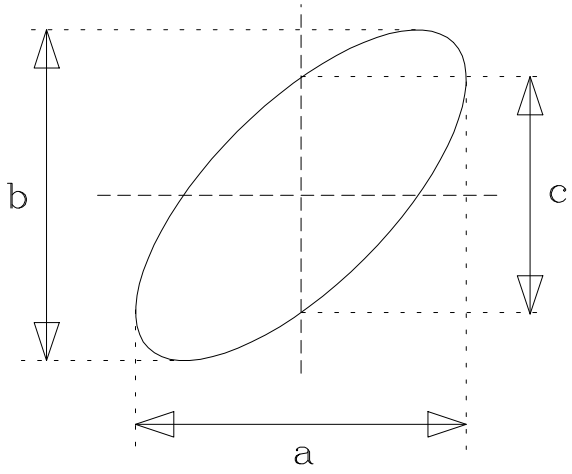
Appendix C

Lissajous patterns and phase shift



Switch the scope display to XY–mode to observe the Lissajous pattern as shown in the figure below. Be sure to note the sensitivity setting of each input in your measurement. The amplitude values should be recorded in volts rather than divisions. Set the sensitivities so that the major axis of the ellipse is at an angle of about 45° and several divisions in length. The pattern should be centered on the screen so that the central chord of the ellipse c, can be measured with the vertical center line of the scope graticule.

An easy way to perform the measurement is as follows:

1. Ground the vertical amplifier input (with the input switch) and align the trace with the horizontal center line.
2. Switch the vertical amplifier to DC and ground the horizontal amplifier input. Center the trace horizontally. Measure the length of that trace which is the quantity b.
3. Switch the horizontal amplifier to DC and measure c.

Assuming the input voltage of the circuit was monitored using the X input of the scope, and the output voltage with the Y input, the observed gain, G, and the phase shift, ϕ, are given by the following relations:

$$G = \frac{b}{a} \qquad \text{and} \qquad \phi = \arcsin \frac{c}{b}$$