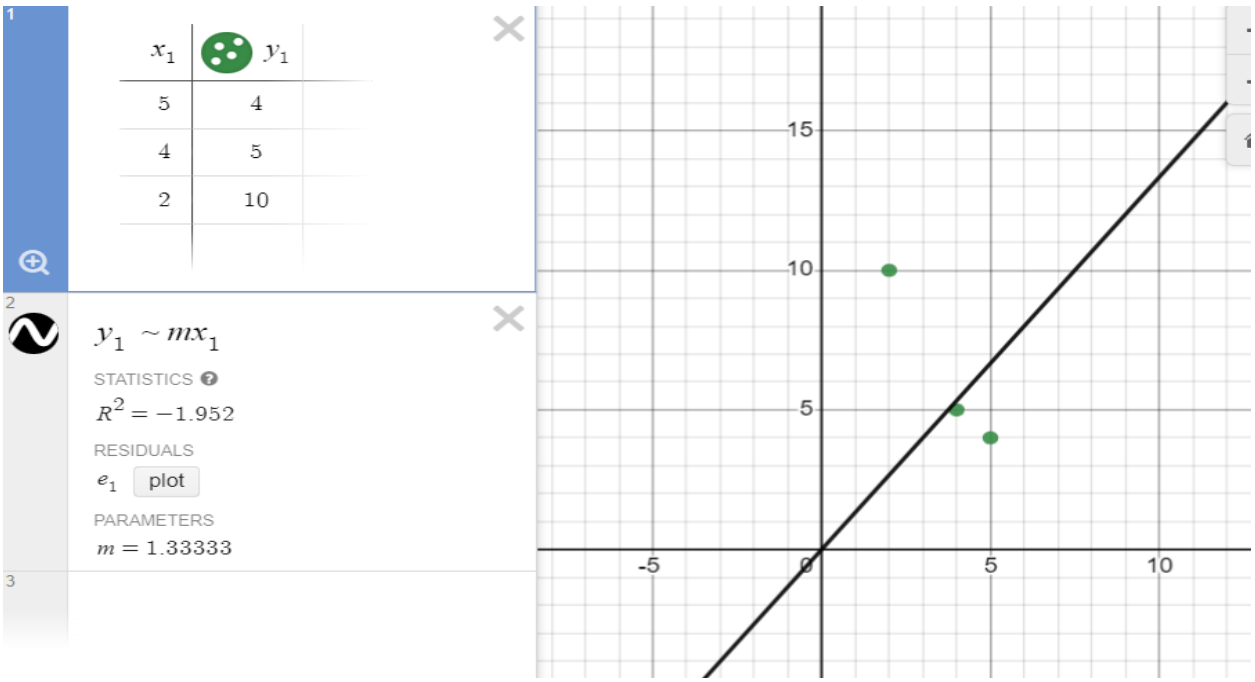
Data:

Table 1: Data for working out the unknown frequency of an alternating voltage signal

Known frequency (frequency of the alternating voltage signal generated by the function generator) 'a' (Hz)	Number of complete cycles along the axis for one complete cycle around the Lissajous curve (n_x)	Number of complete cycles along the y-axis for one complete cycle around the Lissajous curve (n_y)	b =a.$\frac{n_x}{n_y}$ (line frequency) 'b'(Hz)	Mean value of 'b' (Hz)
4	5	1	20	
5	4	1	20	20
10	2	1	20	

Find the slope from 'a' vs n_x graph (Calculate m from the best-fit line. It should be a straight line passing through the origin):



Here the graph represents the slope of 'a' vs n_x where the x-axis represents n_x and the y-axis represents 'a'.

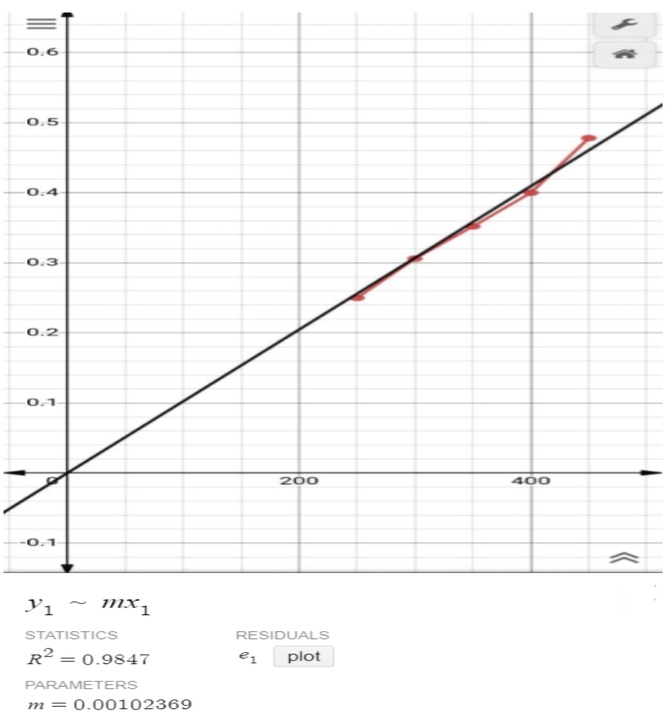
Frequency to be determined (line frequency), 'b'(Hz) = 20Hz

Table 2: Data for determining the time base of the oscilloscope

Frequency of the alternating voltage signal generated by a function generator *f* (Hz)	Number of horizontal divisions between two consecutive peaks *D*	Time base (time/division) T_B*(s/Div)*	The average value of the time base (time/division) T_B*(s/Div)*
250	4	10^{-3}	1.0172×10^{-3}
300	3.26	1.02×10^{-3}	
350	2.84	1.006×10^{-3}	
400	2.5	10^{-3}	
450	2.09	1.06×10^{-3}	

1/D	0.25
	0.306
	0.352
	0.4
	0.478

- Find the slope from the *1/D* vs. *f* graph (Calculate m from the best-fit line. It should be a straight line passing through the origin):

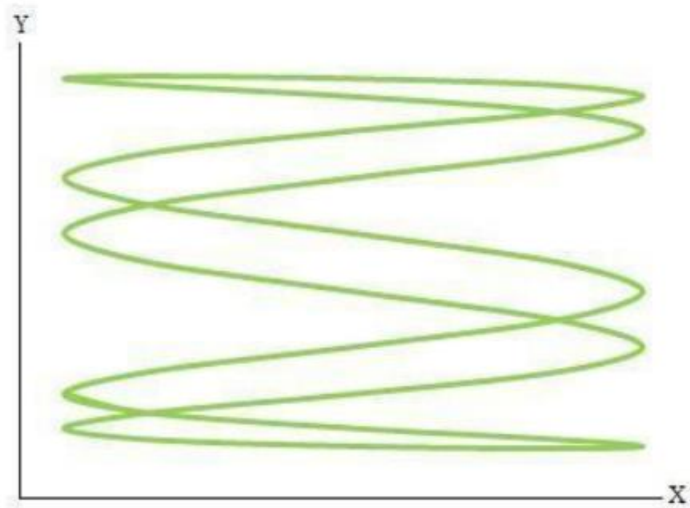


Here we have taken a graph that represents a slope of (*1/D* vs. *f*), where the x-axis represents (*f*) and the y-axis represents *(1/D)*

- Time base of the oscilloscope, T_B = 1.0172× 10^{-3}

Answer to the following questions:

1. From the given figure:

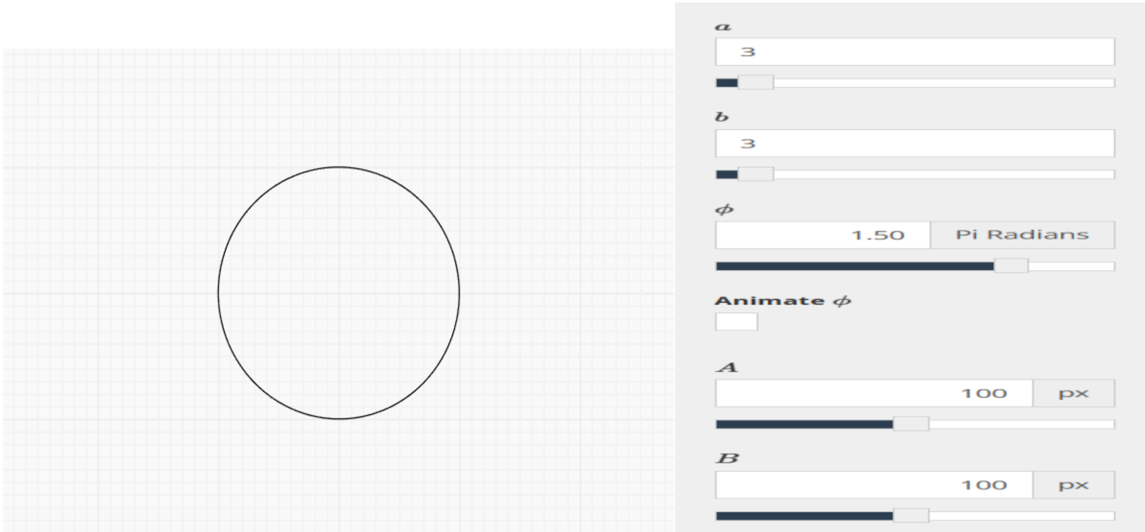


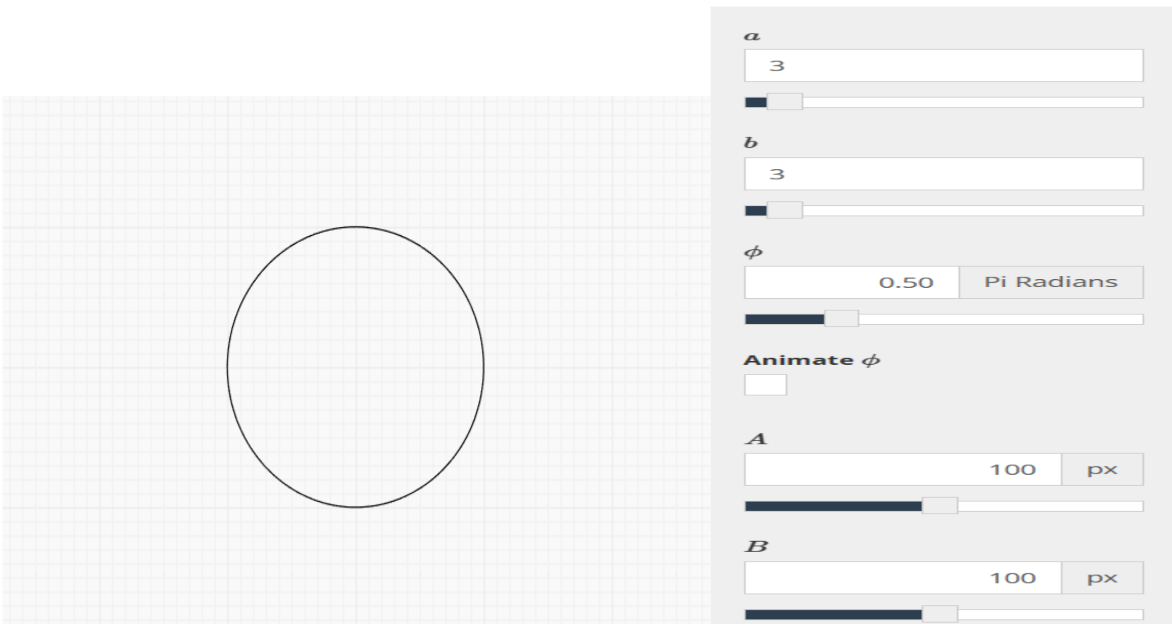
For this Lissajous curve, what is T_x/T_y ?

Ans: We know that T_x/T_y means $\frac{n_x}{n_y}$. So, the answer will be $\frac{1}{5}$.

2. What is the specific phase condition required to achieve a perfect circular Lissajous curve when both input signals 'a' and 'b' share identical frequencies?

Ans:

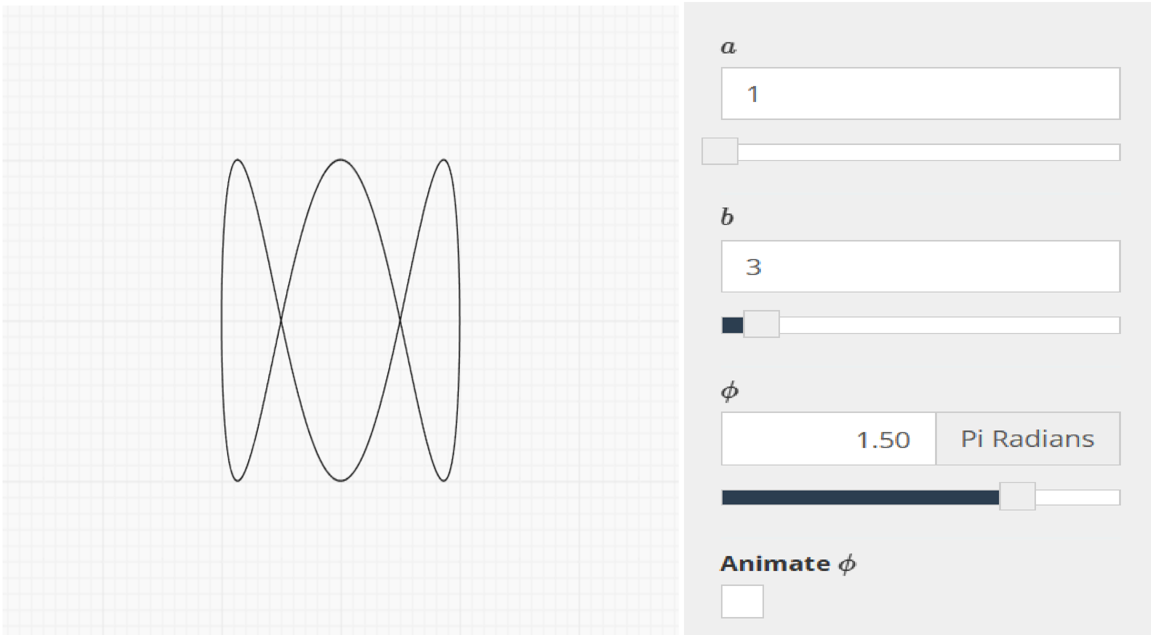




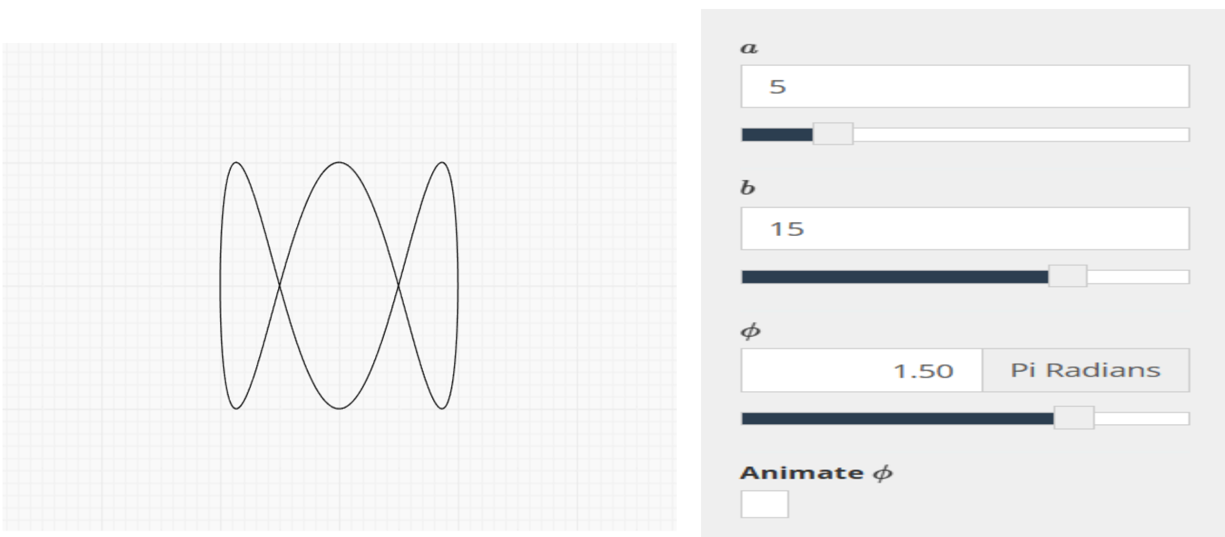
If we take the value of a and b where a= 3 and b = 3, then we can see that $\phi = 1.5$ *and* $\phi = 0.5$, In those positions we can achieve a perfect circular Lissajous curve when both input signals 'a' and 'b' share identical frequencies

3. **Explain the similarity in the Lissajous figures when inputting values a = 1 and b = 3 compared to a = 5 and b = 15.**
   Ans:

   For a = 1 and b = 3



For a = 5 and b = 15



Here we can see that there is no difference in the Lissajous figures when inputting values a = 1 and b = 3 compared to a = 5 and b = 15.

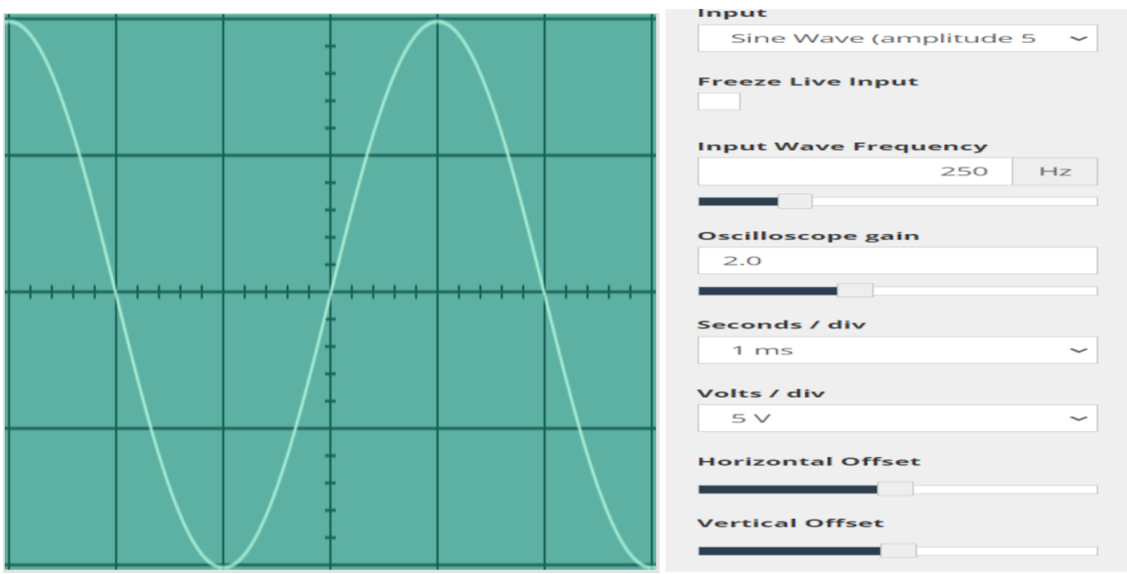
4. Define the "Time Base" of an Oscilloscope.

Ans: The “time base” refers to the section or component of the instrument that controls the horizontal sweep or timing of the displayed waveform. It determines how quickly the waveform is traced across the screen horizontally, allowing you to visualize the signal in the domain.

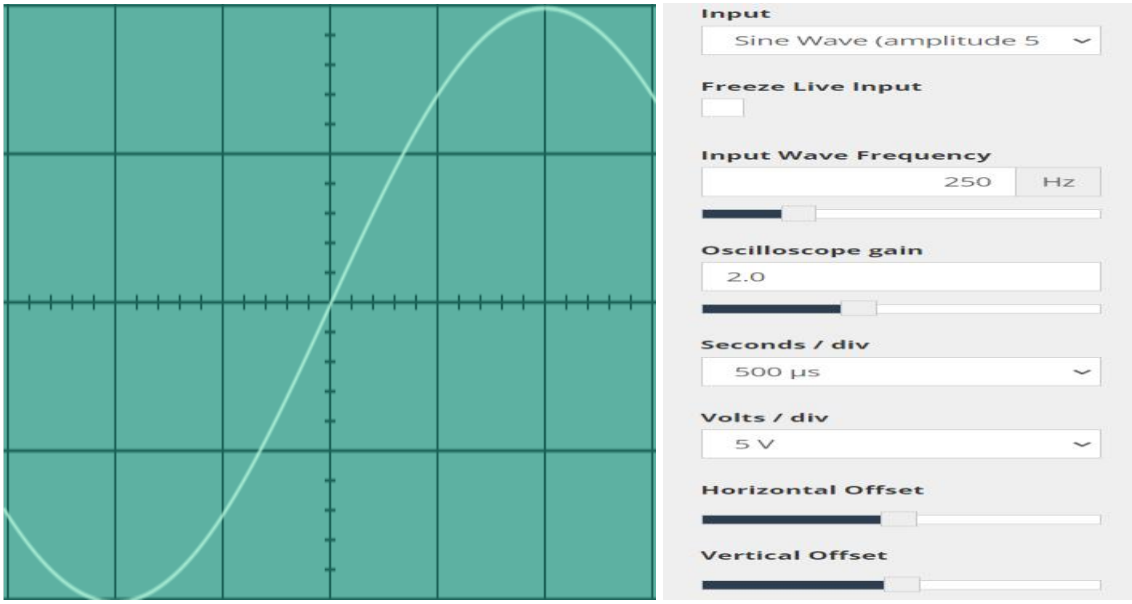
5. If we were to keep the input frequency in our virtual oscilloscope fixed and change other parameters in the following ways, what would happen in each case? (I) doubling gain (ii) halving the time base & (iii) doubling the volts/div. Discuss any change in values as well as in the output in our oscilloscope screen.

   Ans.

(i)Doubling gain:



ii) Halving the time base:



iii) Doubling the volts/div.