No Writing on Left-Side Pages
Keep these clear for grader comments.

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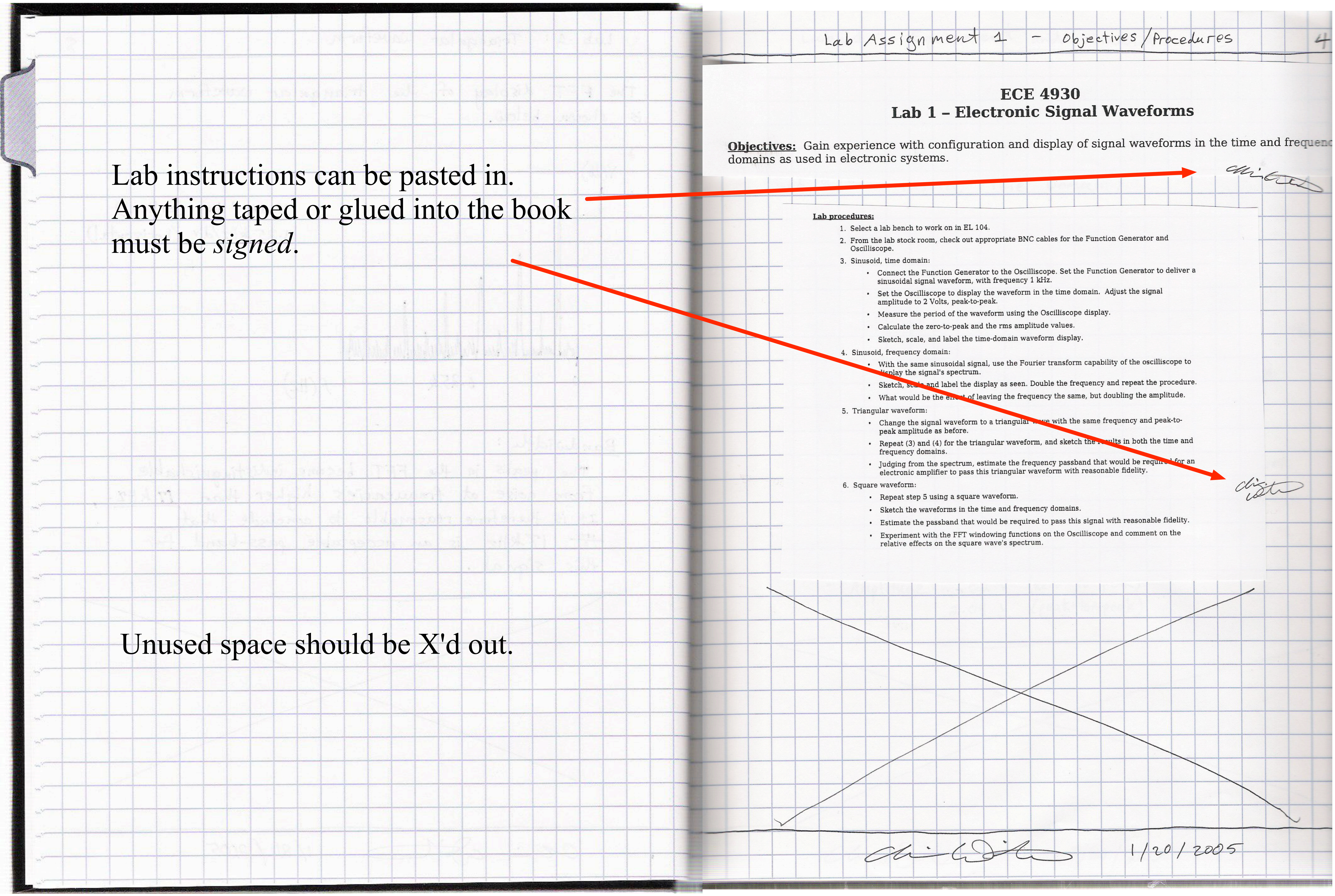
Blueline

Each page has a header to identify the Lab, the Part, and the Page Number.



Each page has a footer containing your *signature* and the *date*.

For all equipment, list the make, model and inventory control number (look for the USU bar code).

Give detailed descriptions of your methods. If possible, draw figures showing your experimental configurations.

Make sure all measurements are ***clearly marked.*** Where appropriate, list measured data in *tables*.

Equipment used for experiments:

- Tektronics TDS 2012 oscilloscope, SN 93975.
- Tektronics CFG 250 function generator, SN 58936.

Part 3: Sinusoid, Time Domain.

The function generator was connected to the oscilloscope on ch. 1 using a BNC cable. The "Main Output" connector was used on the function generator. The "Sync" connector on the function gen. was connected to the "External Trigger" on the scope.

The scope was configured to use 1V per division on channel 1, 500μs per division on the time axis, and the trigger source was set to "ext."

The sinusoid was adjusted to 1KHz, 2V peak-to-peak, with zero DC offset. Using the scope, the following measurements were taken:

- Period: 982 μs
- Amplitude: 1.02 V (zero-to-peak)
  2.04 V (peak-to-peak)

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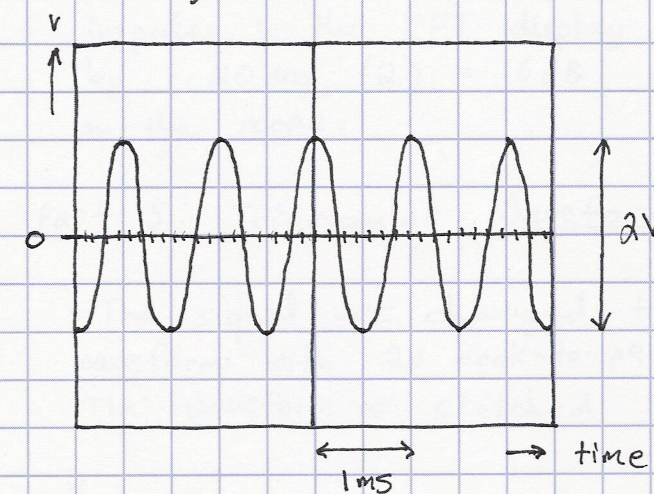
Carefully draw oscilloscope plots, and be sure to label the units per division on the vertical and horizontal axes.

Be sure to add any information that might affect the outcome of your measurements.

The displayed waveform is sketched below, with 500 mV / div on the voltage scale and 500 μs / div on the time scale.



Part 4: Sinusoid, Frequency Domain

The scope's FFT function was accessd via the "Math Menu" button. The waveform is sketched below, showing 10 dB / div on the vertical, and 250 Hz/div on the horizontal axis.

A "flat top" window was used for the FFT.

An impulse is observed at 1000 Hz.

[illegible signature] 1/20/2005

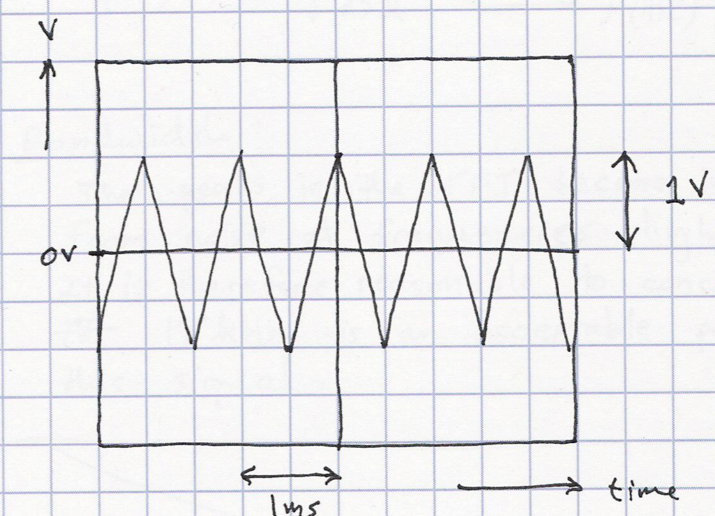
Provide any mathematical equations that you use in your calculations.

Doubling the amplitude:

If the frequency is held constant while the amplitude is doubled the height of the impulse in the FFT display will be raised by $20 \log_{10}(2) = 6\,dB$, which is 0.6 div on the scope.

Part 5: Triangular Waveform

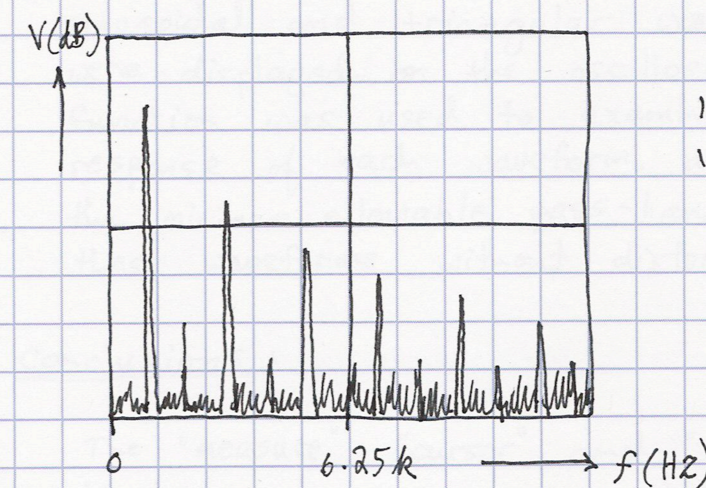
The signal was changed to a triangular waveform with 2V peak-to-peak at 1kHz. The waveform is sketched below.



The waveform was then viewed using the FFT function. This time the frequency response revealed many impulses, as shown on the next page.

Chris White 1/20/2005

The FFT display of the triangular waveform is shown below.



10 dB / div (vertical)
1.25 kHz/div (horizontal)

Bandwidth:

The peaks in the FFT become indistinguishable from noise at frequencies higher than 17 kHz. It is therefore reasonable to conclude that ~~17~~ 17 kHz is an acceptable pass-band for this signal.

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Always finish your lab with a summary and conclusions. The summary should briefly state the kind of topics and experiments that were examined in the lab.

Your conclusions should reflect any knowledge gained through your experiments. Note that the lab book is not a diary. Don't say something like "I learned that signals have frequency components." Instead, try and provide professional conclusions that would be useful to someone else.

Imagine that you will be reading this lab book years from now, to remind yourself of the lab's key points. Write the conclusions in a way that will refresh your memory.

Summary:

The function generator was used to produce sinusoidal and triangular waveforms which were displayed on the oscilloscope. The FFT function was used to examine the frequency response of each waveform, and to assess the minimum allowable pass-band for processing these waveforms without distortion.

Conclusions:

The "measure", "cursor" and "Math Menu" buttons on the oscilloscope provide extremely valuable tools for examining signals. The "cursor" button is also essential for performing detailed measurements. External triggering is very useful for stabilizing the oscilloscope's display.

The FFT display revealed that a triangular waveform requires much greater bandwidth than a sinusoid of the same frequency. This is because the triangular wave is made up of many harmonic components at frequencies above the fundamental.

These results highlight the limitations of narrow-band circuits when dealing with complicated waveforms. If the circuit's bandwidth is too small, it will destroy important frequency components and distort the signal.

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