Exercises:

1. Compute the Fourier coefficients, a_0, a_n and b_n for the "flipped" bipolar, triangle wave, in the time domain:
$$f(\theta) = f(kx) = -(2/\pi)\theta \quad \text{for} \quad 0 \le \theta < \pi/2$$
$$f(\theta) = f(kx) = +(2/\pi)\theta - 2 \quad \text{for} \quad \pi/2 \le \theta < 3\pi/2$$
$$f(\theta) = f(kx) = -(2/\pi)\theta + 4 \quad \text{for} \quad 3\pi/2 \le \theta < 2\pi$$
Compare these Fourier coefficients with those obtained above for the "unflipped" bipolar triangle wave.

2. Compute the Fourier coefficients, a_0, a_n and b_n for the "shifted" bipolar triangle wave, in the time domain:
$$f(\theta) = f(kx) = +(2/\pi)\theta - 1 \quad \text{for} \quad 0 \le \theta < \pi$$
$$f(\theta) = f(kx) = -(2/\pi)\theta + 3 \quad \text{for} \quad \pi \le \theta < 2\pi$$
Compare these Fourier coefficients with those obtained above for the "unflipped" and "flipped" bipolar triangle waves.

3. Work your way through the details of computing the Fourier coefficients, a_0, a_n and b_n for the above-discussed *specific* case of the bipolar sawtooth wave.

4. Concoct a waveform shape of your own interest, write out its mathematical representation, $f(\theta)$ over the interval $0 \le \theta < 2\pi$, and compute the Fourier coefficients, a_0, a_n and b_n associated with your waveform.

5. For each of the above exercises, use e.g. *MathLab*, or a spreadsheet program, such as *Excel* to make plots of the harmonic amplitudes, $|r_n|$, the loudness ratios, L_n / L_1 and Fourier contruction of the original waveform, for e.g. the first few harmonics.

References for Fourier Analysis and Further Reading:

1. Fourier Series and Boundary Value Problems, 2nd Edition, Ruel V. Churchill, McGraw-Hill Book Company, 1969.

2. Mathematics of Classical and Quantum Physics, Volumes 1 & 2, Frederick W. Byron, Jr. and Robert W. Fuller, Addison-Wesley Publishing Company, 1969.

3. Mathematical Methods of Physics, 2nd Edition, Jon Matthews and R.L. Walker, W.A. Benjamin, Inc., 1964.