Lektion 2

dito-Operator

$tmp := expand((x-y)\cdot(x+y))$

$$x^2 - y^2 \tag{1.1}$$

$factor(tmp)$

$$(x-y)\ (x+y) \tag{1.2}$$

$4\cdot 4$

$$16 \tag{1.3}$$

$\%$

$$16 \tag{1.4}$$

$\%\%\%$

$$(x-y)\ (x+y) \tag{1.5}$$

$expand(\mathbf{(1.4)})$

$$16 \tag{1.6}$$

Summen

$S := sum(j, j=1\,..n)$

$$\frac{1}{2}\ (n+1)^2 - \frac{1}{2}\ n - \frac{1}{2} \tag{2.1}$$

$normal(S)$

$$\frac{1}{2}\ n^2 + \frac{1}{2}\ n \tag{2.2}$$

$S1 := sum\left(j^2, j=1\,..n\right)$

$$\frac{1}{3}\ (n+1)^3 - \frac{1}{2}\ (n+1)^2 + \frac{1}{6}\ n + \frac{1}{6} \tag{2.3}$$

$normal(S1)$

$$\frac{1}{3}\ n^3 + \frac{1}{2}\ n^2 + \frac{1}{6}\ n \tag{2.4}$$

$sum\left(\frac{1}{j^2}, j=1\,..infinity\right)$

$$\frac{1}{6}\ \pi^2 \tag{2.5}$$

Tücke

$sum\left(q^j, j=0\,..infinity\right)$

$$-\frac{1}{q-1} \quad (2.1.1)$$

sum$(5^j, j = 0..infinity)$

$$\infty \quad (2.1.2)$$

Grenzwerte

$a := \frac{(9 \cdot x^2 - 5)}{(x-2) \cdot (x-3)}$

$$\frac{9\,x^2 - 5}{(x-2)\,(x-3)} \quad (3.1)$$

limit$(a, x = 2)$

undefined (3.2)

$b := \frac{n! \cdot \exp(n)}{n^n \cdot \mathrm{sqrt}(n)}$

$$\frac{n!\,e^n}{n^n \sqrt{n}} \quad (3.3)$$

limit$(b, n = infinity)$

$$\sqrt{2}\,\sqrt{\pi} \quad (3.4)$$

Ableitungen und bestimmte Integrale

$f := x^n$

$$x^n \quad (4.1)$$

diff(f, x)

$$\frac{x^n\,n}{x} \quad (4.2)$$

simplify$(\%)$

$$x^{n-1}\,n \quad (4.3)$$

diff(f, x, x, x)

$$\frac{x^n\,n^3}{x^3} - \frac{3\,x^n\,n^2}{x^3} + \frac{2\,x^n\,n}{x^3} \quad (4.4)$$

simplify$(\%)$

$$x^{n-3}\,n\,(n^2 - 3\,n + 2) \quad (4.5)$$

factor$(\%)$

$$x^{n-3}\,n\,(n-1)\,(n-2) \quad (4.6)$$

diff$(f, x\$5)$

$$\frac{x^n n^5}{x^5} - \frac{10\, x^n n^4}{x^5} + \frac{35\, x^n n^3}{x^5} - \frac{50\, x^n n^2}{x^5} + \frac{24\, x^n n}{x^5} \quad \textbf{(4.7)}$$

$x\$5$

$$x, x, x, x, x \quad \textbf{(4.8)}$$

$diff\,(f, x\$0)$

Error, invalid input: diff expects 2 or more arguments, but received 1

$diff\,(f, [x\$0])$

$$x^n \quad \textbf{(4.9)}$$

$f1 := x^3$

$$x^3 \quad \textbf{(4.10)}$$

$int(\,f1, x = 0\,..1\,)$

$$\frac{1}{4} \quad \textbf{(4.11)}$$

$f2 := \dfrac{1}{1 + x^4}$

$$\frac{1}{x^4 + 1} \quad \textbf{(4.12)}$$

$I1 := int(\,f2, x = -infinity\,..infinity)$

$$\frac{1}{2}\,\pi\,\sqrt{2} \quad \textbf{(4.13)}$$

Numerische Überprüfung

$I2 := Int(\,f2, x = -infinity\,..infinity)$

$$\int_{-\infty}^{\infty} \frac{1}{x^4 + 1}\, \mathrm{d}x \quad \textbf{(4.1.1)}$$

$evalf\,(I2)$

$$2.221441469 \quad \textbf{(4.1.2)}$$

$evalf\left(\dfrac{1}{2} \cdot \mathrm{Pi} \cdot \mathrm{sqrt}(2)\right)$

$$2.221441469 \quad \textbf{(4.1.3)}$$

Assumptions

$a :='a'$

$$a \quad \textbf{(5.1)}$$

$f3 := \exp(\,-a \cdot x^2)$

$$\mathrm{e}^{-a\,x^2} \quad \textbf{(5.2)}$$

$int(\,f3, x = -infinity\,..infinity)$

$$\begin{cases} \dfrac{\sqrt{\pi}}{\sqrt{a}} & \operatorname{csgn}(a) = 1 \\ \infty & \mathit{otherwise} \end{cases} \tag{5.3}$$

$int(f3, x = -infinity..infinity)$ assuming $a > 0$

$$\frac{\sqrt{\pi}}{\sqrt{a}} \tag{5.4}$$

$\operatorname{sqrt}(a^2)$

$$\sqrt{a^2} \tag{5.5}$$

$\operatorname{sqrt}(a^2)$ assuming $a < 0$

$$-a \tag{5.6}$$

Unbestimmte Integrale

$int(f1, x)$

$$\frac{1}{4} x^4 \tag{6.1}$$

$F2 := int(f2, x)$

$$\frac{1}{4} \sqrt{2} \arctan\left(x \sqrt{2} + 1\right) + \frac{1}{4} \sqrt{2} \arctan\left(x \sqrt{2} - 1\right) + \frac{1}{8} \sqrt{2} \ln\left(\frac{x^2 + x\sqrt{2} + 1}{x^2 - x\sqrt{2} + 1}\right) \tag{6.2}$$

Überprüfung durch Differentiation

$diff(F2, x)$

$$\frac{1}{2\left(1 + \left(x\sqrt{2} + 1\right)^2\right)} + \frac{1}{2\left(1 + \left(x\sqrt{2} - 1\right)^2\right)} + \frac{1}{8} \frac{1}{x^2 + x\sqrt{2} + 1} \left(\sqrt{2} \left(\frac{2x + \sqrt{2}}{x^2 - x\sqrt{2} + 1} - \frac{\left(x^2 + x\sqrt{2} + 1\right)\left(2x - \sqrt{2}\right)}{\left(x^2 - x\sqrt{2} + 1\right)^2}\right) \left(x^2 - x\sqrt{2} + 1\right)\right) \tag{6.1.1}$$

$normal(\%, expanded)$

$$\frac{1}{x^4 + 1} \tag{6.1.2}$$

Ersetzungen

$a, b, c := 'a', 'b', 'c'$

$$a, b, c \tag{7.1}$$

$r := \left(a \cdot x^2 + b \cdot x + c\right)^3$

$$\left(a\, x^2 + b\, x + c\right)^3 \tag{7.2}$$

$eval(r, \{a = 1, b = -1, c = 3, x = 0\})$

$$27 \tag{7.3}$$

r

$$\left(a\, x^2 + b\, x + c\right)^3 \tag{7.4}$$

Bestimme den geraden Anteil von r

$\frac{1}{2} \cdot (r + eval(r, x = -x))$

$$\frac{1}{2} \left(a\, x^2 + b\, x + c\right)^3 + \frac{1}{2} \left(a\, x^2 - b\, x + c\right)^3 \tag{7.5}$$

$g := expand(\textbf{(7.5)})$

$$a^3 x^6 + 3\, a^2 c\, x^4 + 3\, a\, b^2 x^4 + 3\, a\, c^2 x^2 + 3\, b^2 c\, x^2 + c^3 \tag{7.6}$$

$collect(g, x)$

$$a^3 x^6 + \left(3\, a^2 c + 3\, a\, b^2\right) x^4 + \left(3\, a\, c^2 + 3\, b^2 c\right) x^2 + c^3 \tag{7.7}$$

$F2$

$$\frac{1}{4} \sqrt{2} \arctan\left(x \sqrt{2} + 1\right) + \frac{1}{4} \sqrt{2} \arctan\left(x \sqrt{2} - 1\right) + \frac{1}{8} \sqrt{2} \ln\left(\frac{x^2 + x\sqrt{2} + 1}{x^2 - x\sqrt{2} + 1}\right) \tag{7.8}$$

$limit(F2, x = infinity) - limit(F2, x = -infinity)$

$$\frac{1}{2} \pi \sqrt{2} \tag{7.9}$$

Maple rechnet komplex

I^2

$$-1 \tag{8.1}$$

$z := x + I \cdot y$

$$x + \mathrm{I}\, y \tag{8.2}$$

$\mathrm{Re}(z)$

$$\Re(x + \mathrm{I}\, y) \tag{8.3}$$

$\mathrm{Re}(z)$ assuming $x :: real, y :: real$

$$x \tag{8.4}$$

$\mathrm{abs}(z)$ assuming $x :: real, y :: real$

$$\sqrt{x^2 + y^2} \tag{8.5}$$

$conjugate(z)$ assuming $x :: real, y :: real$

$$x - \mathrm{I}\, y \tag{8.6}$$

Ausdrücke und Funktionen

$f := x \rightarrow \sin(x \cdot \mathrm{Pi})$

$$x \rightarrow \sin(x\,\pi) \quad (9.1)$$

$f\left(-\frac{1}{2}\right)$

$$-1 \quad (9.2)$$

r

$$\left(a\,x^2 + b\,x + c\right)^3 \quad (9.3)$$

$r(x)$

$$\left(a(x)\;x(x)^2 + b(x)\;x(x) + c(x)\right)^3 \quad (9.4)$$

$R := unapply(r, (x, a, b, c))$

$$(x, a, b, c) \rightarrow \left(a\,x^2 + b\,x + c\right)^3 \quad (9.5)$$

$R(0, 1, -1, 3)$

$$27 \quad (9.6)$$

Tücke

$g := \exp(x)$

$$e^x \quad (9.1.1)$$

$g(x)$

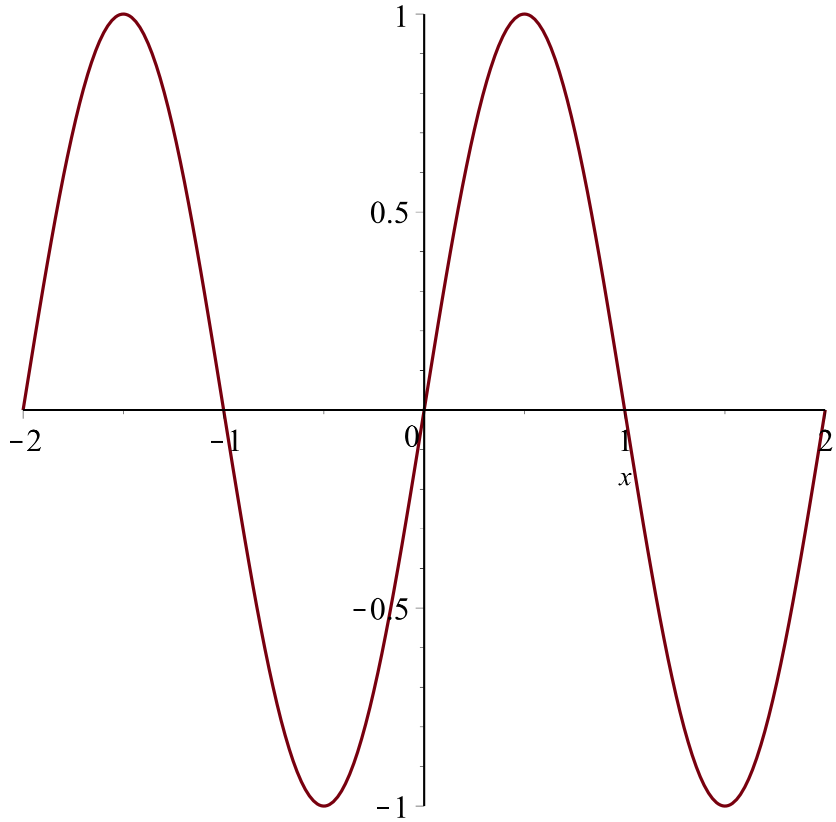
$$e^x(x) \quad (9.1.2)$$

Funktionsgraphen

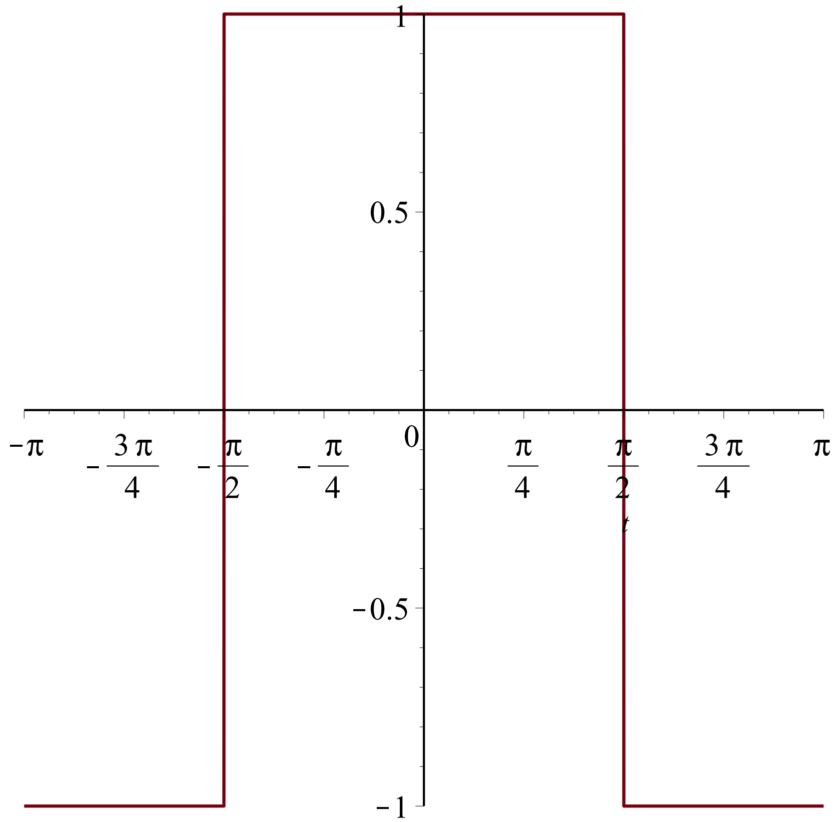
$ausdruck := \sin(\mathrm{Pi} \cdot x)$

$$\sin(\pi\,x) \quad (10.1)$$

$plot(ausdruck, x = -2 .. 2)$



$plot(\mathrm{csgn}(\exp(I \cdot t)), t = -\mathrm{Pi} .. \mathrm{Pi})$



(10.2)