

```

[ > restart:
> 5^(5^5);
19110125979454775203564045597039645991980810489900943371395127892465205\
  30242615803012059386519739850265586440155794462235359212788673806972288\
  41014691598660208796189675719570183928166033804761122597553362610100148\
  26511234131477682524114930944471769652827562851967375143953575424790932\
  19206641883011787169122552421070050709064674382870851449950256586194461\
  54318351137984913369177992812743384043154923685552678359637410210533154\
  60313537253257486369091597786903282664591829838152302869365728736914226\
  48131291743762136325730321645282979486862576245362218017673224940567642\
  81936007872071383707235530544635615394640118534849379271951459450550823\
  27492216058489129109451899599486861995431476669380130371761635925944797\
  46164220050885079469804487133205133160739134230540198872570038329801246\
  05019701346739717590902738949392381731578699684589979478106804282243609\
  37839463352654228157043028324423855150823164909672857121717081232327904\
  81817268327510112746782317410985888683708522000711733492253913322300756\
  14718042900752767779335230620061828601245525424306100689480544658470482\
  06509826643193609603887362585107470743406362869765767026992586499535579\
  76318173902550891331223294743930343956161328334072831663498258145226862\
  00430779908468810380418736832480090387359621291963360258312078167367374\
  25333228792969072054905956214068888259912445818423795978634764843156737\
  60923625090371511798941424262270220066286486867868710182980872802560693\
  10194928083082504419842479679205890881711232719230145558291674679519743\
  05480264046468540027339938607985944659615017525869658114475685100415686\
  87730903712482535343839285397598749458497050038225012489284001826590056\
  25128618762993804440734014234706205578530532503491818958970719930566218\
  85129631875017435359602822010382116160485451210393133122563322607664362\
  36688296850208839496142830484739113991669622649948563685234712873294796\
  68088450940589395110465094413790950227654565313301867063352132302846051\
  94343813998105614006525953007317907727110657834941746426847209561346473\
  27748584238274899668755052504394218232191357223054066715373374248543645\
  66378204570165459321815405354839361425066449858540330746646854189014813\
  4347714650315037954175778622811776585876941680908203125
[ > log[10]( % ):
  evalf( % );
                                     2184.281263
[ > ifactor( 5^(5^5) );
                                     (5)3125
[ > 3!!!!;
26012189435657951002049032270810436111915218750169457857275418378508356\

```



```
48473911399166962264994856368523471287329479668088450940589395110465094\  
41379095022765456531330186706335213230284605194343813998105614006525953\  
00731790772711065783494174642684720956134647327748584238274899668755052\  
50439421823219135722305406671537337424854364566378204570165459321815405\  
35483936142506644985854033074664685418901481343477146503150379541757786\  
22811776585876941680908203125
```

```
> evalb( % );
```

true

```
> restart;
```

```
> nextprime( 10^10 );
```

10000000019

```
> prevprime( 10^20 );
```

999999999999999989

```
> N := %% * %;
```

$N := 1000000001899999999889999999791$

```
> #ifactor(N);
```

```
> st:=time();
```

```
ifactor(N);
```

```
time()-st;
```

(999999999999999989) (10000000019)

10.659

```
> restart;
```

```
> Matrix( [[1,2],[3,4]] );
```

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

```
> A:=< <1,2> | <3,4> >;
```

$$A := \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$$

```
> < < 1, 2> , < 3, 4> >;
```

$$\begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

```
> < < 1 | 2 > | < 3 | 4 > >;
```

[1 2 3 4]

```
> CharacteristicPolynomial( A );
```

CharacteristicPolynomial $\left(\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}\right)$

```
> with( LinearAlgebra ): #;
```

```
> CharacteristicPolynomial( A );
```

Error, (in LinearAlgebra:-CharacteristicPolynomial) expected at least 2 arguments, got 1

```

> CharacteristicPolynomial( A, T );
      T^2 - 5T - 2
> solve( % );
      5 + sqrt(33)  5 - sqrt(33)
      2 + 2        2 - 2
> [%];
      [ 5 + sqrt(33)  5 - sqrt(33) ]
      [ 2 + 2        2 - 2 ]
> nops(%);
      2
> A;
      [ 1  3 ]
      [ 2  4 ]
> JordanNormalForm( A );
      JordanNormalForm( [ [ 1  3 ]
                          [ 2  4 ] ] )

```

```

> ?Jordan
> ?JordanForm
> JordanForm(A);

```

$$\begin{bmatrix} \frac{5}{2} + \frac{\sqrt{33}}{2} & 0 \\ 0 & \frac{5}{2} - \frac{\sqrt{33}}{2} \end{bmatrix}$$

```

> F := <<0, 1> | <1, 1>>;

```

$$F := \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$$

```

> JNF, TRAFO := JordanForm( F, output=['J', 'Q'] );

```

$$JNF, TRAFO := \begin{bmatrix} \frac{1}{2} - \frac{\sqrt{5}}{2} & 0 \\ 0 & \frac{1}{2} + \frac{\sqrt{5}}{2} \end{bmatrix}, \begin{bmatrix} \frac{(1+\sqrt{5})\sqrt{5}}{10} & \frac{(-1+\sqrt{5})\sqrt{5}}{10} \\ -\frac{\sqrt{5}}{5} & \frac{\sqrt{5}}{5} \end{bmatrix}$$

```

> TRAFO . JNF . TRAFO^(-1);

```

$$\begin{bmatrix} \frac{(1+\sqrt{5})\sqrt{5}\left(\frac{1}{2} - \frac{\sqrt{5}}{2}\right)}{10} + \frac{(-1+\sqrt{5})\sqrt{5}\left(\frac{1}{2} + \frac{\sqrt{5}}{2}\right)}{10}, \\ \frac{(1+\sqrt{5})\sqrt{5}\left(\frac{1}{2} - \frac{\sqrt{5}}{2}\right)^2}{10} + \frac{(-1+\sqrt{5})\sqrt{5}\left(\frac{1}{2} + \frac{\sqrt{5}}{2}\right)^2}{10} \end{bmatrix}$$

$$\left[-\frac{\left(\frac{1}{2}-\frac{\sqrt{5}}{2}\right)\sqrt{5}}{5} + \frac{\left(\frac{1}{2}+\frac{\sqrt{5}}{2}\right)\sqrt{5}}{5}, -\frac{\left(\frac{1}{2}-\frac{\sqrt{5}}{2}\right)^2\sqrt{5}}{5} + \frac{\left(\frac{1}{2}+\frac{\sqrt{5}}{2}\right)^2\sqrt{5}}{5} \right]$$

> simplify(%);

$$\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$$

> restart;

> p:=X^12-1;

$$p := X^{12} - 1$$

> factor(p);

$$(X-1)(1+X^2+X)(1+X)(1-X+X^2)(1+X^2)(X^4-X^2+1)$$

> factor(p,sqrt(3));

$$(1-X+X^2)(1+X^2+X)(X^2+X\sqrt{3}+1)(X^2-X\sqrt{3}+1)(1+X^2)(X-1)(1+X)$$

> eval(%);

$$(1-X+X^2)(1+X^2+X)(X^2+X\sqrt{3}+1)(X^2-X\sqrt{3}+1)(1+X^2)(X-1)(1+X)$$

> expand(%);

$$X^{12} - 1$$

> int(1/(x^6-1), x);

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

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

> diff(%, x);

$$\frac{1}{6(x-1)} - \frac{2x+1}{12(x^2+x+1)} - \frac{1}{3\left(1+\frac{(2x+1)^2}{3}\right)} + \frac{2x-1}{12(x^2-x+1)} - \frac{1}{3\left(1+\frac{(2x-1)^2}{3}\right)}$$

$$- \frac{1}{6(x+1)}$$

> simplify(%);

$$\frac{1}{(x^2+x+1)(x^2-x+1)(x^2-1)}$$

> expand(%);

$$\frac{1}{(x^2+x+1)(x^2-x+1)(x^2-1)}$$

> normal(%);

$$\frac{1}{(x^2+x+1)(x^2-x+1)(x^2-1)}$$

> normal(%, expanded);

$$\frac{1}{x^6-1}$$

> diff(int(1/(x^6-1), x), x) = 1/(x^6-1);

```

1
2x+1
1
2x-1
1
-----
6(x-1) 12(x^2+x+1) 3(1+(2x+1)^2/3) + 12(x^2-x+1) 3(1+(2x-1)^2/3)
-
1
6(x+1) = 1
x^6-1
> evalb(%);
false
> int( 1/(x^6-1), x=2..3 );
-1/12 ln(13) - 1/6 sqrt(3) arctan(7*sqrt(3)/3) + 1/6 ln(7) - 1/6 ln(2) + 1/12 ln(3) + sqrt(3) pi / 18
> evalf( % );
0.0054712845
> int( 1/(x^7-1), x );
1/7 ln(x-1) + 1/7 ( sum_{R=RootOf(-Z^6+_Z^5+_Z^4+_Z^3+_Z^2+_Z+1)} -R ln(x-_R) )
> sum( z, z=RootOf( x^7-1 ) );
0
> sum( z^2, z=RootOf( x^7-1 ) );
0
> sum( z^7, z=RootOf( x^7-1 ) );
7
> restart:
> ode:= D(f)(x) = 3 * f(x);
ode := D(f)(x)=3 f(x)
> ic := f(0)=1;
ic := f(0)=1
> lsg:=dsolve( { ode, ic }, f(x) );
lsg := f(x)=e^(3x)
> convert( ode, diff );
convert( %, D );
d
--- f(x)=3 f(x)
dx
D(f)(x)=3 f(x)
> subs( lsg, convert( ode, diff ) );
d
--- (e^(3x))=3 e^(3x)
dx
> eval( % );
3 e^(3x) = 3 e^(3x)
> # Und wie testet man ic ?
> restart:
> expr:= x^3-x ;
expr := x^3 - x
> f:= unapply( expr, x );

```

```
f := x -> x^3 - x
```

```
> f(3);
```

24

```
> f(a);
```

$a^3 - a$

```
> f(a+1);
```

$(a+1)^3 - a - 1$

```
> expr2 := (f / (1-2*f)) (z) ;
```

$$\text{expr2} := \frac{z^3 - z}{1 - 2z^3 + 2z}$$

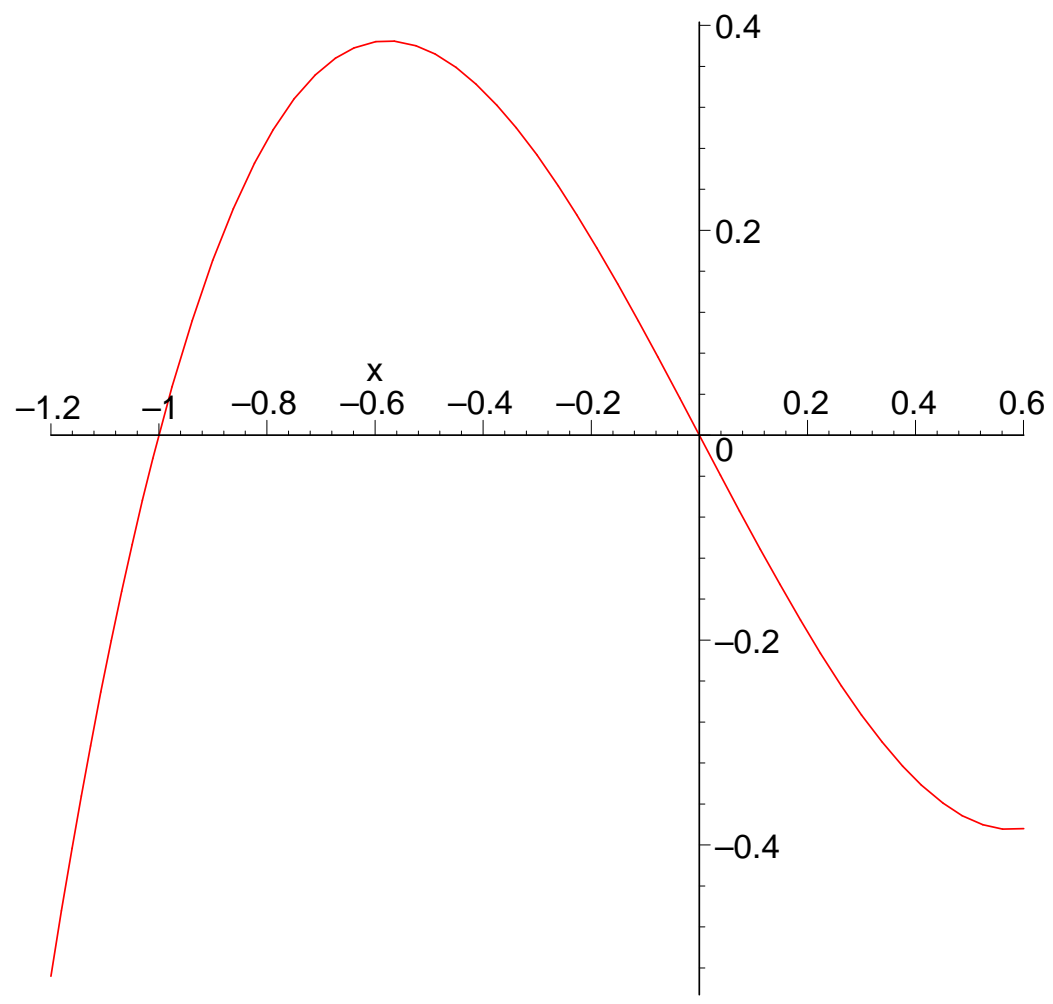
```
> expr;
```

$x^3 - x$

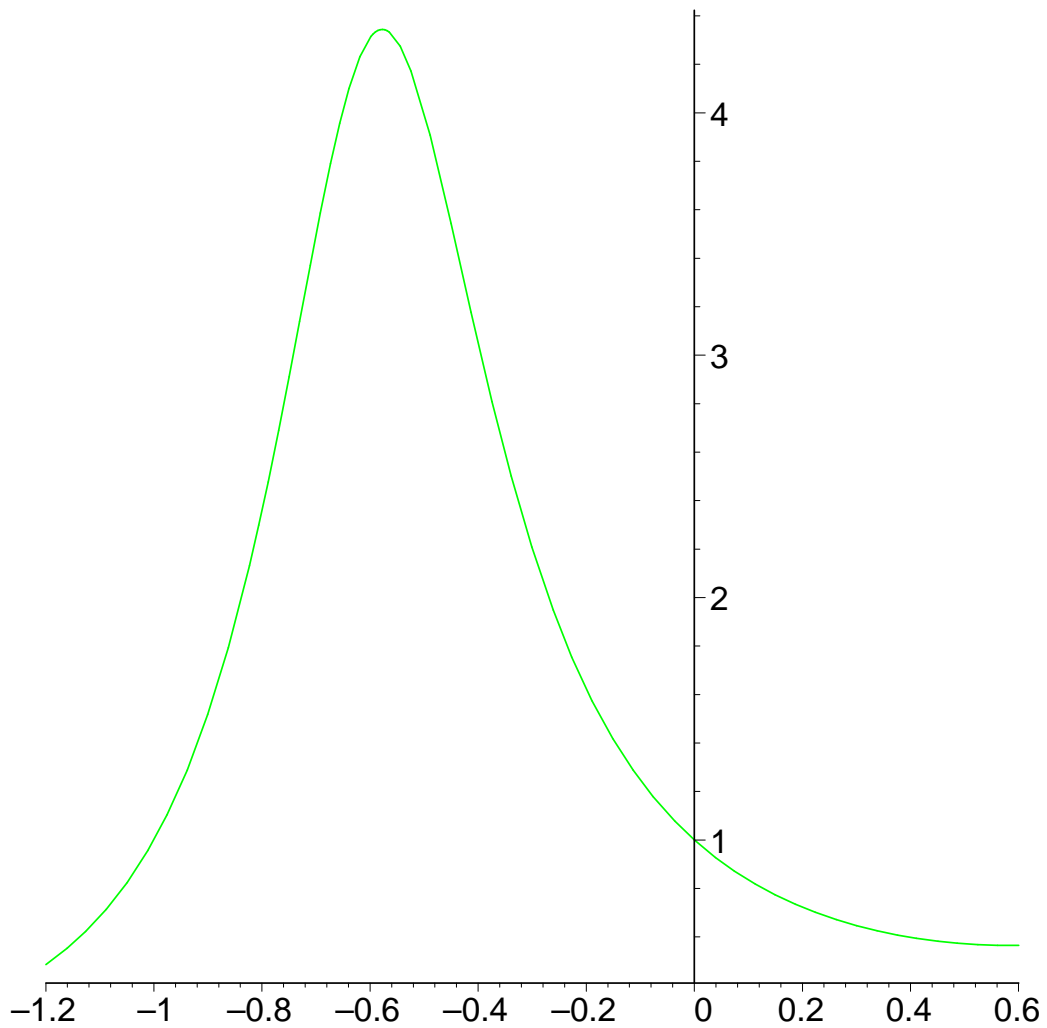
```
> plot( expr, -1.2..0.6 );
```

Plotting error, empty plot

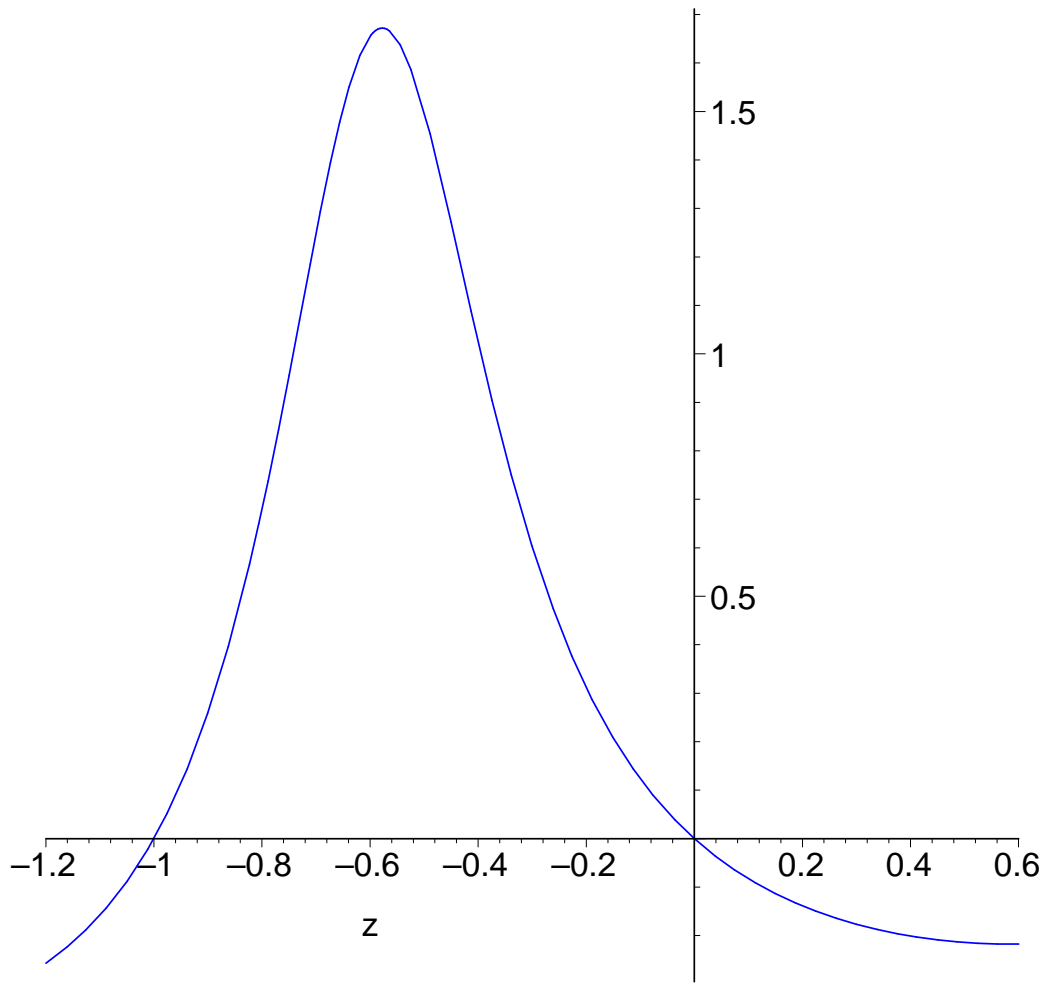
```
> plot( expr, x=-1.2..0.6 );
```



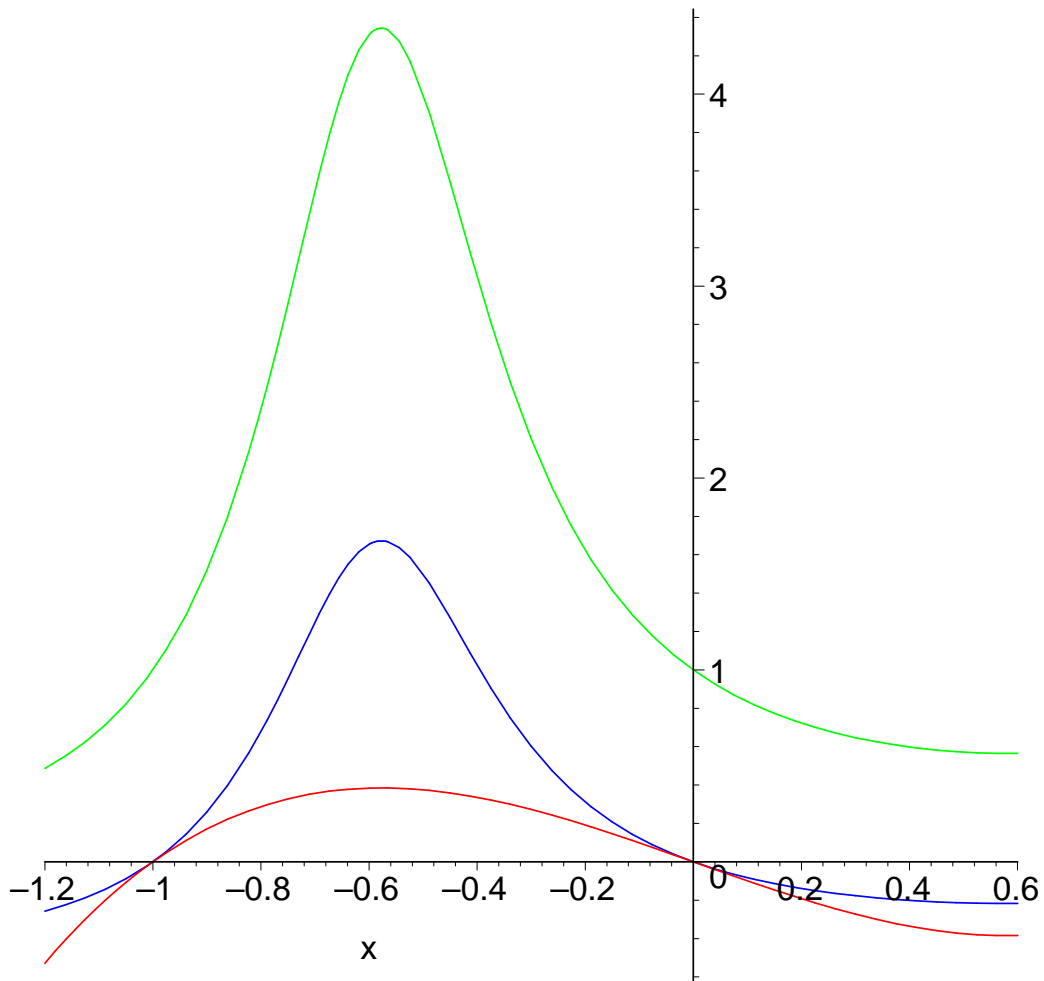
```
> plot( 1/(1-2*f), -1.2..0.6, color=green );
```



```
> plot( expr2, z=-1.2..0.6, color=blue );
```



```
> plots[display]( [ %%, %, % ] );
```



```
> expr2;
```

$$\frac{z^3 - z}{1 - 2z^3 + 2z}$$

```
> solve( expr2, z );
```

0, 1, -1

```
> NST:= [ solve( expr2, {z} ) ];
```

NST:=[[z=0], {z=1}, {z=-1}]

```
> subs( NST[2], expr2 );
```

0

```
> expr2z:=normal( diff( expr2, z ) );
```

$$expr2z := \frac{3z^2 - 1}{(-1 + 2z^3 - 2z)^2}$$

```
> EST:= [ solve( expr2z, {z} ) ];
```

$$EST := \left[\left\{ z = \frac{\sqrt{3}}{3} \right\}, \left\{ z = -\frac{\sqrt{3}}{3} \right\} \right]$$

> EST[1];

$$\left\{ z = \frac{\sqrt{3}}{3} \right\}$$

> subs(EST[1], expr2);

$$-\frac{2\sqrt{3}}{9\left(1 + \frac{4\sqrt{3}}{9}\right)}$$

> subs(EST[1], expr2z);

0

> expr2zz:=normal(diff(expr2, z, z));

$$expr2zz := -\frac{2(3z + 12z^4 - 6z^2 + 2)}{(-1 + 2z^3 - 2z)^3}$$

> subs(EST[1], expr2zz);

$$-\frac{2\left(\sqrt{3} + \frac{4}{3}\right)}{\left(-1 - \frac{4\sqrt{3}}{9}\right)^3}$$

> evalb(% > 0);

$$\frac{2\left(\sqrt{3} + \frac{4}{3}\right)}{\left(-1 - \frac{4\sqrt{3}}{9}\right)^3} < 0$$

> evalf(%);

$$-1.105966737 < 0.$$

> evalb(%);

true

> taylor(expr2, z=0);

$$-z + 2z^2 - 3z^3 + 4z^4 - 4z^5 + O(z^6)$$

> taylor(expr2, op(EST[1]));

$$-\frac{2\sqrt{3}}{9\left(1 + \frac{4\sqrt{3}}{9}\right)} + \frac{\sqrt{3} - \frac{12}{9 + 4\sqrt{3}}}{1 + \frac{4\sqrt{3}}{9}} \left(z - \frac{\sqrt{3}}{3}\right)^2 + \frac{1 - \frac{4\sqrt{3}}{9 + 4\sqrt{3}}}{1 + \frac{4\sqrt{3}}{9}} \left(z - \frac{\sqrt{3}}{3}\right)^3 + \frac{486}{(9 + 4\sqrt{3})^2 \left(1 + \frac{4\sqrt{3}}{9}\right)} \left(z - \frac{\sqrt{3}}{3}\right)^4 + \frac{324\sqrt{3}}{(9 + 4\sqrt{3})^2 \left(1 + \frac{4\sqrt{3}}{9}\right)} \left(z - \frac{\sqrt{3}}{3}\right)^5 + O\left(\left(z - \frac{\sqrt{3}}{3}\right)^6\right)$$

> simplify(%);

$$-\frac{2\sqrt{3}}{9+4\sqrt{3}} + \frac{81\sqrt{3}}{(9+4\sqrt{3})^2} \left(z - \frac{\sqrt{3}}{3}\right)^2 + \frac{81}{(9+4\sqrt{3})^2} \left(z - \frac{\sqrt{3}}{3}\right)^3 + \frac{4374}{(9+4\sqrt{3})^3} \left(z - \frac{\sqrt{3}}{3}\right)^4 + \frac{2916\sqrt{3}}{(9+4\sqrt{3})^3} \left(z - \frac{\sqrt{3}}{3}\right)^5 + O\left(\left(z - \frac{\sqrt{3}}{3}\right)^6\right)$$

```

[ > restart:
[ > hi:=proc()
[   "Hallo Studis!";
[ end proc:
[ > hi();
[                                     "Hallo Studis!"
[
[ > hi2:=proc( S::string )
[   if S="Maple" then
[     "Hallo Studis!";
[   else
[     "Häh? Wie bitte?";
[   end if;
[ end proc;
[ hi2 :=
[   proc(S::string) if S = "Maple" then "Hallo Studis!" else "Häh? Wie bitte?"end if end proc
[ > hi2("Olaf");
[                                     "Häh? Wie bitte?"
[ > hi2("Maple");
[                                     "Hallo Studis!"
[ > hi2( 5+x );
[ Error, invalid input: hi2 expects its 1st argument, S, to be of type string,
[ but received 5+x
[ >
[ >

```