```
> restart;
> f:=x->exp(cos(tan(sin(x))));
```

$$f := x \to \mathbf{e}^{\cos(\tan(\sin(x)))}$$

```
> diff(f(x),x$2);
```

$$-\cos(\tan(\sin(x)))\,(1+\tan(\sin(x))^2)^2\,\cos(x)^2\,\mathbf{e}^{\cos(\tan(\sin(x)))} - 2\sin(\tan(\sin(x)))\tan(\sin(x))\,(1+\tan(\sin(x))^2)\cos(x)^2\,\mathbf{e}^{\cos(\tan(\sin(x)))} + \sin(\tan(\sin(x)))\,(1+\tan(\sin(x))^2)\sin(x)\,\mathbf{e}^{\cos(\tan(\sin(x)))} + \sin(\tan(\sin(x)))^2\,(1+\tan(\sin(x))^2)^2\,\cos(x)^2\,\mathbf{e}^{\cos(\tan(\sin(x)))}$$

```
> subs(x=0,%);
```

$$-\cos(\tan(\sin(0)))\,(1+\tan(\sin(0))^2)^2\,\cos(0)^2\,\mathbf{e}^{\cos(\tan(\sin(0)))} - 2\sin(\tan(\sin(0)))\tan(\sin(0))\,(1+\tan(\sin(0))^2)\cos(0)^2\,\mathbf{e}^{\cos(\tan(\sin(0)))} + \sin(\tan(\sin(0)))\,(1+\tan(\sin(0))^2)\sin(0)\,\mathbf{e}^{\cos(\tan(\sin(0)))} + \sin(\tan(\sin(0)))^2\,(1+\tan(\sin(0))^2)^2\,\cos(0)^2\,\mathbf{e}^{\cos(\tan(\sin(0)))}$$

```
> simplify(%);
```

$$-\mathbf{e}$$

```
> f2:=unapply(diff(f(x),x$2),x);
```

$$f2 := x \to -\cos(\tan(\sin(x)))\,(1+\tan(\sin(x))^2)^2\,\cos(x)^2\,\mathbf{e}^{\cos(\tan(\sin(x)))} - 2\sin(\tan(\sin(x)))\tan(\sin(x))\,(1+\tan(\sin(x))^2)\cos(x)^2\,\mathbf{e}^{\cos(\tan(\sin(x)))} + \sin(\tan(\sin(x)))\,(1+\tan(\sin(x))^2)\sin(x)\,\mathbf{e}^{\cos(\tan(\sin(x)))} + \sin(\tan(\sin(x)))^2\,(1+\tan(\sin(x))^2)^2\,\cos(x)^2\,\mathbf{e}^{\cos(\tan(\sin(x)))}$$

```
> f2(0);
```

$$-\mathbf{e}$$

```
> f2:=(D@@2)(f);
```

$$f2 := x \to -\cos(\tan(\sin(x)))\,(1+\tan(\sin(x))^2)^2\,\cos(x)^2\,\mathbf{e}^{\cos(\tan(\sin(x)))} - 2\sin(\tan(\sin(x)))\tan(\sin(x))\,(1+\tan(\sin(x))^2)\cos(x)^2\,\mathbf{e}^{\cos(\tan(\sin(x)))} + \sin(\tan(\sin(x)))\,(1+\tan(\sin(x))^2)\sin(x)\,\mathbf{e}^{\cos(\tan(\sin(x)))} + \sin(\tan(\sin(x)))^2\,(1+\tan(\sin(x))^2)^2\,\cos(x)^2\,\mathbf{e}^{\cos(\tan(\sin(x)))}$$

```
> f2(0);
```

$$-\mathbf{e}$$

```
> f6:=(D@@6)(f):
> f6(0);
```

$$57\,\mathbf{e}$$

```
> f:=x->(x^3+9*x-102)*exp(arctan(1/3*x+5/3));
```

$$f := x \to (x^3 + 9\,x - 102)\,\mathbf{e}^{\arctan(1/3\,x + 5/3)}$$

```
> f1:=D(f);
```

$$f1 := x \rightarrow (3\,x^2+9)\,\mathbf{e}^{\arctan(1/3\,x+5/3)} + \frac{\frac{1}{3}\,(x^3+9\,x-102)\,\mathbf{e}^{\arctan(1/3\,x+5/3)}}{1+\left(\frac{1}{3}\,x+\frac{5}{3}\right)^2}$$

```
> simplify(f1(x));
```

$$3\,\frac{\mathbf{e}^{\arctan(1/3\,x+5/3)}\,x\,(37\,x+x^3+11\,x^2+39)}{34+x^2+10\,x}$$

```
> s:=solve(f1(x)=0,x);
```

$$s := 0,\ \text{-}3,\ -4+\sqrt{3},\ -4-\sqrt{3}$$

```
> f2:=(D@@2)(f);
```

$$f2 := x \rightarrow 6\,x\,\mathbf{e}^{\arctan(1/3\,x+5/3)} + \frac{\frac{2}{3}\,(3\,x^2+9)\,\mathbf{e}^{\arctan(1/3\,x+5/3)}}{1+\left(\frac{1}{3}\,x+\frac{5}{3}\right)^2} - \frac{1}{3}\,\frac{(x^3+9\,x-102)\,\mathbf{e}^{\arctan(1/3\,x+5/3)}\left(\frac{2}{9}\,x+\frac{10}{9}\right)}{\left(1+\left(\frac{1}{3}\,x+\frac{5}{3}\right)^2\right)^2} + \frac{\frac{1}{9}\,(x^3+9\,x-102)\,\mathbf{e}^{\arctan(1/3\,x+5/3)}}{\left(1+\left(\frac{1}{3}\,x+\frac{5}{3}\right)^2\right)^2}$$

```
> f2(s[1]);
```

$$\frac{117}{34}\,\mathbf{e}^{\arctan(5/3)}$$

```
> f2(s[2]);
```

$$\frac{18}{13}\,\mathbf{e}^{\arctan(2/3)}$$

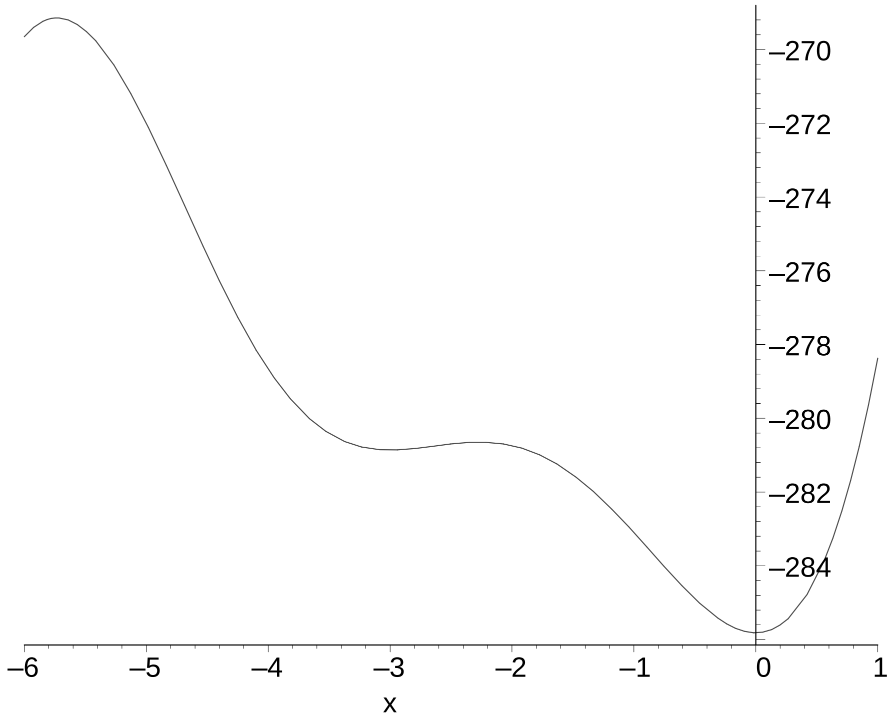
```
> simplify(f2(s[3]));
```

$$6\,\frac{\mathbf{e}^{\arctan(1/3+1/3\sqrt{3})}\,(-153+61\sqrt{3})}{(13+2\sqrt{3})^2}$$

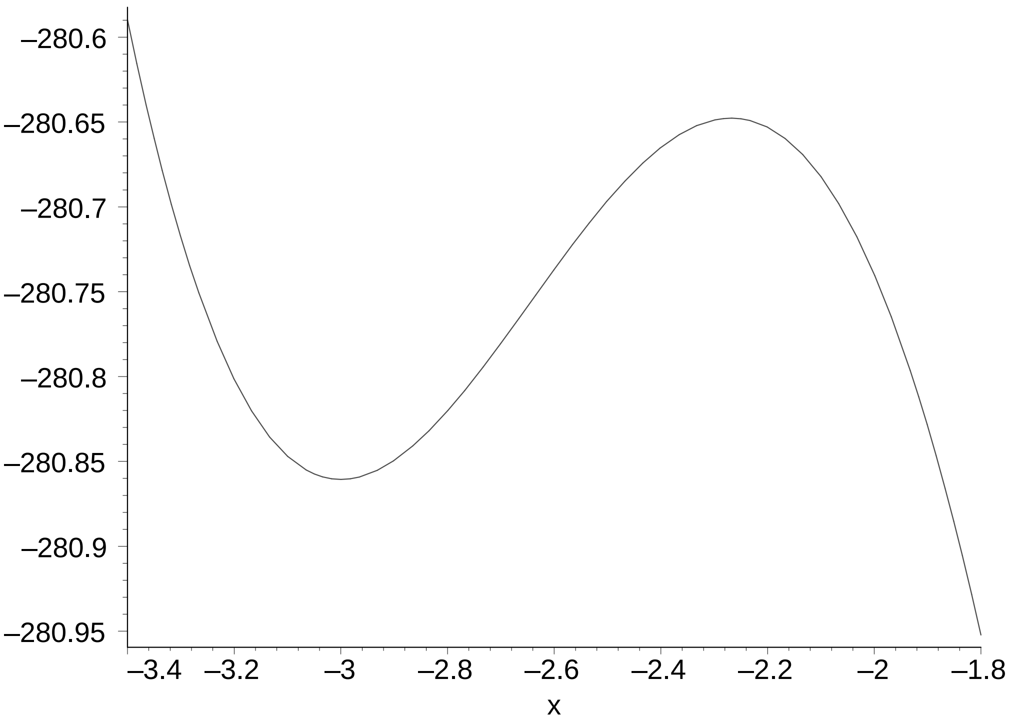
```
> simplify(f2(s[4]));
```

$$-6\,\frac{\mathbf{e}^{(-\arctan(-1/3+1/3\sqrt{3}))}\,(153+61\sqrt{3})}{(-13+2\sqrt{3})^2}$$

```
> plot(f(x),x=-6..1);
```




```
> plot(f(x),x=-3.4..-1.8);
```




```
> minimize(f(x),x,location=true);
```

$$-\infty, \{[\{x = -\infty\}, -\infty]\}$$

```
> minimize(f(x),x=-4..-2,location=true);
```

$$-156\,e^{\arctan(2/3)},\ \{[\{x=-3\},-156\,e^{\arctan(2/3)}]\}$$

```
> minimize(f(x),x=-4..-1,location=true);
```

$$-112\,e^{\arctan(4/3)},\ \{[\{x=-1\},-112\,e^{\arctan(4/3)}]\}$$

```
> minimize(f(x),x=-4..1,location=true);
```

$$-102\,e^{\arctan(5/3)},\ \{[\{x=0\},-102\,e^{\arctan(5/3)}]\}$$

```
>
> f:=x->exp(-x^2+x)*(x^2+4*x+1);
```

$$f := x \rightarrow e^{(-x^2+x)}\,(x^2+4\,x+1)$$

```
> f1:=D(f);
```

$$f1 := x \rightarrow (-2\,x+1)\,e^{(-x^2+x)}\,(x^2+4\,x+1)+e^{(-x^2+x)}\,(2\,x+4)$$

```
> f1(x);
```

$$(-2\,x+1)\,e^{(-x^2+x)}\,(x^2+4\,x+1)+e^{(-x^2+x)}\,(2\,x+4)$$

```
> s:=solve(f1(x)=0,x);
```

$$s := 1,\ -\frac{9}{4}+\frac{1}{4}\sqrt{41},\ -\frac{9}{4}-\frac{1}{4}\sqrt{41}$$

```
> evalf(%);
```

1., -.649218941, -3.850781059

```
> f2:=(D@@2)(f);
```

$$f2 := x \rightarrow -2\,e^{(-x^2+x)}\,(x^2+4\,x+1)+(-2\,x+1)^2\,e^{(-x^2+x)}\,(x^2+4\,x+1)$$
$$+2\,(-2\,x+1)\,e^{(-x^2+x)}\,(2\,x+4)+2\,e^{(-x^2+x)}$$

```
> f2(s[1]);
```

-16

```
> simplify(f2(s[2]));
```

$$\frac{1}{4}\,e^{(-79/8+11/8\sqrt{41})}\,(-41+13\sqrt{41})$$

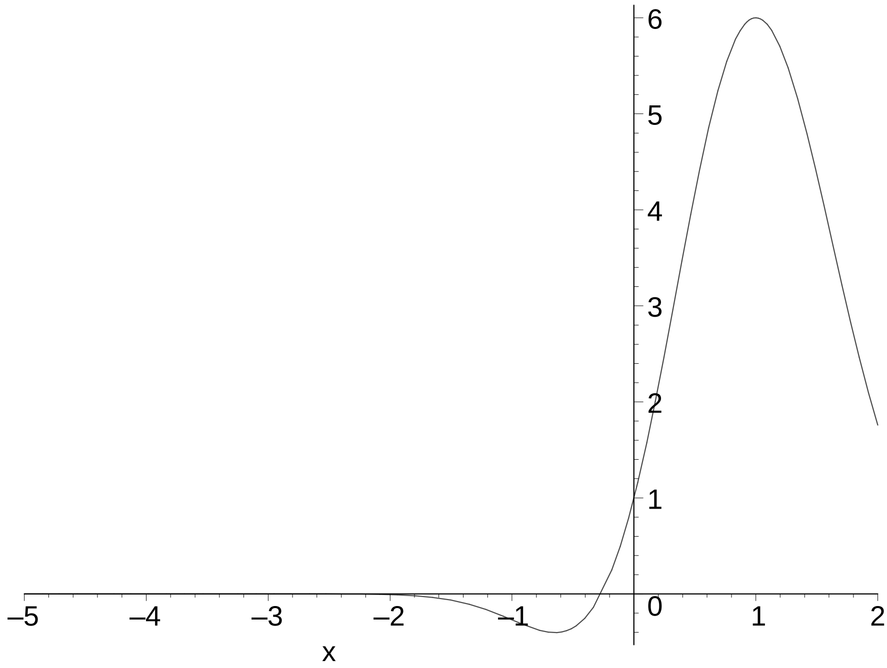
```
> evalf(%);
```

3.619672912

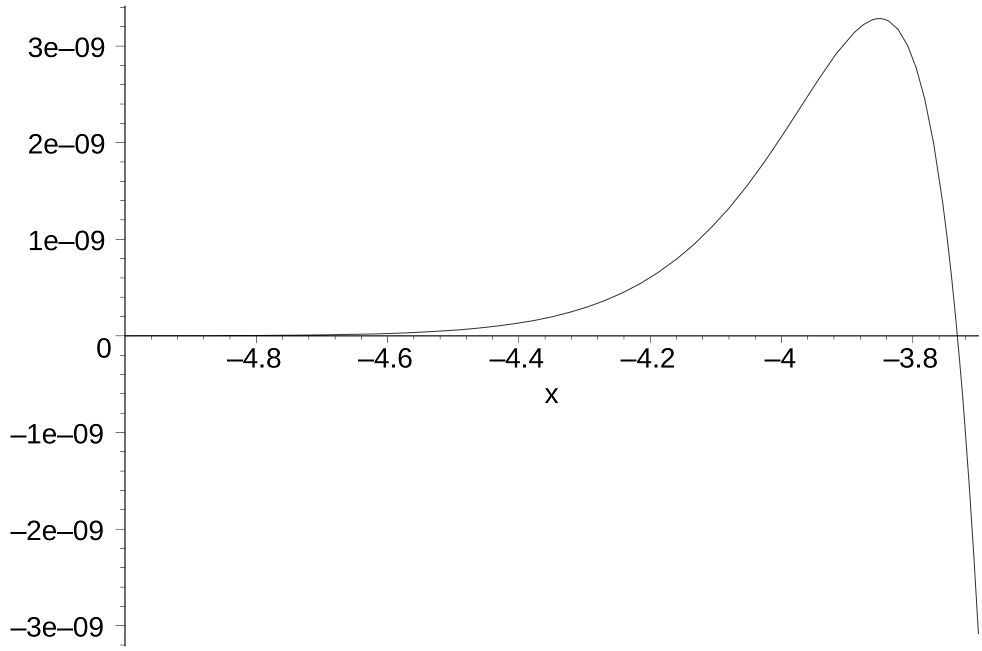
```
> simplify(f2(s[3]));
```

$$-\frac{1}{4}\,e^{(-79/8-11/8\sqrt{41})}\,(41+13\sqrt{41})$$

```
> plot(f(x),x=-5..2);
```




```
> plot(f(x),x=-5..-3.7);
>
```




```
> maximize(f(x),x=-infinity..-1,location=true);
```

$$e^{(-(-9/4-1/4\sqrt{41})^2-9/4-1/4\sqrt{41})}\left(\left(-\frac{9}{4}-\frac{1}{4}\sqrt{41}\right)^2-8-\sqrt{41}\right),$$
$$\left\{\left[\left\{x=-\frac{9}{4}-\frac{1}{4}\sqrt{41}\right\}, e^{(-(-9/4-1/4\sqrt{41})^2-9/4-1/4\sqrt{41})}\left(\left(-\frac{9}{4}-\frac{1}{4}\sqrt{41}\right)^2-8-\sqrt{41}\right)\right]\right\}$$

```
> evalf(%);
```

$$.3284526044\ 10^{-8}, \{[\{x=-3.850781059\}, .3284526044\ 10^{-8}]\}$$

```
> restart;
> f:=x->x^2+c;
```

$$f := x \to x^2+c$$

```
> (f@@4)(x);
```

$$(((x^2+c)^2+c)^2+c)^2+c$$

```
> (f@@2)(0);
```

$$c^2+c$$

```
> solve((f@@2)(0)=0,c);
```

$$0, -1$$

```
> solve((f@@3)(0)=0,c);
```

$$0, -\frac{1}{6}(100+12\sqrt{69})^{(1/3)}-\frac{2}{3}\frac{1}{(100+12\sqrt{69})^{(1/3)}}-\frac{2}{3}, \frac{1}{12}(100+12\sqrt{69})^{(1/3)}+\frac{\frac{1}{3}}{(100+12\sqrt{69})^{(1/3)}}-\frac{2}{3}+\frac{1}{2}I\sqrt{3}\left(-\frac{1}{6}(100+12\sqrt{69})^{(1/3)}+\frac{\frac{2}{3}}{(100+12\sqrt{69})^{(1/3)}}\right),$$
$$\frac{1}{12}(100+12\sqrt{69})^{(1/3)}+\frac{\frac{1}{3}}{(100+12\sqrt{69})^{(1/3)}}-\frac{2}{3}-\frac{1}{2}I\sqrt{3}\left(-\frac{1}{6}(100+12\sqrt{69})^{(1/3)}+\frac{\frac{2}{3}}{(100+12\sqrt{69})^{(1/3)}}\right)$$

```
> evalf(%);
```

$$0., -1.754877667, -.1225611669-.7448617670\,I, -.1225611669+.7448617670\,I$$

```
> solve((f@@4)(0)=0,c);
```

$$0, -1, \mathrm{RootOf}(\_Z^6+3\,\_Z^5+3\,\_Z^4+3\,\_Z^3+2\,\_Z^2+1, index=1),$$
$$\mathrm{RootOf}(\_Z^6+3\,\_Z^5+3\,\_Z^4+3\,\_Z^3+2\,\_Z^2+1, index=2),$$
$$\mathrm{RootOf}(\_Z^6+3\,\_Z^5+3\,\_Z^4+3\,\_Z^3+2\,\_Z^2+1, index=3),$$
$$\mathrm{RootOf}(\_Z^6+3\,\_Z^5+3\,\_Z^4+3\,\_Z^3+2\,\_Z^2+1, index=4),$$
$$\mathrm{RootOf}(\_Z^6+3\,\_Z^5+3\,\_Z^4+3\,\_Z^3+2\,\_Z^2+1, index=5),$$

$$\mathrm{RootOf}(\_Z^6+3\,\_Z^5+3\,\_Z^4+3\,\_Z^3+2\,\_Z^2+1,\ index=6)$$

```
> fsolve((f@@4)(0)=0,c,complex);
```

-1.940799807, -1.310702641, -1.000000000, -.1565201668 − 1.032247109 *I*, -.1565201668 + 1.032247109 *I*, 0., .2822713908 − .5300606176 *I*, .2822713908 + .5300606176 *I*

```
> A:=n->int(1/(x^n+1),x);
```

$$A := n \to \int \frac{1}{x^n+1}\,dx$$

```
> B:=n->int(1/(x^n+1),x=0..1);
```

$$B := n \to \int_0^1 \frac{1}{x^n+1}\,dx$$

```
> C:=n->Int(1/(x^n+1),x=0..1);
```

$$C := n \to \int_0^1 \frac{1}{x^n+1}\,dx$$

```
> A(1);
```

$$\ln(x+1)$$

```
> B(1);
```

$$\ln(2)$$

```
> C(1);
```

$$\int_0^1 \frac{1}{x+1}\,dx$$

```
> A(2);
```

$$\arctan(x)$$

```
> B(2);
```

$$\frac{1}{4}\pi$$

```
> A(3);
```

$$\frac{1}{3}\ln(x+1)-\frac{1}{6}\ln(x^2-x+1)+\frac{1}{3}\sqrt{3}\,\arctan\left(\frac{1}{3}(2\,x-1)\sqrt{3}\right)$$

```
> A(4);
```

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

```
> A(5);
```

$$\frac{1}{5}\ln(x+1)-\frac{1}{20}\ln(-2x^2+x+\sqrt{5}\,x-2)\sqrt{5}-\frac{1}{20}\ln(-2x^2+x+\sqrt{5}\,x-2)-\frac{\arctan\left(\frac{-4x+1+\sqrt{5}}{\sqrt{10-2\sqrt{5}}}\right)}{\sqrt{10-2\sqrt{5}}}$$
$$+\frac{\frac{1}{5}\arctan\left(\frac{-4x+1+\sqrt{5}}{\sqrt{10-2\sqrt{5}}}\right)\sqrt{5}}{\sqrt{10-2\sqrt{5}}}-\frac{1}{20}\ln(2x^2-x+\sqrt{5}\,x+2)+\frac{1}{20}\ln(2x^2-x+\sqrt{5}\,x+2)\sqrt{5}$$
$$+\frac{\arctan\left(\frac{4x-1+\sqrt{5}}{\sqrt{10+2\sqrt{5}}}\right)}{\sqrt{10+2\sqrt{5}}}+\frac{\frac{1}{5}\arctan\left(\frac{4x-1+\sqrt{5}}{\sqrt{10+2\sqrt{5}}}\right)\sqrt{5}}{\sqrt{10+2\sqrt{5}}}$$

```
> A(6);
```

$$\frac{1}{3}\arctan(x)-\frac{1}{12}\sqrt{3}\ln(x^2-\sqrt{3}\,x+1)+\frac{1}{6}\arctan(2x-\sqrt{3})+\frac{1}{12}\sqrt{3}\ln(x^2+\sqrt{3}\,x+1)$$
$$+\frac{1}{6}\arctan(2x+\sqrt{3})$$

```
> A(7);
```

$$\frac{1}{7}\ln(x+1)-\frac{1}{7}\left(\sum_{\_R=\mathrm{RootOf}(\_Z^6-\_Z^5+\_Z^4-\_Z^3+\_Z^2-\_Z+1)}\_R\ln(x-\_R)\right)$$

```
> B(7);
```

$$\frac{1}{7}\ln(2)-\frac{1}{7}\left(\sum_{\_R=\mathrm{RootOf}(\_Z^6-\_Z^5+\_Z^4-\_Z^3+\_Z^2-\_Z+1)}\_R\ln(1-\_R)\right)$$
$$+\frac{1}{7}\left(\sum_{\_R=\mathrm{RootOf}(\_Z^6-\_Z^5+\_Z^4-\_Z^3+\_Z^2-\_Z+1)}\_R\ln(-\_R)\right)$$

```
> evalf(%);
```

$$.9154795274+0.\,I$$

```
> C(7);
```

$$\int_0^1\frac{1}{x^7+1}\,dx$$

```
> evalf(%);
```

$$.9154795268$$

```
> B(8);
```

$$\left(\sum_{\_R=\mathrm{RootOf}(16777216\,\_Z^8+1)}\_R\ln(1+8\,\_R)\right)-\left(\sum_{\_R=\mathrm{RootOf}(16777216\,\_Z^8+1)}\_R\ln(8\,\_R)\right)$$

```
> evalf(%);
```

$$.9246517058+0.\,I$$

```
> evalf(C(8));
```

$$.9246517058$$

```
> F:=(x,y)->x^y-y^x;
```

$$F := (x, y) \to x^y - y^x$$

```
> F(a,b);
```

$$a^b - b^a$$

```
> D[1$2,2$2](F)(2,4);
```

$$48\ln(2)^2 + 56\ln(2) + 6 - 2\ln(4)^2 - 6\ln(4)$$

```
> simplify(%);
```

$$40\ln(2)^2 + 44\ln(2) + 6$$

```
> diff(F(x,y),x,x,y,y);
```

$$\frac{x^y \ln(x)^2 y^2}{x^2} + \frac{4 x^y \ln(x) y}{x^2} + \frac{2 x^y}{x^2} - \frac{x^y \ln(x)^2 y}{x^2} - \frac{2 x^y \ln(x)}{x^2} - \frac{y^x x^2 \ln(y)^2}{y^2} + \frac{y^x x \ln(y)^2}{y^2} - \frac{4 y^x x \ln(y)}{y^2} - \frac{2 y^x}{y^2} + \frac{2 y^x \ln(y)}{y^2}$$

```
> subs({x=2,y=4},%);
```

$$48\ln(2)^2 + 56\ln(2) + 6 - 2\ln(4)^2 - 6\ln(4)$$

```
> simplify(%);
```

$$40\ln(2)^2 + 44\ln(2) + 6$$

```
>
```