

**Trigonometrisches Polynom:**

Stützstellen (Meßstellen)

seq(x, x, 1, 20, 1) ⇒ xliste

{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18} ▶

Stützwerte (Meßwerte)

{6, 10, 7, 4, 1, -2, 0, 2, 0, 1, 2, 1, 0, -1, 1, 3, -.5, -4, -1} ▶

{6, 10, 7, 4, 1, -2, 0, 2, 0, 1, 2, 1, 0, -1, 1, 3,  $-\frac{1}{2}$ , -4, -1} ▶

dim(xliste)

20

dim(yliste)

20

Statistik (Datenpunkte) 

Periode  $T=2p=20$ ,  $\omega=\frac{2\pi}{T}=\frac{\pi}{p}$

**Ansatz:** Trigonometrisches Polynom

$$P_m(x) = \frac{a_0}{2} + \sum_{k=1}^m (a_k * \cos(k\omega x) + b_k * \sin(k\omega x)), \quad m < n,$$

n:=10

10

$$\omega = \frac{\pi}{n}$$

$\frac{\pi}{10}$

Define  $a(k) = \text{approx}\left(\frac{1}{n} * \text{sum}(y_{\text{liste}} * \cos(k * \omega * x_{\text{liste}}))\right)$

done

$\text{listToMat}(\text{seq}(a(k), k, 1, 10, 1))$

$$\begin{bmatrix} 1.319099462 \\ 0.4199593469 \\ -1.243573253 \\ -0.4140576475 \\ 0.8 \\ -0.1949593469 \\ -0.3598709328 \\ 0.08905764747 \\ -0.01565527619 \\ 0.05 \end{bmatrix}$$

Define  $b(k) = \text{approx}\left(\frac{1}{n} * \text{sum}(y_{\text{liste}} * \sin(k * \omega * x_{\text{liste}}))\right)$

done

$\text{listToMat}(\text{seq}(b(k), k, 1, 10, 1))$

$$\begin{bmatrix} 1.642949121 \\ 2.596229636 \\ 2.062856017 \\ 0.9890214502 \\ -0.25 \\ -0.1587975993 \\ -0.7903135315 \\ -0.1116314074 \\ -0.1204066355 \\ 0 \end{bmatrix}$$

$\text{seq}(a(k) * \cos(k * \omega * x) + b(k) * \sin(k * \omega * x), k, 1, 5, 1) \Rightarrow \text{plis}$

$\left\{ 1.319099462 * \cos\left(\frac{x * \pi}{10}\right) + 1.642949121 * \sin\left(\frac{x * \pi}{10}\right), 0.41 \right\}$

Define  $P_5(x) = \frac{a(0)}{2} + \text{sum}(\text{pliste5})$

done

$P_5(x)$

$$\frac{-8523175 \cdot \cos\left(\frac{3 \cdot x \cdot \pi}{10}\right)}{6853778} + \frac{21356179 \cdot \sin\left(\frac{3 \cdot x \cdot \pi}{10}\right)}{10352724} - \frac{381643}{92}$$

Define  $y1(x) = P_5(x)$

done

$\text{seq}(a(k) \cdot \cos(k \cdot \omega \cdot x) + b(k) \cdot \sin(k \cdot \omega \cdot x), k, 1, 10, 1) \Rightarrow \text{pl}$

$$\left\{ 1.319099462 \cdot \cos\left(\frac{x \cdot \pi}{10}\right) + 1.642949121 \cdot \sin\left(\frac{x \cdot \pi}{10}\right), 0.41 \right\}$$

Define  $P_{10}(x) = \frac{a(0)}{2} + \text{sum}(\text{pliste10})$

done

Define  $y2(x) = P_{10}(x)$

done

2D-Grafik Y1: ...  
Y2: ...

Statistische Grafik

Define  $y3(x) = \begin{cases} 2+4x, & 0 < x \leq 2 \\ 16-3x, & 2 < x \leq 6 \\ -14+2x, & 6 < x \leq 8 \\ 18-2x, & 8 < x \leq 9 \\ -9+x, & 9 < x \leq 11 \\ 13-x, & 11 < x \leq 14 \\ -29+2x, & 14 < x \leq 16 \\ 59-3.5x, & 16 < x \leq 18 \\ -58+3x, & 18 < x \leq 20 \end{cases}$

done

Statistische Grafik

## Fourier-Reihe

$$S(x) = \frac{A_0}{2} + \sum_{k=1}^{\infty} (A_k \cos(k\omega x) + B_k \sin(k\omega x)) \quad \text{mit}$$

$$\text{Define } A(k) = \frac{1}{10} \int_0^{20} y_3(x) \cos(k\omega x) dx$$

done

A(0)

3.15

$$\begin{bmatrix} A(1) \\ A(2) \\ A(3) \\ A(4) \\ A(5) \end{bmatrix} \Rightarrow \text{vecA}$$

$$\begin{bmatrix} 1.308285933 \\ 0.4063237747 \\ -1.154204169 \\ -0.3623584924 \\ 0.6484555751 \end{bmatrix}$$

$$\text{Define } B(k) = \frac{1}{10} \int_0^{20} y_3(x) \sin(k\omega x) dx$$

done

$$\begin{bmatrix} B(1) \\ B(2) \\ B(3) \\ B(4) \\ B(5) \end{bmatrix} \Rightarrow \text{vecB}$$

$$\begin{bmatrix} 1.629480784 \\ 2.511933199 \\ 1.914609381 \\ 0.8655324298 \\ -0.2026423673 \end{bmatrix}$$

Define  $y4(x) = \frac{A(0)}{2} + \sum_{k=1}^5 (\text{vecA}[k, 1] * \cos(k * \omega * x) + \text{vecB}[k, 1] * \sin(k * \omega * x))$

done

y4(x)

$$\frac{-56159594 \cdot \cos\left(\frac{3 \cdot x \cdot \pi}{10}\right)}{48656551} + \frac{11218422 \cdot \sin\left(\frac{3 \cdot x \cdot \pi}{10}\right)}{5859379} - \frac{86843}{2}$$

Define  $y4(x) = \frac{-56159594 \cdot \cos\left(\frac{3 \cdot x \cdot \pi}{10}\right)}{48656551} + \frac{11218422 \cdot \sin\left(\frac{3 \cdot x \cdot \pi}{10}\right)}{5859379} - \frac{86843}{2}$

done

$\begin{bmatrix} A(1) \\ A(2) \\ A(3) \\ A(4) \\ A(5) \\ A(6) \\ A(7) \\ A(8) \\ A(9) \\ A(10) \end{bmatrix} \Rightarrow \text{VecA}$

$\begin{bmatrix} 1.308285933 \\ 0.4063237747 \\ -1.154204169 \\ -0.3623584924 \\ 0.6484555751 \\ -0.1436537924 \\ -0.2363048871 \\ 0.05101103574 \\ -7.64145069E-3 \\ 0.02026423673 \end{bmatrix}$

$$\begin{bmatrix} B(1) \\ B(2) \\ B(3) \\ B(4) \\ B(5) \\ B(6) \\ B(7) \\ B(8) \\ B(9) \\ B(10) \end{bmatrix} \Rightarrow \text{VecB}$$

$$\begin{bmatrix} 1.629480784 \\ 2.511933199 \\ 1.914609381 \\ 0.8655324298 \\ -0.2026423673 \\ -0.1170083802 \\ -0.5189498037 \\ -0.06394098515 \\ -0.05877132785 \\ -4E-11 \end{bmatrix}$$

Define  $y5(x) = \sum_{k=6}^{10} (\text{VecA}[k, 1] * \cos(k * \omega * x) + \text{VecB}[k, 1]) * \rightarrow$

done

$y5(x)$

$$\frac{1519516 \cdot \cos(x \cdot \pi)}{74985109} - \frac{\sin(x \cdot \pi)}{25000000000} - \frac{756971 \cdot \cos\left(\frac{9 \cdot x \cdot \pi}{10}\right)}{99061164} \rightarrow$$

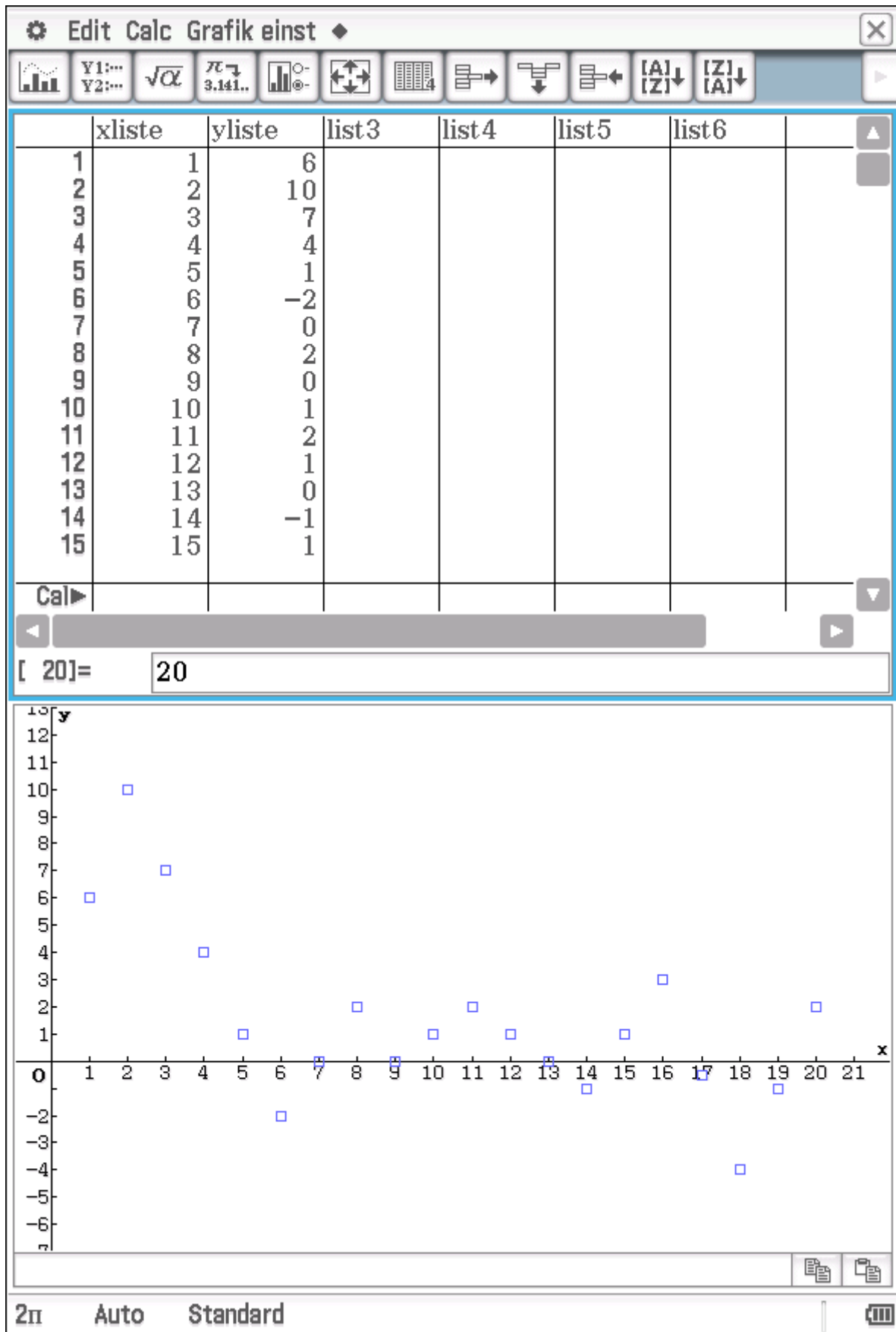
Define  $y5(x) = y4(x) + \frac{1519516 \cdot \cos(x \cdot \pi)}{74985109} - \frac{\sin(x \cdot \pi)}{25000000000} \rightarrow$

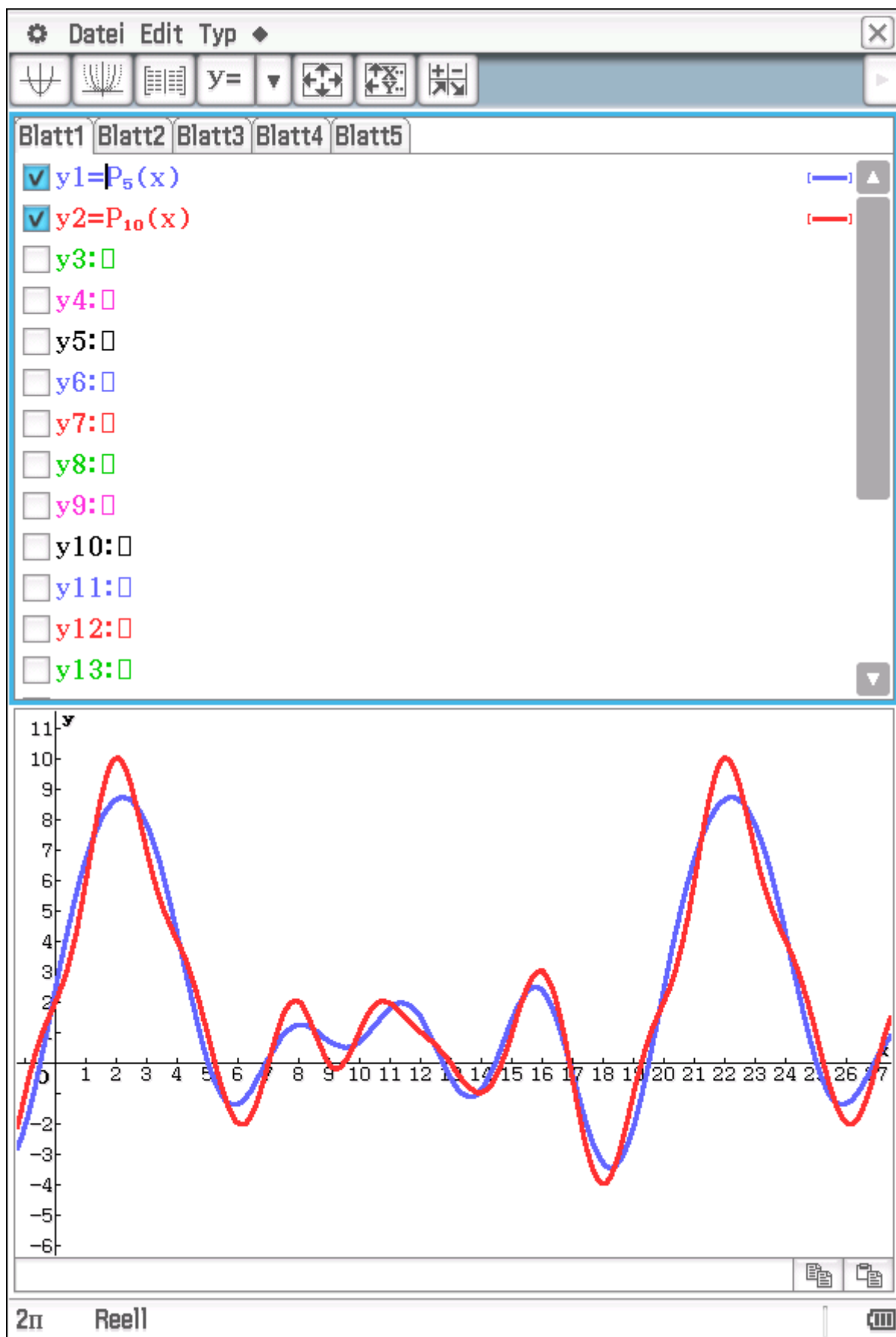
done

2D-Grafik

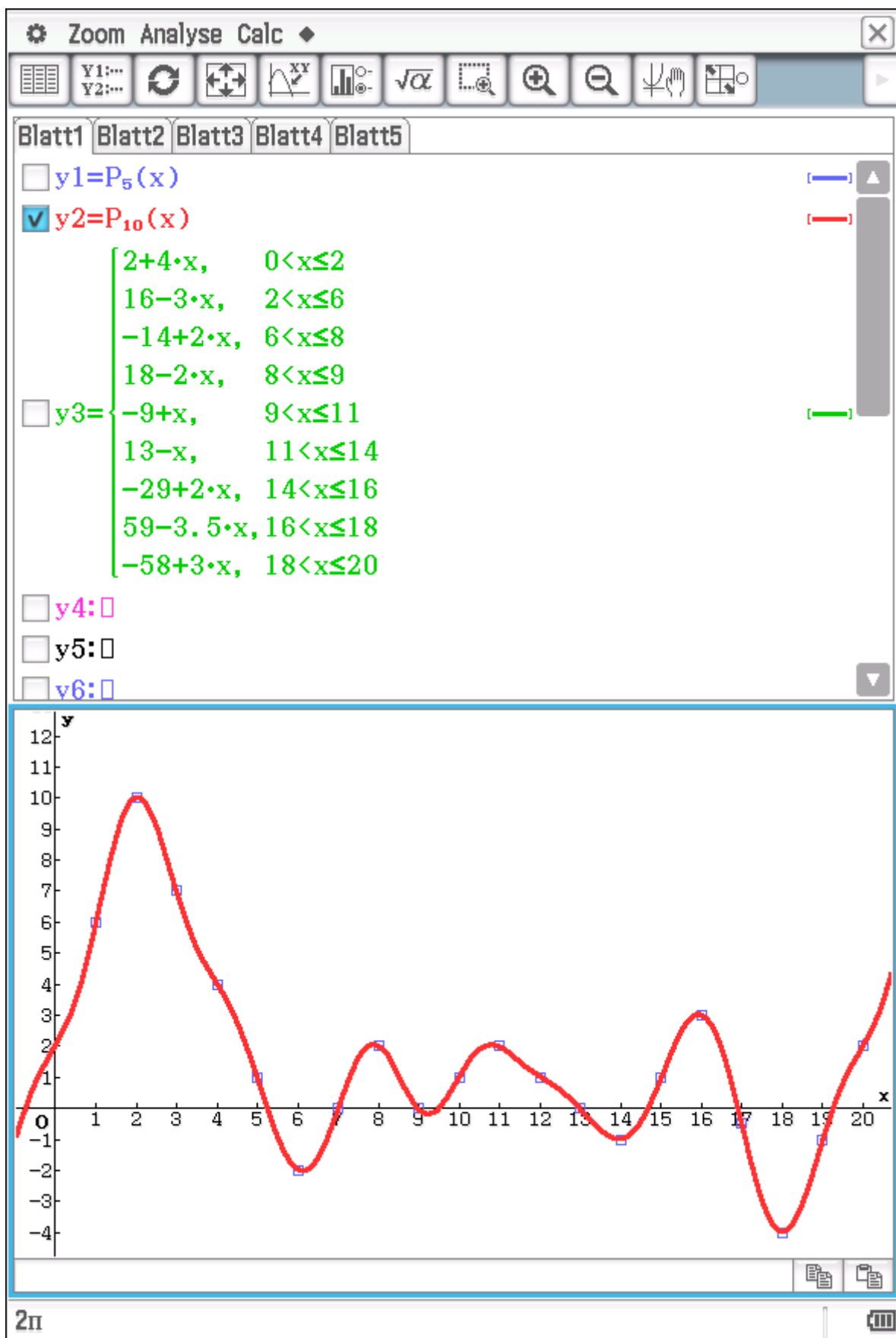
Y1: ...  
Y2: ...

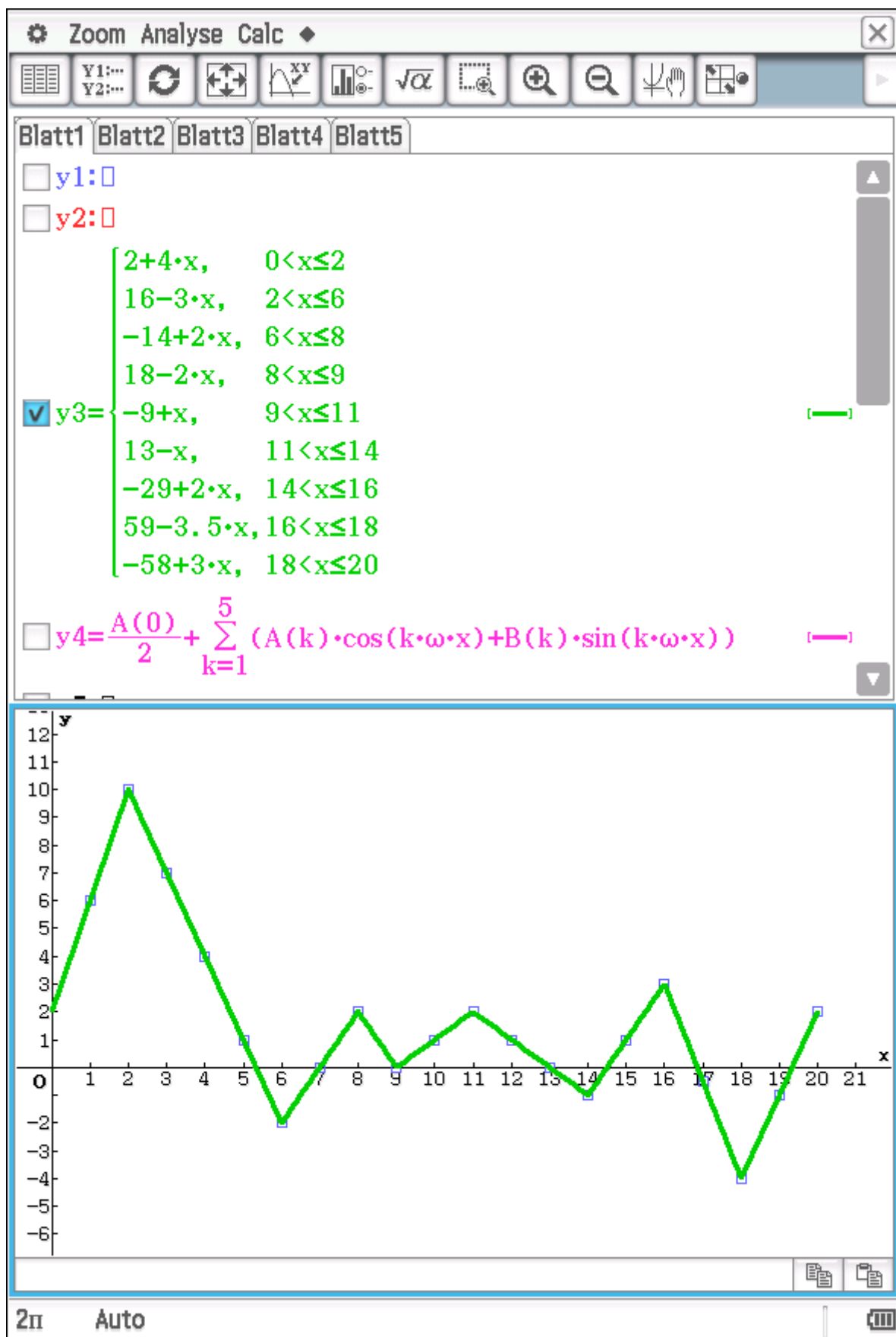
## Datenanpassung – trigonometrisches Polynom (n=20)











# Fourier-Reihe

