

# Kubische Polynomfunktion

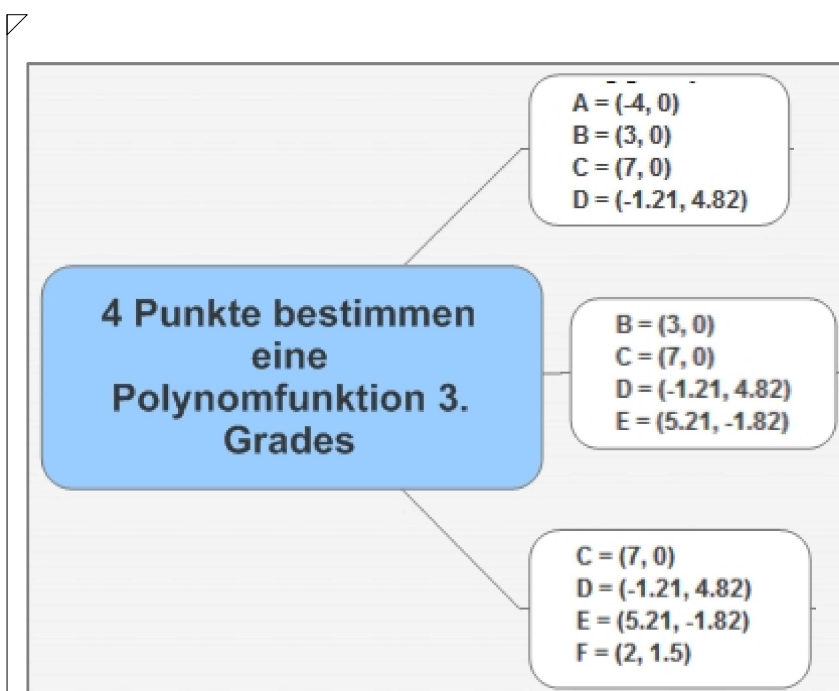
Dokumentnummer: DX1002

(%i73)  $g(x,y):=y=a*x**3+b*x**2+c*x+d;r:rhs(g(x,y));f:r;$

(%o73)  $g(x, y) := y = a x^3 + b x^2 + c x + d$

(%o74)  $a x^3 + b x^2 + c x + d$

(%o75)  $a x^3 + b x^2 + c x + d$



Teilaufgabe 1

A = (-4, 0)  
B = (3, 0)  
C = (7, 0)  
D = (-1.21, 4.82)

(%i76) A:[-4,0];B:[3,0];C:[7,0];D:[-1.21,4.82];

(%o76) [-4, 0]

(%o77) [3, 0]

(%o78) [7, 0]

(%o79) [-1.21, 4.82]

```
(%i80) g1:g(A[1],A[2]);g2:g(B[1],B[2]);g3:g(C[1],C[2]);g4:g(D[1],D[2]);
```

```
(%o80) 0 = d - 4 c + 16 b - 64 a
```

```
(%o81) 0 = d + 3 c + 9 b + 27 a
```

```
(%o82) 0 = d + 7 c + 49 b + 343 a
```

```
(%o83) 4.82 = d - 1.21 c + 1.4641 b - 1.771561 a
```

```
(%i84) l:solve([g1,g2,g3,g4],[a,b,c,d]),numer;
```

```
rat: replaced 4.82 by 241/50 = 4.82
```

```
rat: replaced 1.771561 by 10702/6041 = 1.771560999834465
```

```
rat: replaced -1.4641 by -14641/10000 = -1.4641
```

```
rat: replaced 1.21 by 121/100 = 1.21
```

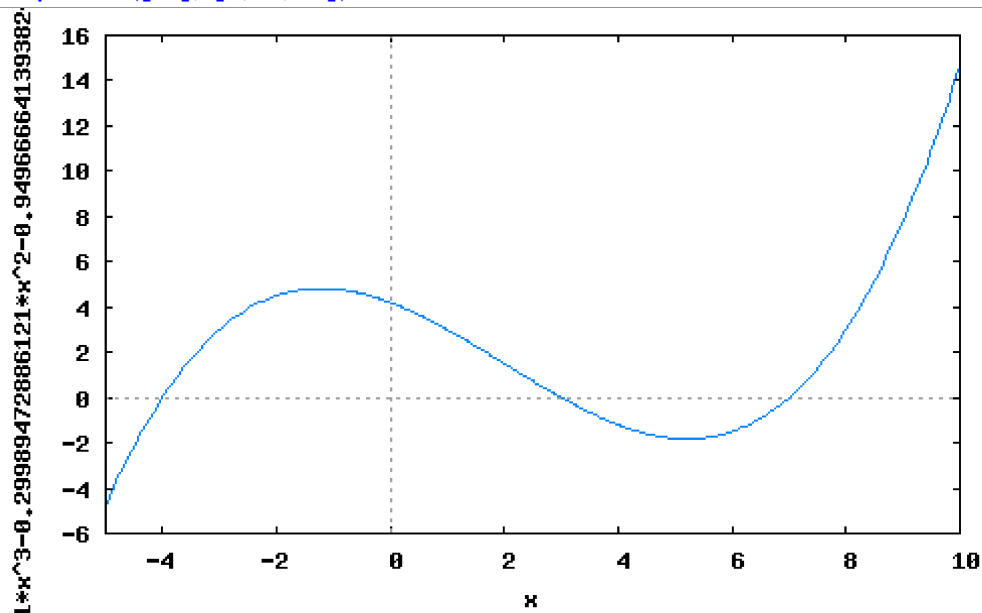
```
(%o84) [ [ a = 0.049982454810201 , b = - 0.29989472886121 , c = - 0.94966664139382 , d =
4.198526204056908 ] ]
```

```
(%i85) f1:f,l;
```

```
(%o85) 0.049982454810201 x3 - 0.29989472886121 x2 - 0.94966664139382 x +
4.198526204056908
```

```
(%i86) wxplot2d([f1], [x,-5,10])$
```

```
(%t86)
```



Anmerkung: A,B und C sind Nullstellen, D ist ein Extremwert (Maximum)

Die Funktion

```
(%i111) f1;
```

```
(%o111) 0.049982454810201 x3 - 0.29989472886121 x2 - 0.94966664139382 x +
4.198526204056908
```

## Die Nullstellen

```
(%i112) A;B;C;
```

```
(%o112) [ - 4 , 0 ]
```

```
(%o113) [ 3 , 0 ]
```

```
(%o114) [ 7 , 0 ]
```

```
(%i116) l:realroots(f1),numer;
```

```
(%o116) [ x = - 3.999999970197678 , x = 3.000000029802322 , x = 6.999999910593033 ]
```

## Der Extremwert

```
(%i117) D;
```

```
(%o117) [ - 1.21 , 4.82 ]
```

```
(%i118) ab:diff(f1,x);
```

```
(%o118) 0.1499473644306 x2 - 0.59978945772242 x - 0.94966664139382
```

```
(%i121) l:realroots(ab=0),numer /* es gibt zwei Extremwerte */;
```

```
(%o121) [ x = - 1.214550226926804 , x = 5.214550226926804 ]
```

## Teilaufgabe 2

```
B = (3, 0)
C = (7, 0)
D = (-1.21, 4.82)
E = (5.21, -1.82)
```

```
(%i87) B:[3,0];C:[7,0];D:[-1.21,4.82];E:[5.21,-1.82];
```

```
(%o87) [ 3 , 0 ]
```

```
(%o88) [ 7 , 0 ]
```

```
(%o89) [ - 1.21 , 4.82 ]
```

```
(%o90) [ 5.21 , - 1.82 ]
```

```
(%i91) g1:g(B[1],B[2]);g2:g(C[1],C[2]);g3:g(D[1],D[2]);g4:g(E[1],E[2]);
```

```
(%o91) 0 = d + 3 c + 9 b + 27 a
```

```
(%o92) 0 = d + 7 c + 49 b + 343 a
```

```
(%o93) 4.82 = d - 1.21 c + 1.4641 b - 1.771561 a
```

```
(%o94) - 1.82 = d + 5.21 c + 27.1441 b + 141.420761 a
```

```
(%i95) l:solve([g1,g2,g3,g4],[a,b,c,d]),numer;
```

```
rat: replaced 4.82 by 241/50 = 4.82
```

```
rat: replaced 1.771561 by 10702/6041 = 1.771560999834465
```

```
rat: replaced -1.4641 by -14641/10000 = -1.4641
```

```
rat: replaced 1.21 by 121/100 = 1.21
```

```
rat: replaced -1.82 by -91/50 = -1.82
```

```
rat: replaced -141.420761 by -178473/1262 = -141.420760697306
```

```
rat: replaced -27.1441 by -49918/1839 = -27.1441000543774
```

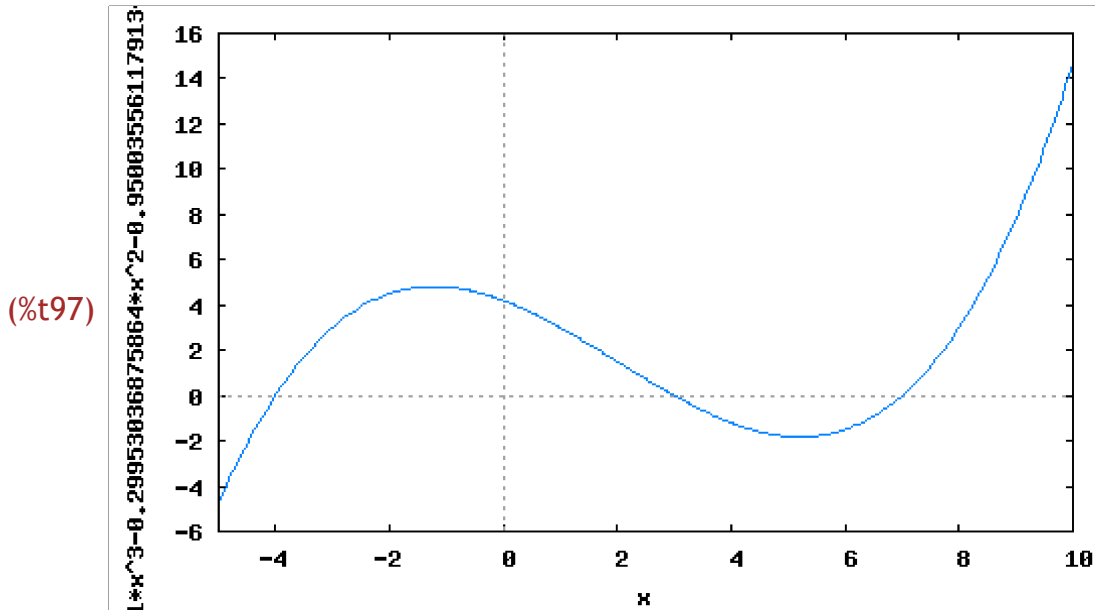
```
rat: replaced -5.21 by -521/100 = -5.21
```

```
(%o95) [ [ a = 0.049941003148931 , b = - 0.29953036875864 , c = - 0.95003556117913 , d =  
4.197472917344038 ] ]
```

```
(%i96) f2:f,l;
```

```
(%o96) 0.049941003148931 x3 - 0.29953036875864 x2 - 0.95003556117913 x +  
4.197472917344038
```

```
(%i97) wxplot2d([f2], [x,-5,10])$
```



Teilaufgabe 3

C = (7, 0)

D = (-1.21, 4.82)

E = (5.21, -1.82)

F = (2, 1.5)

(%i98) C:[7,0];D:[-1.21,4.82];E:[5.21,-1.82];F:[2,1.5];

(%o98) [ 7 , 0 ]

(%o99) [ - 1.21 , 4.82 ]

(%o100) [ 5.21 , - 1.82 ]

(%o101) [ 2 , 1.5 ]

(%i102) g1:g(C[1],C[2]);g2:g(D[1],D[2]);g3:g(E[1],E[2]);g4:g(F[1],F[2]);

(%o102)  $0 = d + 7c + 49b + 343a$

(%o103)  $4.82 = d - 1.21c + 1.4641b - 1.771561a$

(%o104)  $-1.82 = d + 5.21c + 27.1441b + 141.420761a$

(%o105)  $1.5 = d + 2c + 4b + 8a$

(%i106) l:solve([g1,g2,g3,g4],[a,b,c,d]),numer;

rat: replaced 4.82 by  $241/50 = 4.82$

rat: replaced 1.771561 by  $10702/6041 = 1.771560999834465$

rat: replaced -1.4641 by  $-14641/10000 = -1.4641$

rat: replaced 1.21 by  $121/100 = 1.21$

rat: replaced -1.82 by  $-91/50 = -1.82$

rat: replaced -141.420761 by  $-178473/1262 = -141.420760697306$

rat: replaced -27.1441 by  $-49918/1839 = -27.1441000543774$

rat: replaced -5.21 by  $-521/100 = -5.21$

rat: replaced 1.5 by  $3/2 = 1.5$

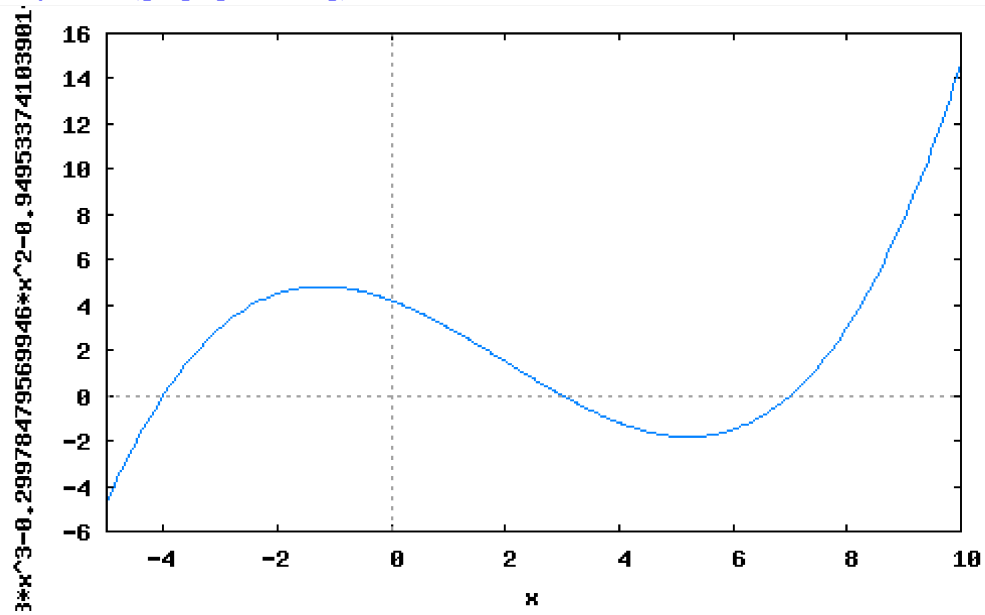
(%o106) [ [  $a = 0.049964132870658$  ,  $b = -0.29978479569946$  ,  $c = -0.94953374103901$  ,  $d = 4.198493601910577$  ] ]

(%i107) f3:f,l;

(%o107)  $0.049964132870658 x^3 - 0.29978479569946 x^2 - 0.94953374103901 x + 4.198493601910577$

(%i108) wxplot2d([f3], [x,-5,10])\$

(%t108)



Alle Ergebnisse stimmen überein, wie die folgende Grafik zeigt

(%i109) wxplot2d([f1,f2,f3], [x,-5,10])\$

(%t109)

