3 - DSO

PHYS 122-119B Lab 3a: DSO


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PHYS 122-119B
Station 32
Lab 3a: DSO (Digital Storage Oscilloscope)
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1

What is your estimate of the accuracy to which you can make measurements with your scope, in terms of cm, mm or DIV?

Answer

In both the vertical and horizontal axes:

$\frac{1}{5}$ DIV

2

What is your measured period and frequency (from counting divisions), with uncertainties, of the 1 kHz square wave calibration signal?

Answer

$\text{DIV} = 250\ \mu s$
Period: $\frac{16}{4}\text{ DIV} = 1000 \pm 10\ \mu s$
Frequency: $\frac{1}{t} \pm \frac{\delta_t}{t} f = 1.00 \pm 0.01\text{kHz}$

3

What is your measurement (by counting divisions) of the peak-to-peak voltage of the calibration signal?

✓ **Answer**

$\text{DIV} = 500\ mV$

Peak-to-peak: $6\ \text{DIV} = 3.0 \pm 0.1\ V$

4

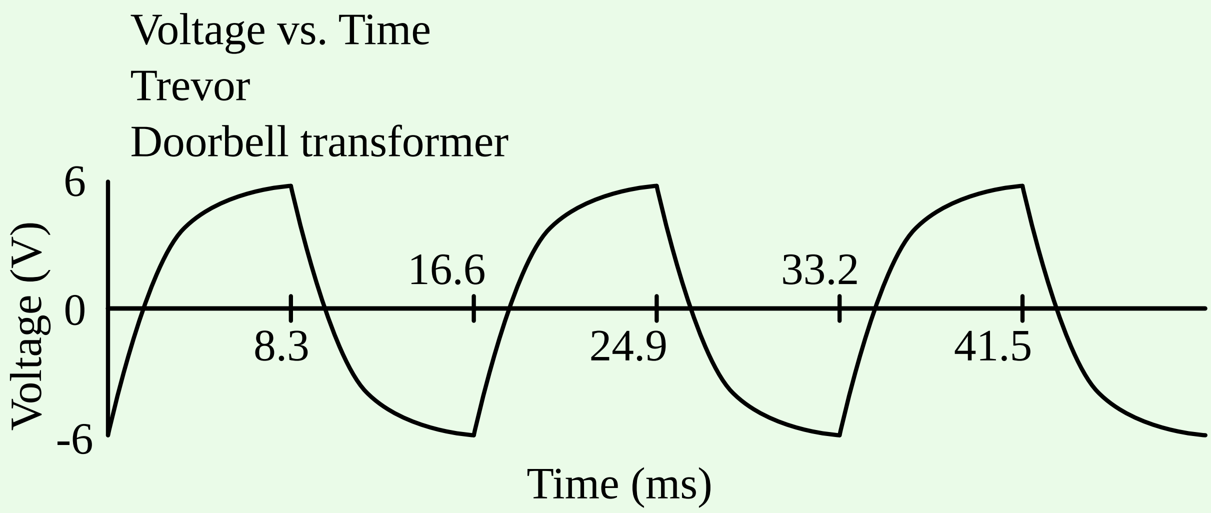
Provide a sketch of the waveform obtained from the doorbell transformer, with appropriate scales on the horizontal and vertical axes. Also provide the period, frequency and peak-to-peak voltage of the signal obtained from your measurements.

✓ **Answer**

$\text{DIV} = 2\ V, 5\ ms$

$V_{pp} = 6\ \text{DIV} = 12.0 \pm 0.4\ V$

$p = \frac{16.6}{5}\ \text{DIV} = 16.6 \pm 0.2\ ms$



5

What voltage did you measure for the doorbell transformer with your DMM? Is this consistent with the scope measurement? (Explain!)

✓ **Answer**

DMM: $4.27\ V \pm 1\%$

If we know that:

$V_{pp} = 2\sqrt{2}V_{rms}$

We can calculate our expected V_{pp} from our DMM reading to compare with our DSO reading.

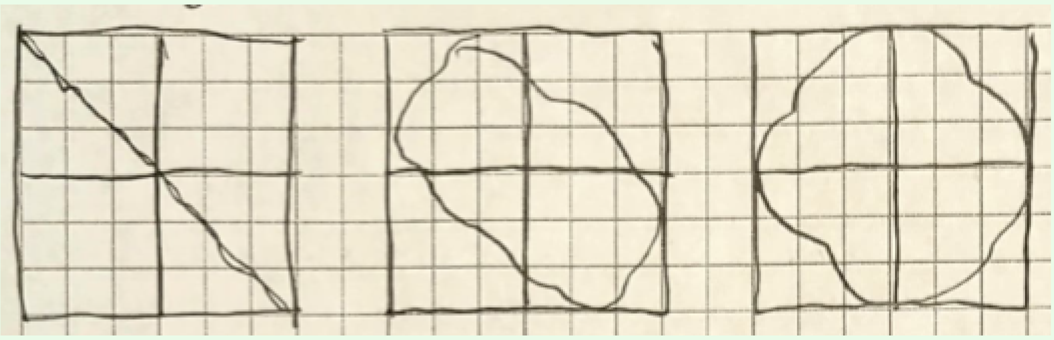
$V_{pp} = 12.1\ V \pm 1\%$

This value lines up closely with the V_{pp} obtained from the DSO.

6

Sketch your Lissajous pattern(s) at 60 Hz. (You should make more than 1 plot to show how this pattern changes during your observation.)

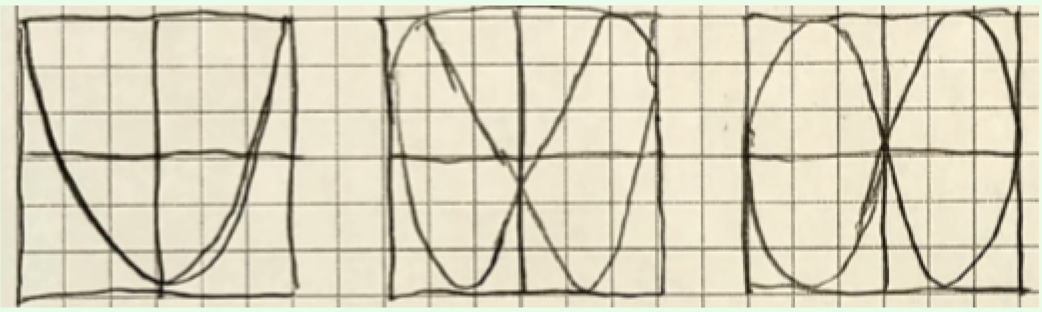
✓ **Answer**



7

Sketch the pattern at 120 Hz.

✓ **Answer**



8

What frequency between 60-120 Hz gives another clear Lissajous pattern?

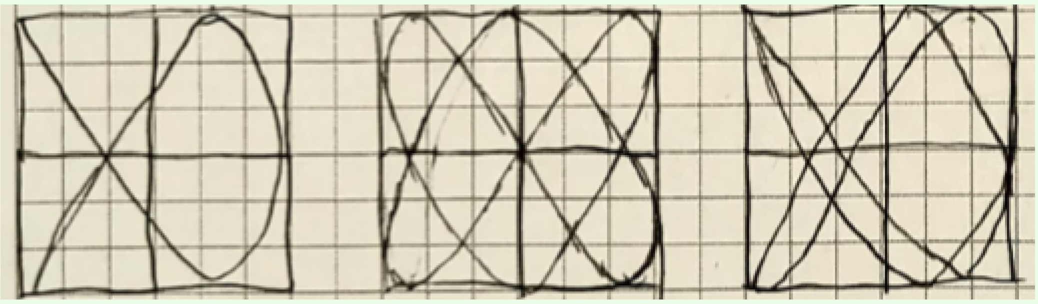
✓ **Answer**

$90.0 \pm 0.1\ Hz$

9

Sketch the pattern at this intermediate frequency.

✓ **Answer**



10

What conditions are necessary to observe Lissajous patterns?

✓ **Answer**

The ratios of the two waves must be simple or small integers.

11

What is the tuning fork frequency you measured from your scope?

✓ **Answer**

$p = \frac{314 \pm 5}{30}\ ns = 10.5 \pm 0.2\ ns$
$f = \frac{1}{p} \pm \frac{\delta_p}{p} f = 95 \pm 2\ MHz$

I doubt this is the actual frequency of the tuning fork, as I would likely be unable to hear it.