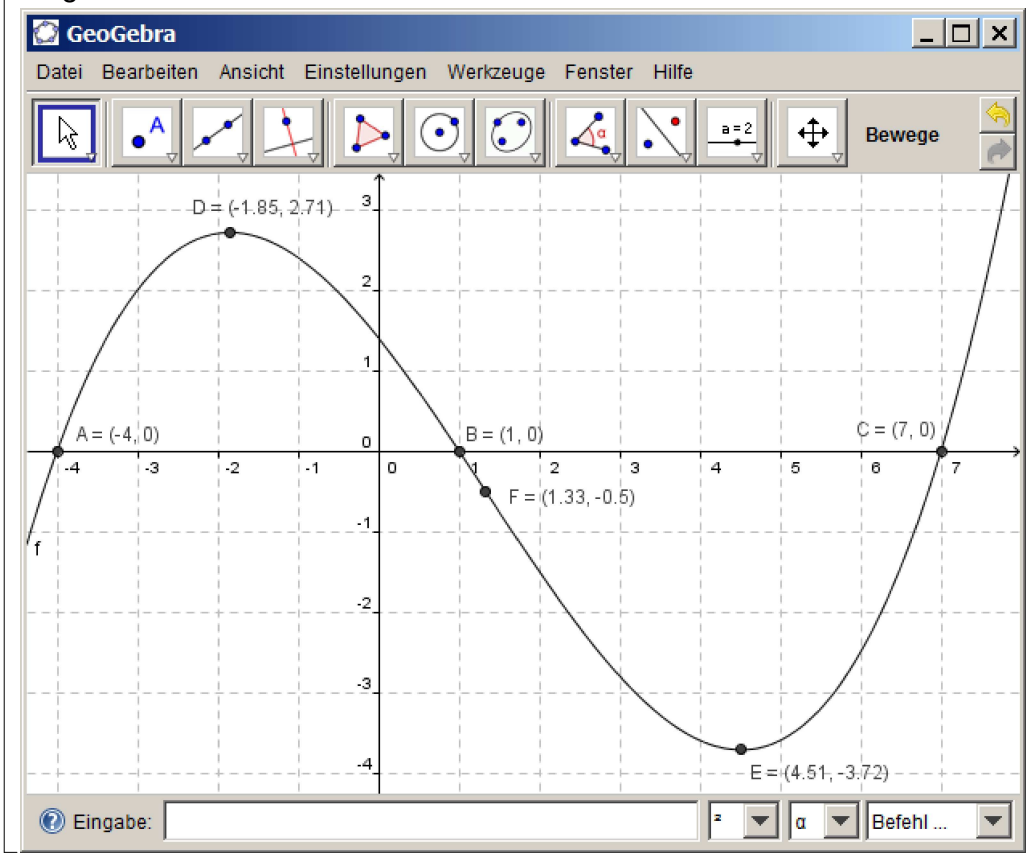
Kurvendiskussion kontrollieren

1 Aufgabe

Figure 1:



2 Lösung

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

2.1 Ermittlung der Polynomfunktion

```
(%i1) x1:-4$y1:0$
      x2:1$y2:0$
      x3:4/3$y3:1/2$
      x4:7$y4:0$
```

```
(%i9) g(x,y):=y=a*x**3+b*x**2+c*x+d;
```

$$(\%o9)\quad g(x,y):=y=a\,x^3+b\,x^2+c\,x+d$$

```
(%i10) g1:g(x1,y1);g2:g(x2,y2);g3:g(x3,y3);g4:g(x4,y4);
```

$$(\%o10)\quad 0=d-4\,c+16\,b-64\,a$$

$$(\%o11)\quad 0=d+c+b+a$$

$$(\%o12)\quad \frac{1}{2}=d+\frac{4\,c}{3}+\frac{16\,b}{9}+\frac{64\,a}{27}$$

$$(\%o13)\quad 0=d+7\,c+49\,b+343\,a$$

```
(%i14) l:algsys([g1,g2,g3,g4],[a,b,c,d]);
```

$$(\%o14)\quad [[a=-\frac{27}{544},b=\frac{27}{136},c=\frac{675}{544},d=-\frac{189}{136}]]$$

```
(%i15) Kubische_Parabel:g(x,y),l;
```

$$(\%o15)\quad y=-\frac{27\,x^3}{544}+\frac{27\,x^2}{136}+\frac{675\,x}{544}-\frac{189}{136}$$

```
(%i16) f:rhs(Kubische_Parabel);
```

$$(\%o16)\quad -\frac{27\,x^3}{544}+\frac{27\,x^2}{136}+\frac{675\,x}{544}-\frac{189}{136}$$

```
(%i17) f(x):=''f;
```

$$(\%o17)\quad \mathrm{f}(x):=-\frac{27\,x^3}{544}+\frac{27\,x^2}{136}+\frac{675\,x}{544}-\frac{189}{136}$$

2.2 Kontrolle der Nullstellen

```
(%i18) n:realroots(f(x));
(%o18) [x=-4,x=1,x=7]
```

2.3 Kontrolle der Extremwerte

```
(%i19) ab:diff(f(x),x);
```

$$(\%o19)\quad -\frac{81\,x^2}{544}+\frac{27\,x}{68}+\frac{675}{544}$$

```
(%i20) ex:realroots(ab),numer;
(%o20) [x=-1.84646400809288,x=4.513130694627762]

(%i23) xE1:ev(x,ex[1])$xE1:floor(xE1*100+0.5)/100.0;
(%o24) -1.85

(%i25) xE2:ev(x,ex[2])$xE2:floor(xE2*100+0.5)/100.0;
(%o26) 4.51

(%i28) yE1:f(xE1)$yE1:floor(yE1*100+0.5)/100.0;
(%o29) -2.69
```

2.4 Kontrolle der Wendepunkte

```
(%i30) ab2:diff(f(x),x,2);
```

$$(\%o30)\quad \frac{27}{68}-\frac{81\,x}{272}$$

```
(%i33) wp:solve(ab2=0,x);
```

$$(\%o33)\quad [x=\frac{4}{3}]$$

```
(%i34) f(x),wp;
```

$$(\%o34)\quad \frac{1}{2}$$