Building a Triangle Wave from Cosine Waves

$A := 1$ Amplitude of the triangle wave

$\lambda := 2\cdot\pi$ Lambda is the wavelength of the triangle wave

$n := 1, 2 .. 7$ Set of harmonics to use

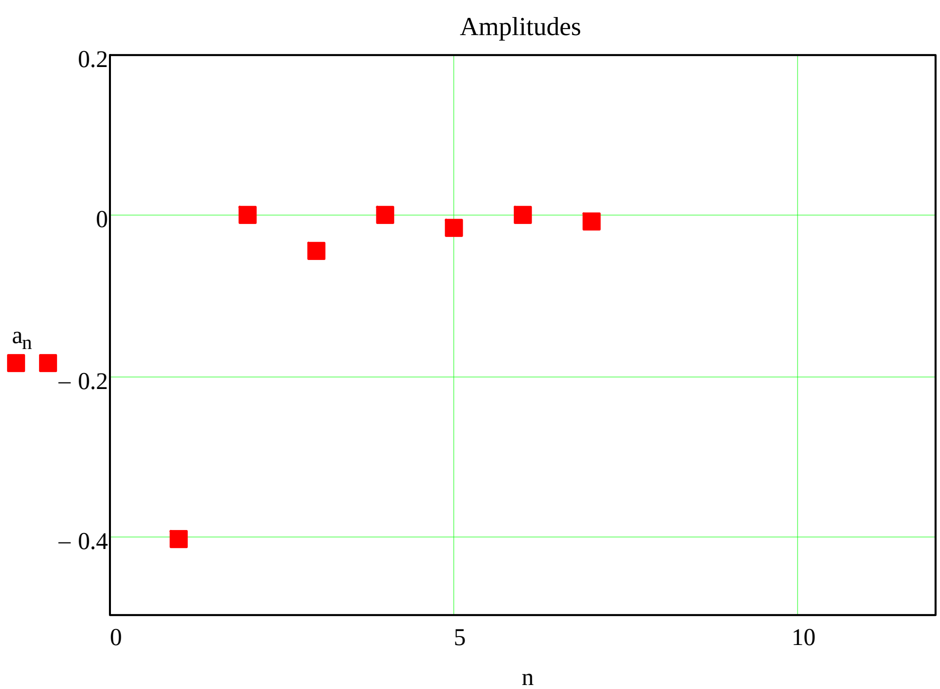
$k_n := n\cdot\frac{2\cdot\pi}{\lambda}$ Wave numbers, one for each harmonic

Exact triangle wave function, for comparison:

$$F_a(x) := \begin{cases} \frac{2A}{\lambda}x & \text{if } x \ge 0 \wedge x \le \frac{\lambda}{2} \\ \frac{2A}{\lambda}\cdot(\lambda - x) & \text{otherwise} \end{cases}$$

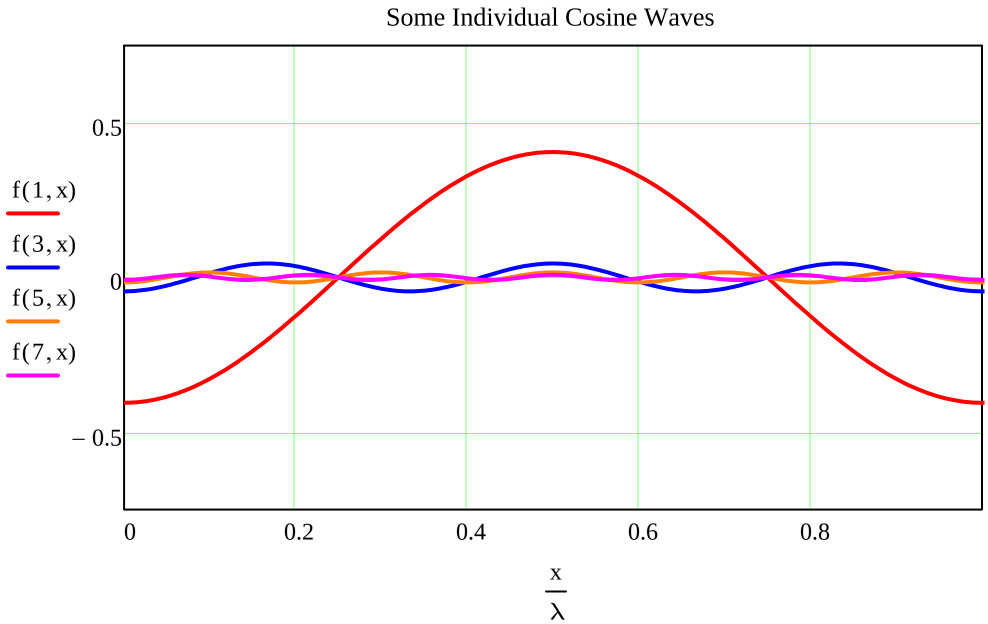
$a_n := \frac{2A\cdot\left[(-1)^n - 1\right]}{(\pi\cdot n)^2}$ "Magic" formula for the amplitudes. (This is derived from Fourier analysis.) Note that only the odd ones are non-zero.

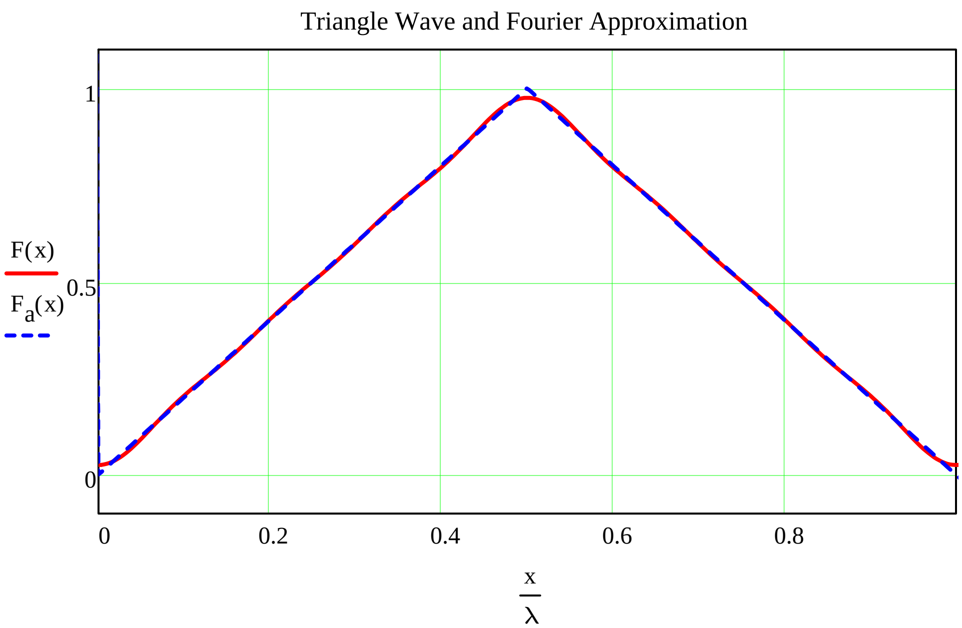
$a_0 := A$ a0 is twice the average value of the function.

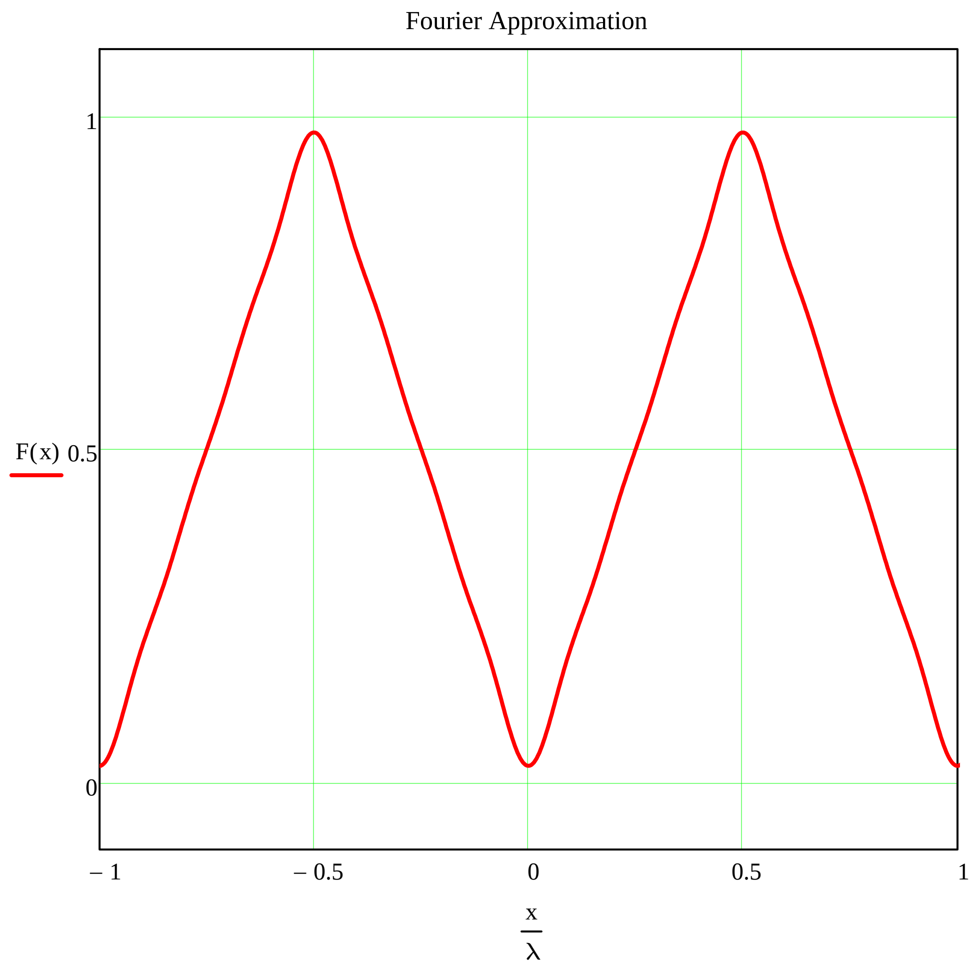


$f(n,x) := a_n \cdot \cos(k_n \cdot x)$ The individual cosine waves

$F(x) := \frac{a_0}{2} + \left(\sum_n f(n,x)\right)$ Truncated Fourier series to approximate the saw-tooth wave.






Fourier Approximation
1
F(x) 0.5
0
− 1
− 0.5
0
0.5
1
x
λ