

Blatt 1

Aufgabe 1

```
> restart;  
> p1 := 1 - x^98;  
> p2 := 1 - x^99;  
> p3 := 1 - x^100;
```

$$\begin{aligned} p1 &:= -x^{98} + 1 \\ p2 &:= -x^{99} + 1 \\ p3 &:= -x^{100} + 1 \end{aligned} \tag{1.1}$$

```
> 'p1' = factor(p1);  
> 'p2' = factor(p2);  
> 'p3' = factor(p3);
```

$$\begin{aligned} p1 &= -(x-1) (x^6 + x^5 + x^4 + x^3 + x^2 + x + 1) (x^{42} + x^{35} + x^{28} + x^{21} + x^{14} + x^7 \\ &\quad + 1) (1+x) (x^6 - x^5 + x^4 - x^3 + x^2 - x + 1) (x^{42} - x^{35} + x^{28} - x^{21} + x^{14} - x^7 \\ &\quad + 1) \\ p2 &= -(x-1) (x^{10} + x^9 + x^8 + x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x + 1) (x^2 + x \\ &\quad + 1) (x^{20} - x^{19} + x^{17} - x^{16} + x^{14} - x^{13} + x^{11} - x^{10} + x^9 - x^7 + x^6 - x^4 + x^3 - x \\ &\quad + 1) (x^6 + x^3 + 1) (x^{60} - x^{57} + x^{51} - x^{48} + x^{42} - x^{39} + x^{33} - x^{30} + x^{27} - x^{21} \\ &\quad + x^{18} - x^{12} + x^9 - x^3 + 1) \\ p3 &= -(x-1) (x^4 + x^3 + x^2 + x + 1) (x^{20} + x^{15} + x^{10} + x^5 + 1) (1+x) (x^4 - x^3 \\ &\quad + x^2 - x + 1) (x^{20} - x^{15} + x^{10} - x^5 + 1) (x^2 + 1) (x^8 - x^6 + x^4 - x^2 + 1) (x^{40} \\ &\quad - x^{30} + x^{20} - x^{10} + 1) \end{aligned} \tag{1.2}$$

```
> 1 - x^41 = factor(1 - x^41);
```

$$\begin{aligned} -x^{41} + 1 &= -(x-1) (x^{40} + x^{39} + x^{38} + x^{37} + x^{36} + x^{35} + x^{34} + x^{33} + x^{32} + x^{31} + x^{30} \\ &\quad + x^{29} + x^{28} + x^{27} + x^{26} + x^{25} + x^{24} + x^{23} + x^{22} + x^{21} + x^{20} + x^{19} + x^{18} + x^{17} \\ &\quad + x^{16} + x^{15} + x^{14} + x^{13} + x^{12} + x^{11} + x^{10} + x^9 + x^8 + x^7 + x^6 + x^5 + x^4 + x^3 + x^2 \\ &\quad + x + 1) \end{aligned} \tag{1.3}$$

Aufgabe 2

```
> restart;  
> ?ifactor;  
> ifactor(940);
```

$$(2)^2 (5) (47) \tag{2.1}$$

```
> 47*30/3*2;
```

$$940 \tag{2.2}$$

```
> ifactor(427!);
```

(2)⁴²¹ (3)²¹⁰ (5)¹⁰⁵ (13)³⁴ (41)¹⁰ (59)⁷ (61)⁷ (67)⁶ (71)⁶ (73)⁵ (79)⁵ (11)⁴¹ (17)²⁶ (157)² (263) (7)⁷⁰ (47)⁹ (151)² (29)¹⁴ (31)¹³ (37)¹¹ (43)⁹ (53)⁸ (23)¹⁸ (19)²³ (167)² (373) (83)⁵ (89)⁴ (97)⁴ (101)⁴ (103)⁴ (107)³ (109)³ (113)³ (127)³ (131)³ (137)³ (139)³ (149)² (163)² (173)² (179)² (181)² (191)² (193)² (197)² (199)² (211)² (223) (227) (229) (233) (239) (241) (251) (257) (269) (271) (277) (281) (283) (293) (307) (311) (313) (317) (331) (337) (347) (349) (353) (359) (367) (379) (383) (389) (397) (401) (409) (419) (421) **(2.3)**

Aufgabe 3

> restart;

(a)

> f := x -> x^2 * (1 - x);

> g := x -> abs(cos(x));

> h := x -> -sqrt(x);

$$f := x \mapsto x^2 (1 - x)$$

$$g := x \mapsto |\cos(x)|$$

$$h := x \mapsto -\sqrt{x}$$

(3.1)

> u := x -> f(g(h(x)));

> v := x -> g(h(f(x)));

> w := x -> h(f(g(x)));

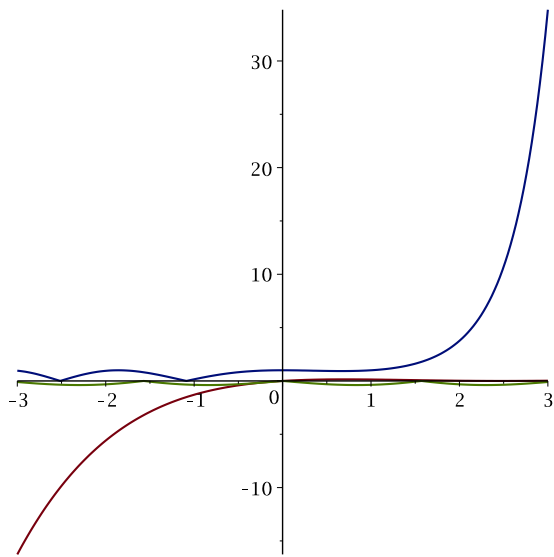
$$u := x \mapsto f(g(h(x)))$$

$$v := x \mapsto g(h(f(x)))$$

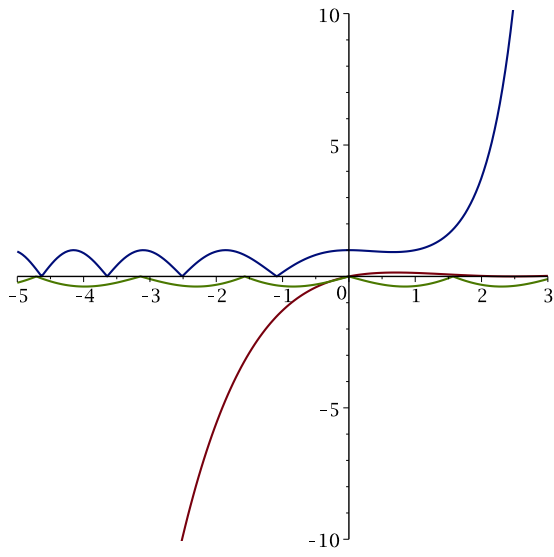
$$w := x \mapsto h(f(g(x)))$$

(3.2)

> plot([u, v, w], -3 .. 3);

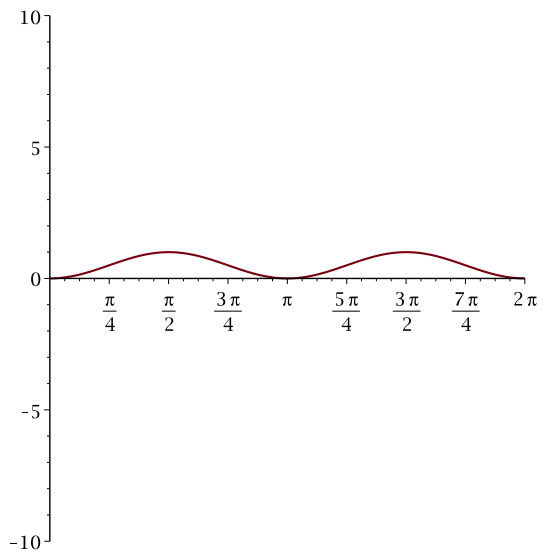


```
> # oder:  
plot([ u, v, w ], -5 .. 3, -10 .. 10);
```

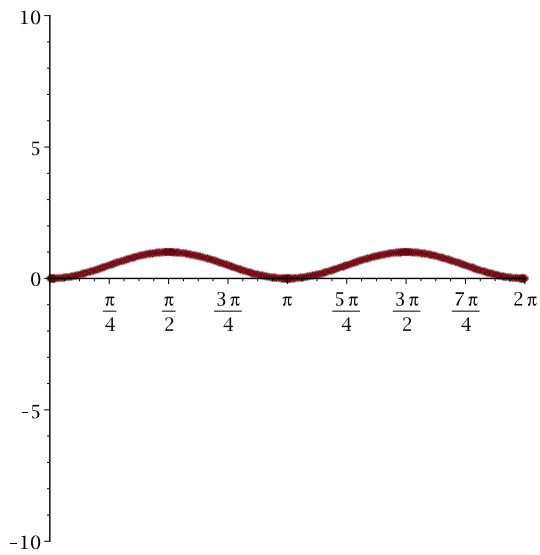


(b)

```
> plot(x -> sin(x)^2, 0 .. 2*Pi, -10..10);
```



```
> plot(x -> sin(x)^2, 0 .. 2*Pi, -10..10, style = point);
```



Aufgabe 4

```
> restart;
> a := x -> x^3 - 8 * x^2 + 20 * x - 16;
> b := x -> x^4 - 8 * x^3 + 9 * x^2 - 16 * x + 14;
> h := x -> a(x) / b(x) * exp(-(x - 3)^2);
```

$$a := x \mapsto x^3 - 8x^2 + 20x - 16$$

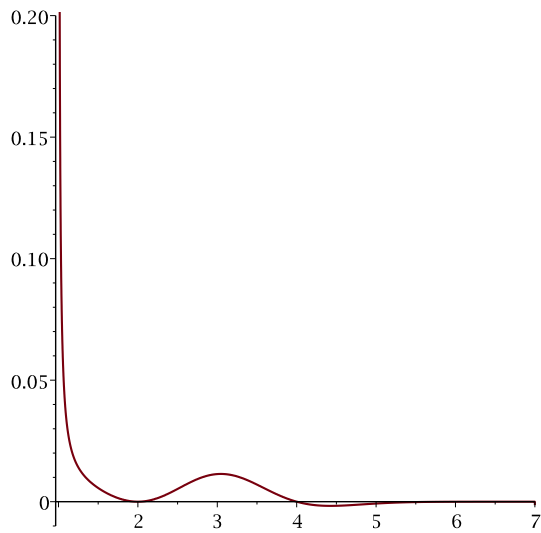
$$b := x \mapsto x^4 - 8x^3 + 9x^2 - 16x + 14$$

$$h := x \mapsto \frac{a(x) e^{-(x-3)^2}}{b(x)}$$

(4.1)

(a)

```
> plot(h, 1 .. 7, -0.01..0.2, numpoints = 10000);
```



(b)

```
> factor(b(x));
```

$$(x-1)(x-7)(x^2+2)$$

(4.2)

(c)

```
> evalf(h(1 + 10^(-9)), 30);
```

$$3.05260648501707093949053460753 \cdot 10^6$$

(4.3)