

```
> restart:
  with(CurveFitting):
  with(plots):
Warning, the name changecoords has been redefined
```

Übungsaufgabe

Beschreibung der Situation

```
> Liste_t := [1 ,2 ,3 ,4 ,5 ,6 ,7 ,8 ,9 ,10,11,12,
              13,14,15,16,17,18,19,20,21,22,23,24,
              25,26,27,28,29,30,31,32,33,34,35,36];
Liste_y := [1.2, 0.7, 2.0, 2.2, 3.2, 2.7, 3.8, 4.3, 3.6, 2.9,
            2.9, 7.7,
            1.4, 0.7, 2.2, 2.3, 3.5, 2.4, 4.0, 4.1, 3.3, 2.7,
            3.1, 6.9,
            1.3, 0.8, 1.9, 2.1, 2.9, 2.5, 4.1, 4.0, 3.2, 2.6,
            3.0, 7.6];

n := nops(Liste_t):
mittelwert_t := sum( Liste_t[i] ,i=1..n)/n;
varianz_t_durch_n := sum( (Liste_t[i]- mittelwert_t)^2, i=1..
n )/(n);
varianz_t_durch_n_1 := sum( (Liste_t[i]- mittelwert_t)^2, i=
1..n )/(n-1);

mittelwert_Y := sum( Liste_y[i] ,i=1..n)/n;
varianz_Y36 := sum( (Liste_y[i]- mittelwert_Y)^2, i=1..n )/
(n);
varianz_Y35 := sum( (Liste_y[i]- mittelwert_Y)^2, i=1..n )/
(n-1);

punkte := zip( (t,y) ->[t,y], Liste_t , Liste_y):

p1 :=plot( punkte , style = point, color= black,view=[0..37,
-3..8]):
p2 :=plot( punkte , style = line , color= red, view=[0..37,
-3..8], thickness=2):
#display(p1);
display(p1,p2);
```

```
Liste_t := [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36]
```

```
Liste_y := [1.2, 0.7, 2.0, 2.2, 3.2, 2.7, 3.8, 4.3, 3.6, 2.9, 2.9, 7.7, 1.4, 0.7, 2.2, 2.3, 3.5, 2.4, 4.0, 4.1, 3.3, 2.7, 3.1, 6.9, 1.3, 0.8, 1.9, 2.1, 2.9, 2.5, 4.1, 4.0, 3.2, 2.6, 3.0, 7.6]
```

$$\text{mittelwert}_t := \frac{37}{2}$$

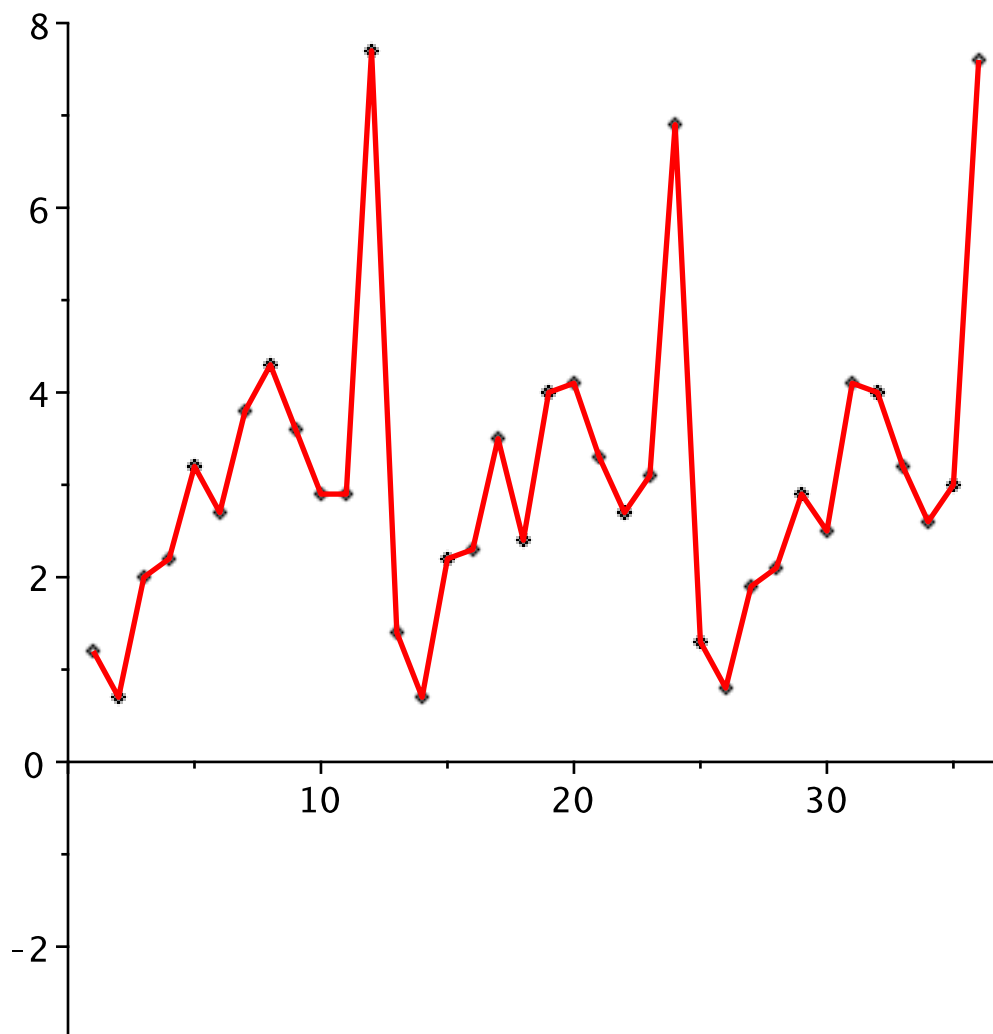
$$\text{varianz}_t_{\text{durch}_n} := \frac{1295}{12}$$

$$\text{varianz}_t_{\text{durch}_n_1} := 111$$

$$\text{mittelwert}_Y := 3.050000000$$

$$\text{varianz}_{Y36} := 2.660833333$$

$$\text{varianz}_{Y35} := 2.736857143$$



Bestimmung der Regressionsgerade $y = at + b$

```
> s1 := n;
```

Anzahl

```

Wertepaare
s2 := sum( Liste_t[j]           , j=1..n); # Summe
aller t_i       Werte
s3 := sum( (Liste_t[j])^2       , j=1..n); # Summe
aller (t_i)^2   Werte
s4 := sum( Liste_y[j]           , j=1..n); # Summe
aller y_i       Werte
s5 := sum( (Liste_t[j])*(Liste_y[j]) , j=1..n); # Summe
aller (t_i)*(y_i) Werte

```

```
s1 := 36
```

```
s2 := 666
```

```
s3 := 16206
```

```
s4 := 109.8
```

```
s5 := 2170.6
```

```

> regr := solve( {s5 = a * s3 + b* s2,
                  s4 = a * s2 + b* n }, {a,b} );

```

```
assign(regr);
```

```
regr := {a=0.03585585586, b=2.386666667}
```

```
> g := t -> a*t + b:
```

```
g(t);
```

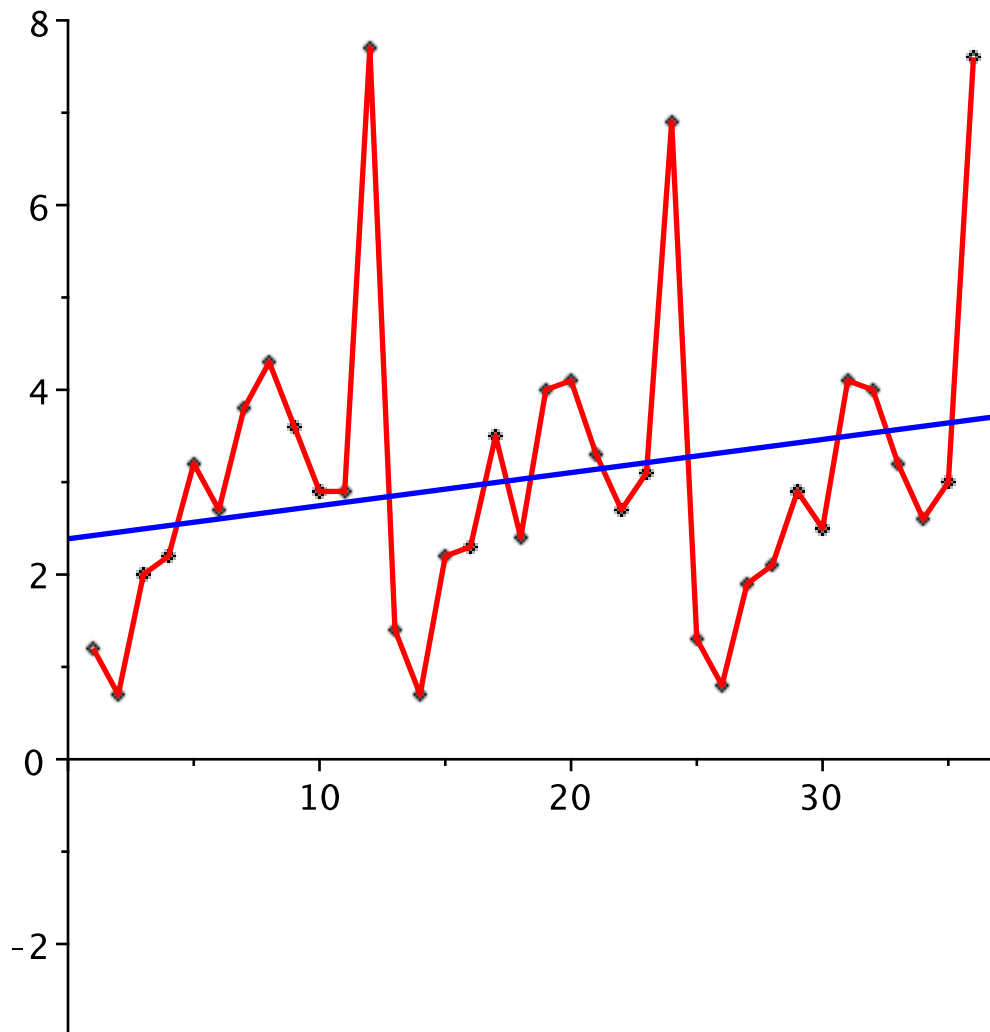
```
0.03585585586 t + 2.386666667
```

```
> g(10);
```

```
2.745225226
```

```
> p3 := plot(g(t), t=0..37, color= blue, thickness =2):
```

```
> display(p1,p2,p3);
```



Bestimmung der Trendbereinigten Zeitreihe

Von jedem Zeitreihenwert wird der zugehörige Werte der Trendfunktion subtrahiert.

```
> for i from 1 to n
  do
    y_stern[i] := Liste_y[i] - g(Liste_t[i]);
  od;
y_sternn := convert(y_stern,'list');
```

$y_{stern_1} := -1.222522523$

$y_{stern_2} := -1.758378379$

$y_{stern_3} := -0.494234235$

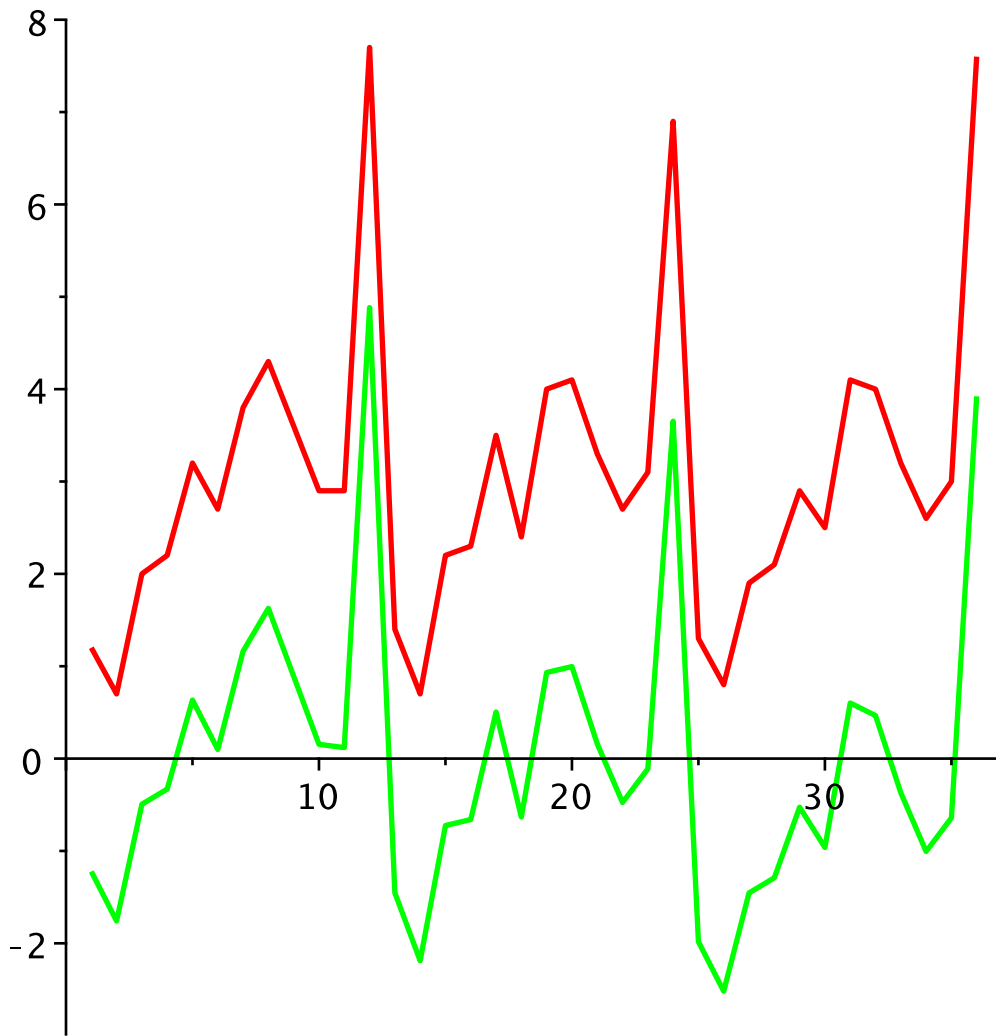
$y_{stern_4} := -0.330090090$

$y_{stern_5} := 0.634054054$

$y_stern_6 := 0.098198198$
 $y_stern_7 := 1.162342342$
 $y_stern_8 := 1.626486486$
 $y_stern_9 := 0.890630630$
 $y_stern_{10} := 0.154774774$
 $y_stern_{11} := 0.118918918$
 $y_stern_{12} := 4.883063063$
 $y_stern_{13} := -1.452792793$
 $y_stern_{14} := -2.188648649$
 $y_stern_{15} := -0.724504505$
 $y_stern_{16} := -0.660360361$
 $y_stern_{17} := 0.503783783$
 $y_stern_{18} := -0.632072072$
 $y_stern_{19} := 0.932072072$
 $y_stern_{20} := 0.996216216$
 $y_stern_{21} := 0.160360360$
 $y_stern_{22} := -0.475495496$
 $y_stern_{23} := -0.111351352$
 $y_stern_{24} := 3.652792792$
 $y_stern_{25} := -1.983063064$
 $y_stern_{26} := -2.518918919$
 $y_stern_{27} := -1.454774775$
 $y_stern_{28} := -1.290630631$
 $y_stern_{29} := -0.526486487$
 $y_stern_{30} := -0.962342343$
 $y_stern_{31} := 0.601801801$
 $y_stern_{32} := 0.465945945$
 $y_stern_{33} := -0.369909910$
 $y_stern_{34} := -1.005765766$
 $y_stern_{35} := -0.641621622$

```
y_stern36 := 3.922522522
```

```
> punkte_stern := zip( (t,y) ->[t,y], Liste_t , y_sternn):  
> p4 :=plot( punkte_stern , style = point, color= green):  
p5 :=plot( punkte_stern , style = line , color= green,  
thickness=2):  
> #display(p1, p4);  
display(p2, p5);
```



Bestimmung der zyklischen Komponente

```
> k := 12;  
m := n/k;  
  
k := 12  
m := 3  
  
> for i from 1 to k  
do
```

```

SS[i] := (1/m)*sum( y_stern[ i + j*k], j=0..m-1):
  for ii from 1 to m-1 do
    SS[i + k*ii] := SS[i]:
  od:
od:

for i from 1 to n do
  S[i] := SS[i];
od;

```

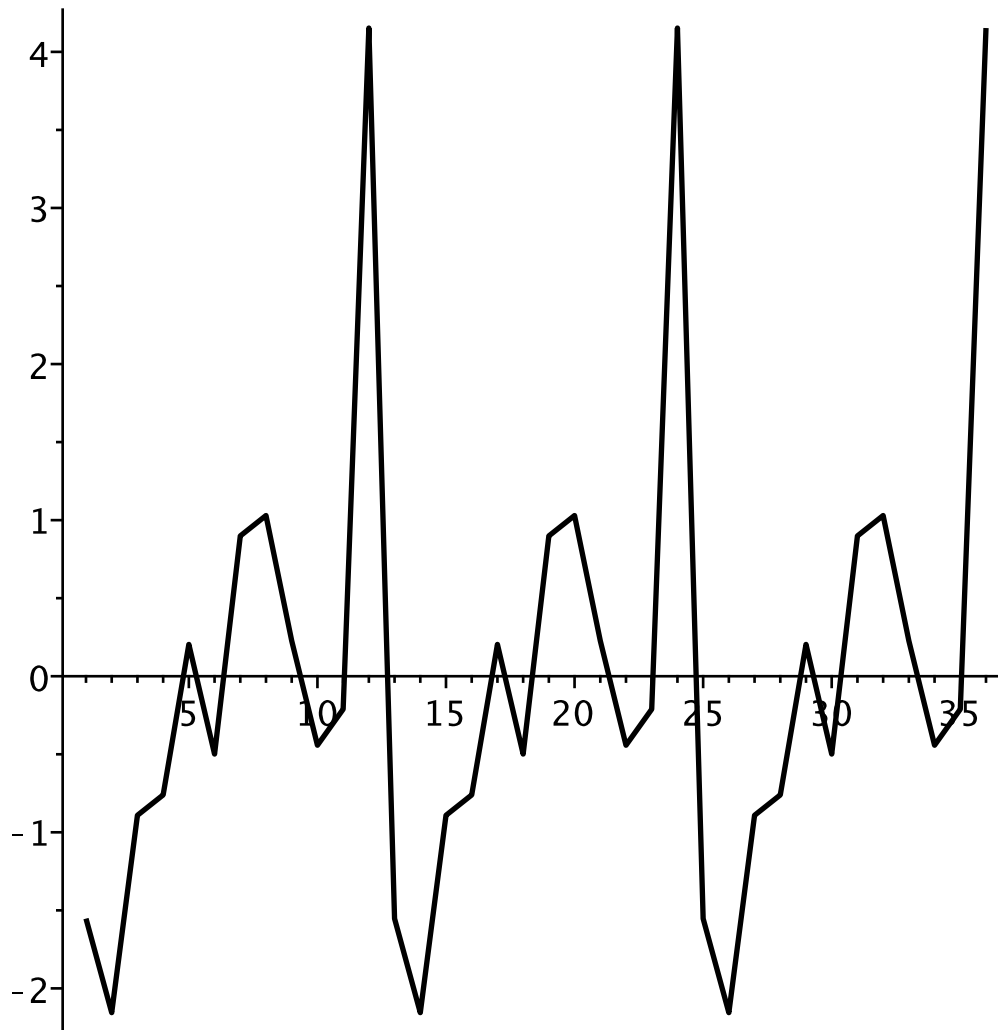
```

S1 := -1.552792793
S2 := -2.155315316
S3 := -0.8911711717
S4 := -0.7603603607
S5 := 0.2037837833
S6 := -0.4987387390
S7 := 0.8987387383
S8 := 1.029549549
S9 := 0.2270270267
S10 := -0.4421621627
S11 := -0.2113513520
S12 := 4.152792793
S13 := -1.552792793
S14 := -2.155315316
S15 := -0.8911711717
S16 := -0.7603603607
S17 := 0.2037837833
S18 := -0.4987387390
S19 := 0.8987387383
S20 := 1.029549549
S21 := 0.2270270267
S22 := -0.4421621627
S23 := -0.2113513520

```

```
S24 := 4.152792793  
S25 := -1.552792793  
S26 := -2.155315316  
S27 := -0.8911711717  
S28 := -0.7603603607  
S29 := 0.2037837833  
S30 := -0.4987387390  
S31 := 0.8987387383  
S32 := 1.029549549  
S33 := 0.2270270267  
S34 := -0.4421621627  
S35 := -0.2113513520  
S36 := 4.152792793
```

```
> S_hut := convert(S,'list');  
> punkte_S := zip( (t,y) ->[t,y], Liste_t , S_hut):  
> p6 :=plot( punkte_S , style = point, color= black):  
p7 :=plot( punkte_S , style = line , color= black, thickness=  
2):  
> #display(p6);  
display(p7);
```

```
> display(p5,p7);
```

