Gleichungen 4. Grades

Dokumentnummer: DX1029
Fachgebiet: Fundamentalsatz der Algebra
Polynome

```
(%i1) kill(all);
(%o0) done
```

1 Aufgabe 1

Figure 1:

```
x^4 + 2x^3 - 3x^2 + 4x - 5 = 0
L = {-3,37192; 1,11029}
```

```
(%i1) g1:x**4+2*x**3-3*x**2+4*x-5=0;
(%o1) x^4+2 x^3-3 x^2+4 x-5=0
```

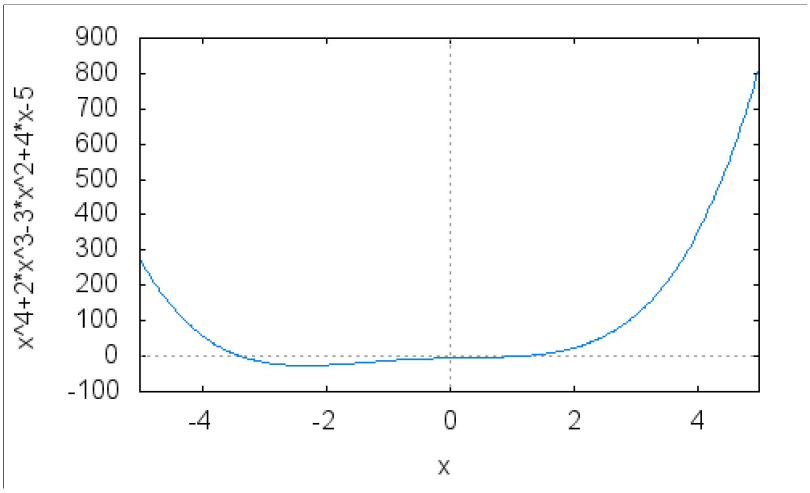
```
(%i2) lr:realroots(g1),numer;
(%o2) [x=-3.371924310922623,x=1.110290735960007]
```

```
(%i3) la:allroots(g1),numer;
(%o3) [x=1.148225828720671 %i+0.13081677003439,x=0.13081677003439-
1.148225828720671 %i,x=1.110290759520588,x=-3.371924299589372]
```

```
(%i4) ls:solve(g1,x),numer;
rat: replaced 939.7037037037038 by 25372/27 = 939.7037037037037
rat: replaced 1.591719189426491 by 23500010/14763917 = 1.591719189426492
(%o4) [x=-3.371924299589372,x=1.110290759520588,x=0.13081677003439-
1.148225828720671 %i,x=1.148225828720671 %i+0.13081677003439]
```

```
(%i5) wxplot2d([lhs(g1)], [x,-5,5])$
```

(%t5)



2 Aufgabe 2

Figure 2:

```
- 23x^4 + 2x^3 - 3x^2 + 44x - 5 = 0
L = {0,114553; 1,19326}
```

```
(%i6) g2:-23*x**4+2*x**3-3*x**2+44*x-5=0;
```

$$-23\,x^4+2\,x^3-3\,x^2+44\,x-5=0$$

```
(%i7) lr:realroots(g2),numer;
```

$$[x=0.11455276608467,x=1.19325664639473]$$

```
(%i8) la:allroots(g2),numer;
```

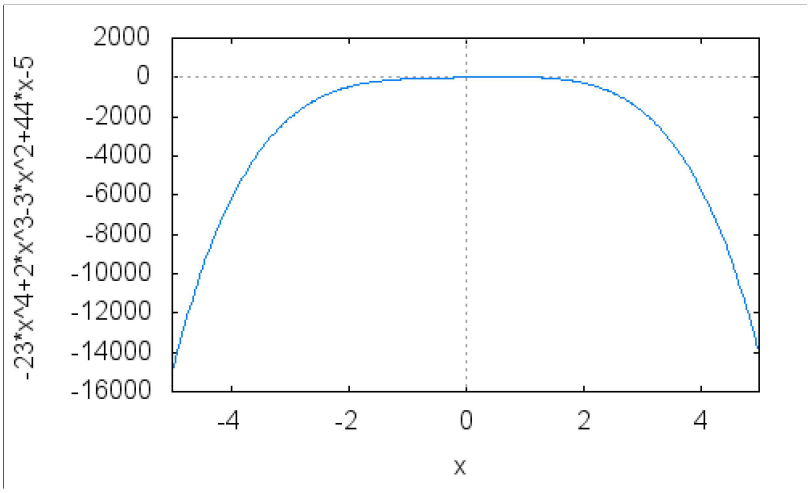
$$[x=0.11455275226797,x=1.103524535025171\,\%i-0.61042644393627,x=-1.103524535025171\,\%i-0.61042644393627,x=1.193256657343707]$$

```
(%i9) ls:solve(g2,x),numer;
rat: replaced -3.54795759020301 by -43168/12167 = -3.54795759020301
rat: replaced -0.703213610586 by -372/529 = -0.703213610586
rat: replaced -0.1304347826087 by -3/23 = -0.1304347826087
rat: replaced -3.54795759020301 by -43168/12167 = -3.54795759020301
rat: replaced -0.703213610586 by -372/529 = -0.703213610586
rat: replaced -0.1304347826087 by -3/23 = -0.1304347826087
rat: replaced 8.2189529053998522E-5 by 1/12167 = 8.2189529053998522E-5
rat: replaced 3.188573522195013 by 52025432/16316209 = 3.188573522195015
rat: replaced 1.598533253679551 by 43382781/27139117 = 1.598533253679551
```

$$[x=-1.103524535025171\,\%i-0.61042644393627,x=1.103524535025171\,\%i-0.61042644393627,x=0.11455275226797,x=1.193256657343707]$$

```
(%i10) wxplot2d([lhs(g2)], [x,-5,5])$
```

(%t10)



3 Aufgabe 3

Figure 3:

```
x^4 + 4x^3 + 6x^2 + 4x + 1 = 0
L = {-1}
```

```
(%i11) g3:x**4+4*x**3+6*x**2+4*x+1=0;
```

$$x^4+4\,x^3+6\,x^2+4\,x+1=0$$

```
(%i12) lr:realroots(g3),numer;
```

$$[x=-1]$$

```
(%i13) la:allroots(g3),numer;
```

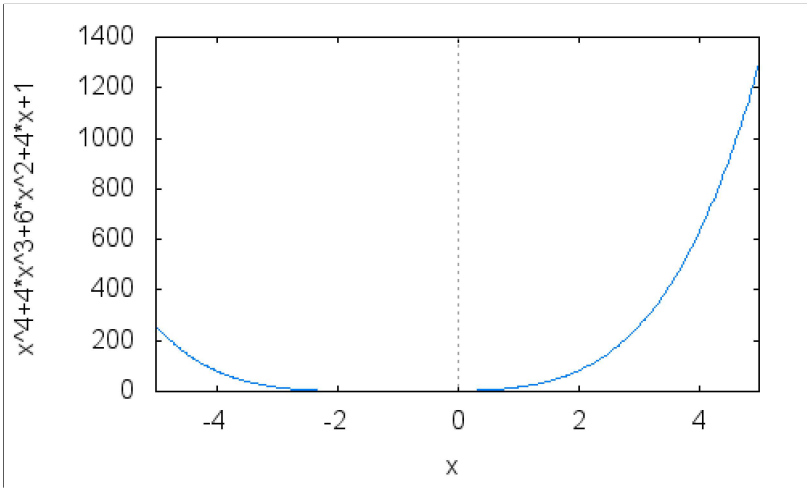
(%o13) $[x=9.3302467008275661\,10^{-5}\,\%i-0.99983874230135, x=-9.3302467008275661\,10^{-5}\,\%i-0.99983874230135, x=2.0809310649702031\,10^{-4}\,\%i-1.000161257698654, x=-2.0809310649702031\,10^{-4}\,\%i-1.000161257698654]$

```
(%i14) ls:solve(g3,x),numer;
```

(%o14) $[x=-1]$

```
(%i15) wxplot2d([lhs(g3)], [x,-5,5])$
```

(%t15)



4 Aufgabe 4

Figure 4:

```
x^4 - 4x^3 + 6x^2 - 4x + 1 = 0
L = {1}
```

```
(%i16) g4:x**4-4*x**3+6*x**2-4*x+1=0;
```

(%o16) $x^4-4\,x^3+6\,x^2-4\,x+1=0$

```
(%i17) lr:realroots(g4),numer;
```

(%o17) $[x=1]$

```
(%i18) la:allroots(g4),numer;
```

(%o18) $[x=1.087308902760765\,10^{-4}\,\%i+0.99984075543509, x=0.99984075543509-1.087308902760765\,10^{-4}\,\%i, x=1.9721880565550667\,10^{-4}\,\%i+1.00015924456491, x=1.00015924456491-1.9721880565550667\,10^{-4}\,\%i]$

```
(%i19) ls:solve(g4,x),numer;
```

(%o19) $[x=1]$

```
(%i20) wxplot2d([lhs(g4)], [x,-5,5])$
```

(%t20)