fs.89p
version: 1.0

This program calculates Fourier series coefficients (a0, a(n), and b(n)) of a given function. The function can have any number of piecewise continues intervals. Results will be stored in one letter variables "o" (=a0), "a" (=a_n), "b" (=b_n) and "f" (= series as a function of "k"). Resulted coefficients are a function of "n", thus for example finding a(15) would be easy (type a|n=15 in the entry line).

Calculations are based on these formulas:

$$s_N(x) = \frac{a_0}{2} + \sum_{n=1}^{N} \left(\overbrace{A_n \sin(\phi_n)}^{a_n} \cos\left(\frac{2\pi n x}{P}\right) + \overbrace{A_n \cos(\phi_n)}^{b_n} \sin\left(\frac{2\pi n x}{P}\right) \right)$$

$$a_n = \frac{2}{P} \int_{x_0}^{x_0+P} s(x) \cdot \cos\left(\frac{2\pi n x}{P}\right)\, dx$$

$$b_n = \frac{2}{P} \int_{x_0}^{x_0+P} s(x) \cdot \sin\left(\frac{2\pi n x}{P}\right)\, dx$$

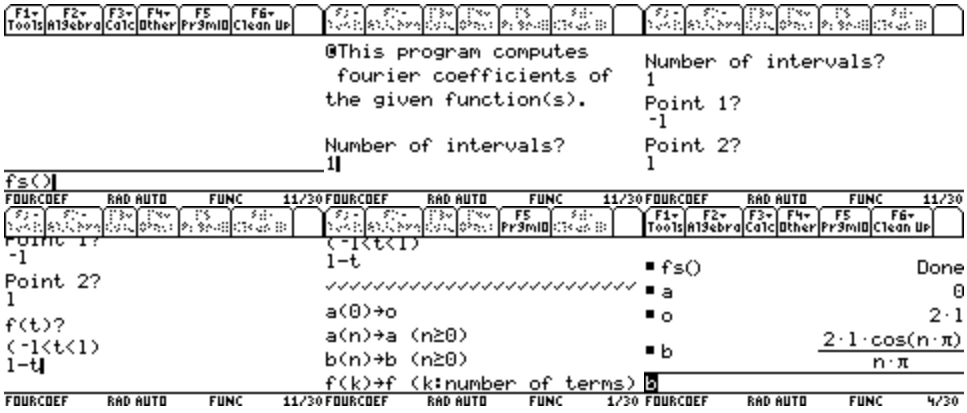
(Note that in some references they may defer a bit, specifically, **a0** may be calculated two times as a0 in this formula, but the final result is always the same)

Using the program is pretty straightforward, see the following examples.

Example1:

Find the Fourier coefficients for f(x)=l-x on -l<x<l:

Solution:

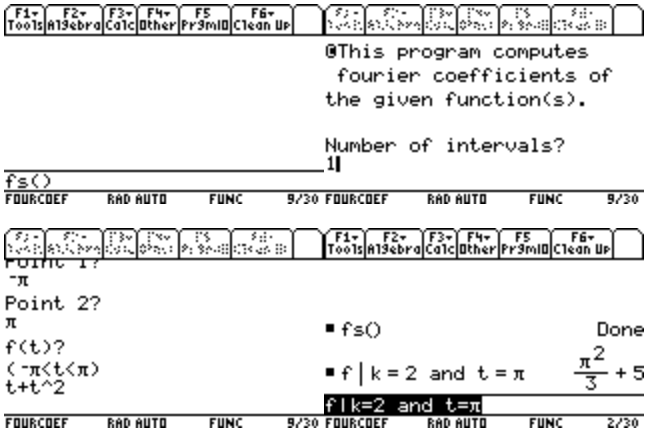


Example2:

Find sum of the first 2 terms of Fourier series of f(x) when x=pi:

f(x)=x+x^2 on -pi<x<pi

Solution:



Example3:

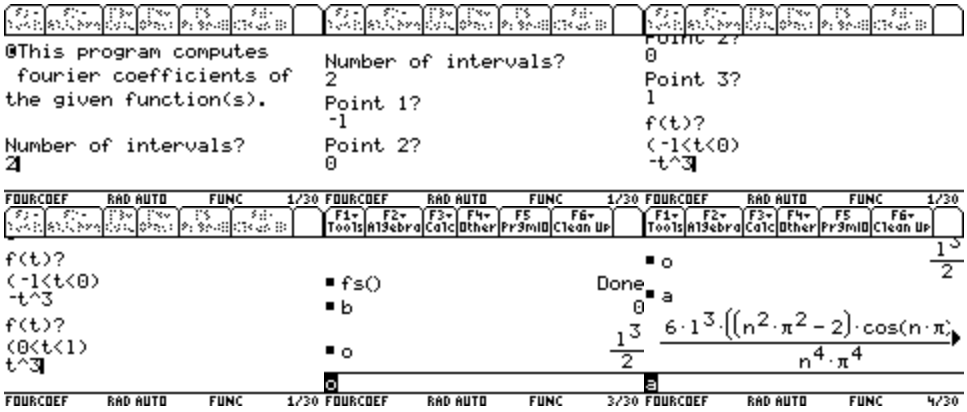
Find the Fourier sine cosine series for:

$f(x) = x^3; \quad 0 < x < l$

Solution:

Currently the program does not calculate sine and cosine coefficients directly, but it's easy to find odd and even extensions of functions. (See http://tutorial.math.lamar.edu/Classes/DE/FourierCosineSeries.aspx for more information)

$$g(x) = \begin{cases} f(-x) = -x^3; & -l < x < 0 \\ f(x) = x^3; & 0 < x < l \end{cases}$$



Example4:

What is bn coefficient of Fourier sine series for the following function?

$$f(t) = \begin{cases} \dfrac{2r}{l}t; 0 < t < \dfrac{l}{2} \\ \dfrac{2r}{l}(l-t); \dfrac{l}{2} < t < l \end{cases}$$

Solution:

$$g(t)=\begin{cases}\dfrac{-2r}{l}(l+t); -l<t<-\dfrac{l}{2}\\ \dfrac{2r}{l}t; -\dfrac{l}{2}<t<0\\ \dfrac{2r}{l}t; 0<t<\dfrac{l}{2}\\ \dfrac{2r}{l}(l-t); \dfrac{l}{2}<t<l\end{cases}$$