W1FTSERIS

Fourier serie of spatial wavelength λ for the interval from -1 to 1(shown to 2).

For N = 0 the only term is a sine wave from -1 to 1, of wavelength λ = 2.
For N = 1 a sine-term with 1/3 of λ and smaller amplitude is added.
For N = 2 a term with 1/5 of λ and smaller amplitude, and so on.
If N is large, we see a perfect step function.

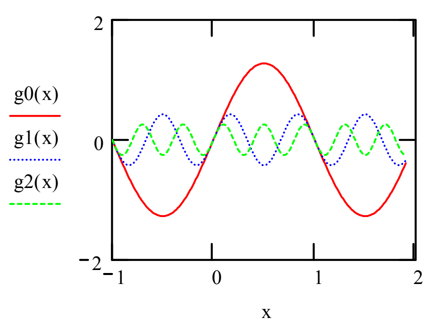
For smaller N (in the 20th) we see "Gibb's phenomenon", the corners are not round and there is "overshooting". For large N it disappears.

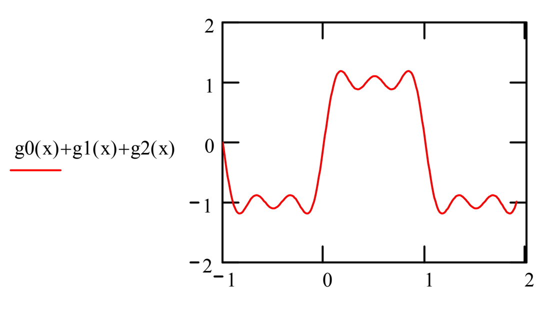
$x := -1, -.99 .. 1.9 \qquad \Lambda := 1 \qquad n := 0, 1 .. 200 \qquad N \equiv 100$

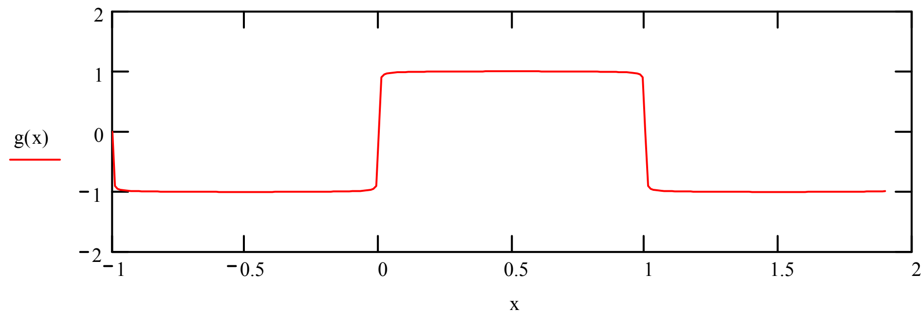
$$g(x) := \sum_{n=0}^{N} \left[\frac{4 \cdot \sin\left[2 \cdot \pi \cdot x \cdot (f_n)\right]}{(2 \cdot n + 1) \cdot \pi} \right] \qquad f_n := \frac{2 \cdot n + 1}{2 \cdot \Lambda}$$

For larger and larger N one can see how more and more waves with shorter and shorter wavelength are used to build the step function.

$$g0(x) := \frac{4 \cdot \sin\left(\pi \cdot x \cdot \frac{1}{\Lambda}\right)}{\pi} \qquad g1(x) := \frac{4 \cdot \sin\left(\pi \cdot x \cdot \frac{2 \cdot 1 + 1}{\Lambda}\right)}{(2 \cdot 1 + 1) \cdot \pi} \qquad g2(x) := \frac{4 \cdot \sin\left(\pi \cdot x \cdot \frac{2 \cdot 2 + 1}{\Lambda}\right)}{(2 \cdot 2 + 1) \cdot \pi}$$







2
1
0
−1
−2
g(x)
−1
−0.5
0
0.5
1
1.5
2
x

$\omega\Lambda$