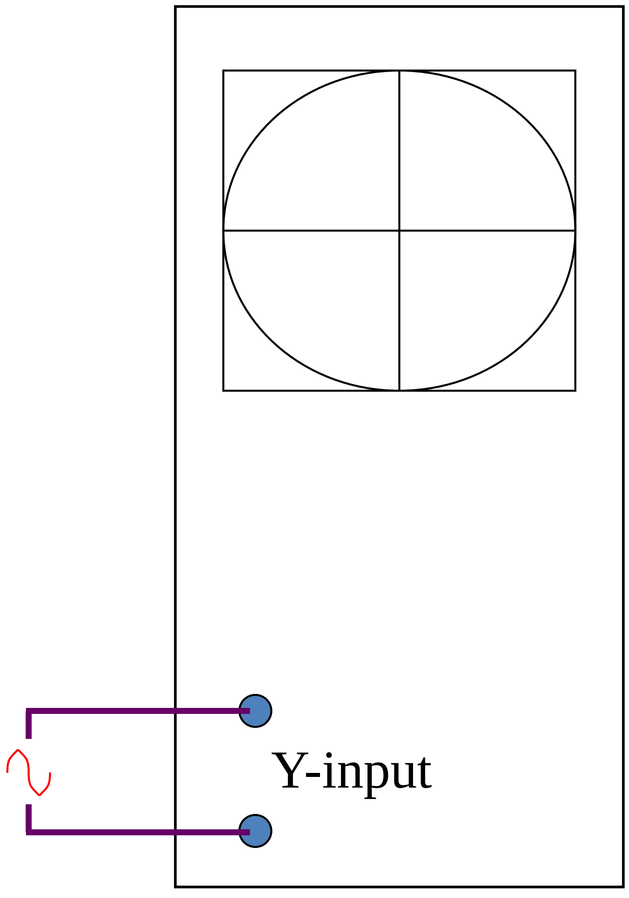
C.R.O. as a Voltmeter

- it has nearly infinite resistance (between the X- and Y-plates), therefore draws very little current;
- it can be used to measure both d.c. and a.c. voltages; and
- it has an immediate response.

Displaying Waveforms

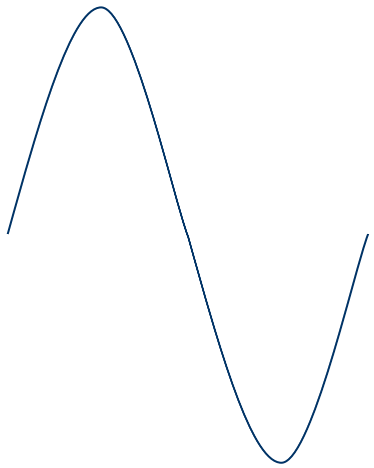
- Set the time-base to a suitable frequency,
- Apply the input to the Y-plate
  - a steady waveform of the input will be displayed on the c.r.o.

Displaying Waveforms

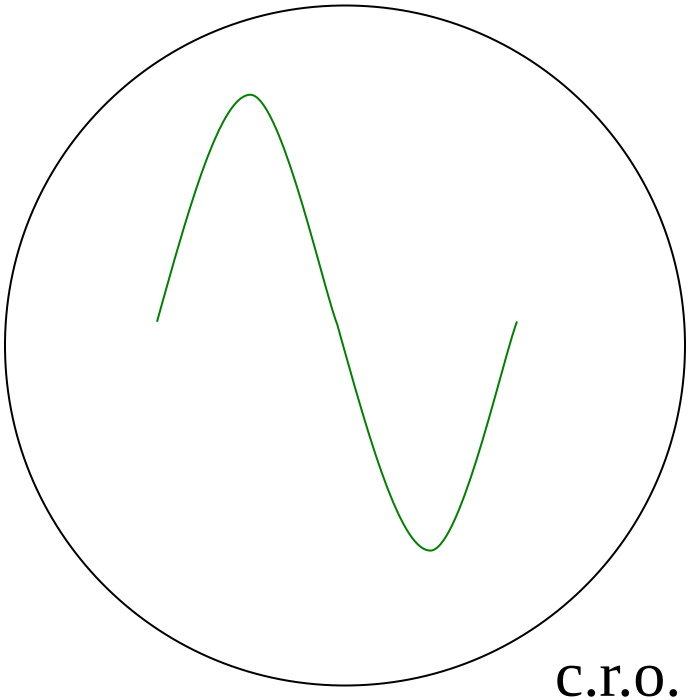


Displaying Waveforms

- When input voltage frequency is the **same** as the time-base frequency



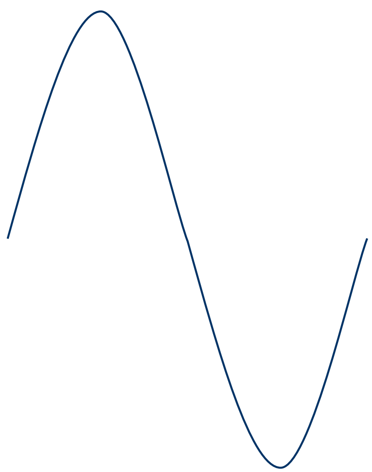
Input Voltage



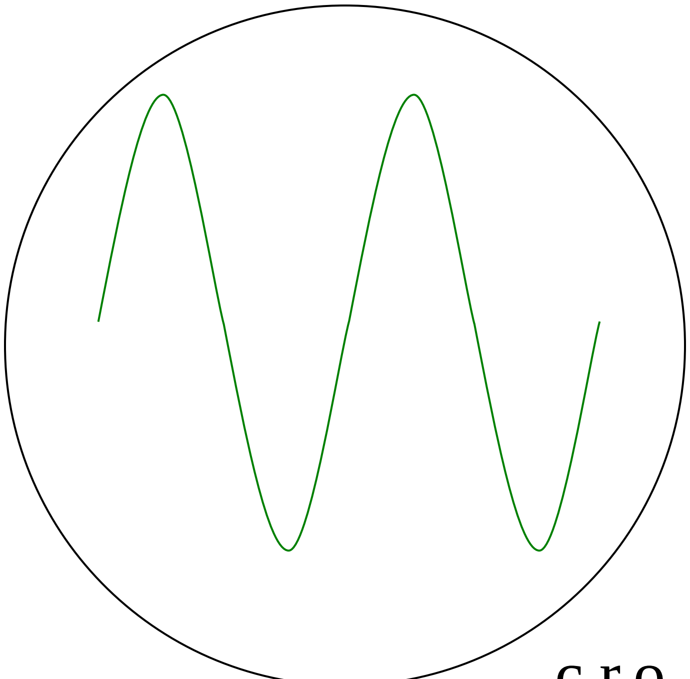
c.r.o. screen

Displaying Waveforms

- When input voltage frequency is the **twice** the time-base frequency

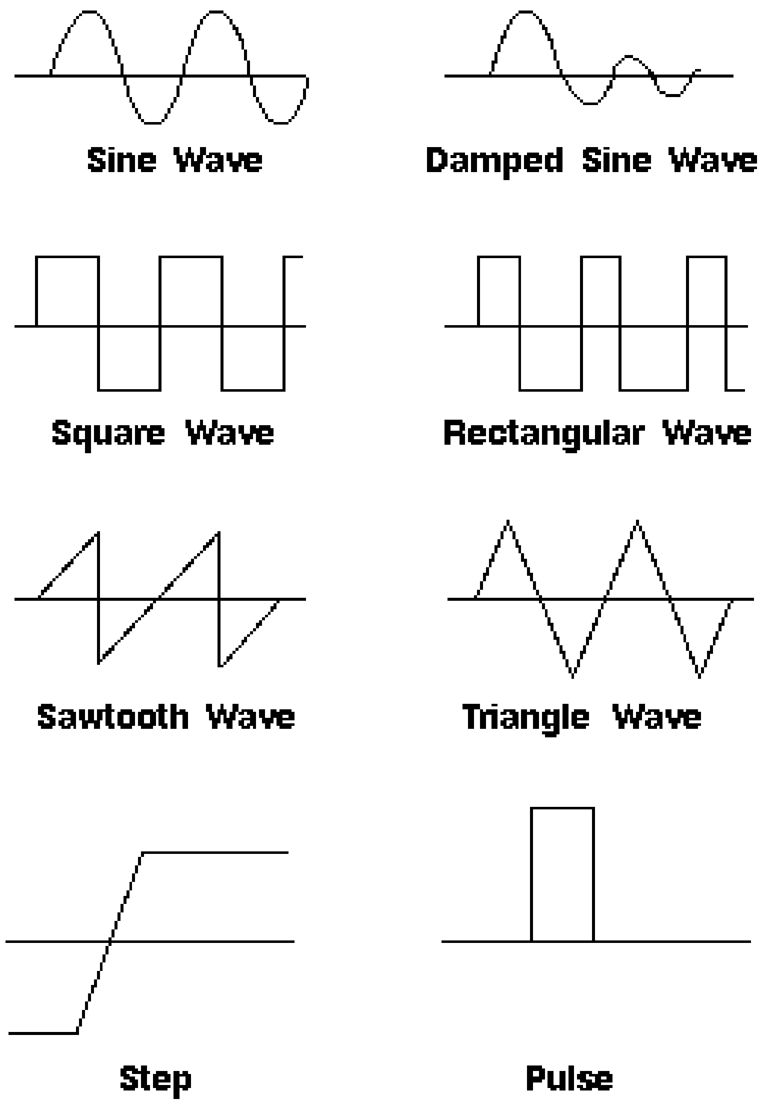


Input Voltage

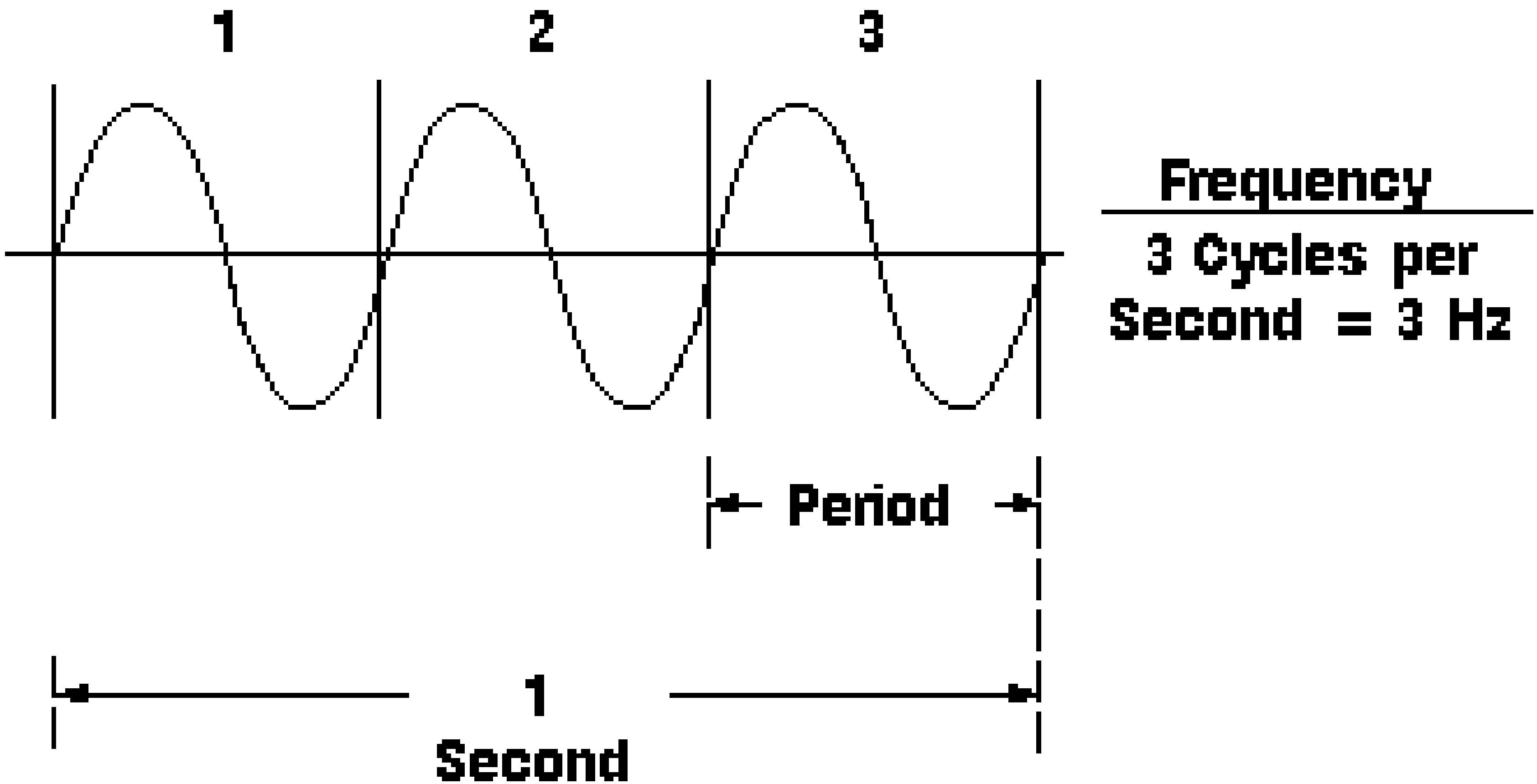


c.r.o. screen

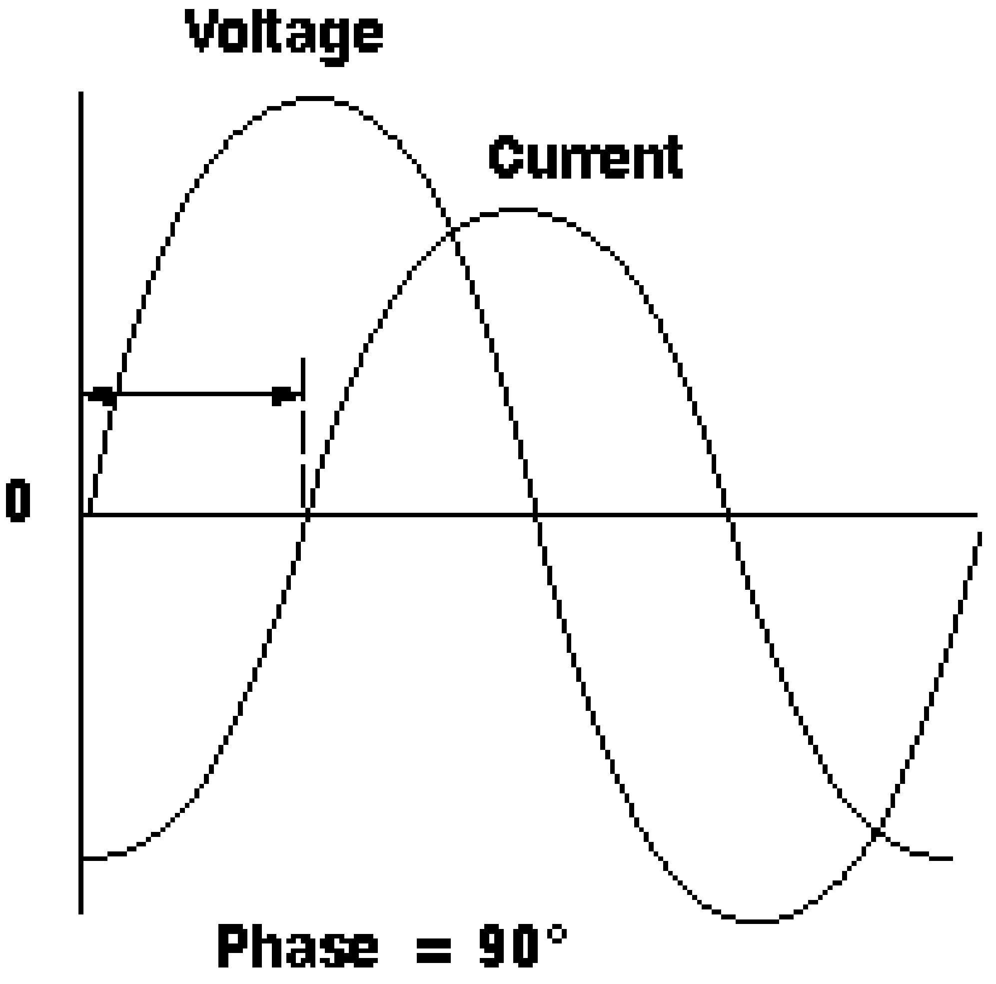
Waveform shapes tell you a great deal about a signal



If a signal repeats, it has a *frequency*. The frequency is measured in Hertz (Hz) and equals the number of times the signal repeats itself in one second



Voltage, Current, & Phase



Lissajous’ Figures

- Lissajous’ figure can be displayed by applying two a.c. signals simultaneously to the X-plates and Y-plates of an oscilloscope.
- As the frequency, amplitude and phase difference are altered, different patterns are seen on the screen of the CRO.

Lissajous' Figures

Same amplitude but different frequencies