```
>
> restart;
```

- Load from http://www.ccas.ru/ca/TruncatedSeries the archive truncatedseries2020.zip with two files: maple.ind and maple.lib.
- Put these files to some directory, for example to "/usr/userlib".
- Assign libname := "/usr/userlib", libname in the Maple session.

```
> libname := "", libname;
```

$$libname := "", "/opt/maple2020/lib" \qquad (1)$$

```
> with(TruncatedSeries) :
```

Samples from
S. A. Abramov, A. A. Ryabenko, and D. E. Khmelnov,
Truncated and Infinite Power Series in the Role of Coefficients of Linear Ordinary Differential Equations
in Computer Algebra in Scientific Computing 2020 (CASC 2020)

```
>
```

1

```
> eq1 := (-1 + x + x^2 + O(x^3)) * theta(y(x), x, 2) + (-2 + O(x^3)) * theta(y(x), x, 1) + (1 + x
        + Sum(x^i/i!, i = 2 .. infinity)) * y(x);
  LaurentSolution(eq1, y(x), 'threshold' = 'h');
```

$$eq1 := \left(-1 + x + x^2 + O(x^3)\right) \theta(y(x), x, 2) + \left(-2 + O(x^3)\right) \theta(y(x), x, 1) + \left(1 + x + \left(\sum_{i=2}^{\infty} \frac{x^i}{i!}\right)\right) y(x)$$

$$[\,] \qquad (1.1)$$

```
> h;
```

$$-\infty \qquad (1.2)$$

2

```
> f := proc(i)
    if i = 0 then 0;
    elif i :: posint then
        limit(diff(exp(-1/x^2), x $ i), x = 0);
    else 'procname'(i);
    end if;
  end proc:
> eq2 := (-1 + x + x^2 + O(x^3)) * theta(y(x), x, 2) + (-2 + O(x^3)) * theta(y(x), x, 1) + Sum(f(i) * x^i,
        i = 0 .. infinity) * y(x);
```

$$eq2 := \left(-1 + x + x^2 + O(x^3)\right) \theta(y(x), x, 2) + \left(-2 + O(x^3)\right) \theta(y(x), x, 1) + \left(\sum_{i=0}^{\infty} f(i) x^i\right) y(x) \qquad (2.1)$$

```
> LaurentSolution(eq2, y(x), 'top' = 2, 'threshold' = 'h2');
```

$$\left[\frac{\_c_1}{x^2} - \frac{4 \_c_1}{x} + \_c_2 + O(x), \_c_2 + O(x^3)\right] \qquad (2.2)$$

```
> h2
```

$$FAIL \qquad (2.3)$$

```
> LaurentSolution(eq2, y(x), 'top' = 5, 'threshold' = 'h2');
```

$$\left[\frac{\_c_1}{x^2} - \frac{4 \_c_1}{x} + \_c_2 + O(x), \_c_2 + O(x^6)\right] \qquad (2.4)$$

```
> h2;
```

$$FAIL \qquad (2.5)$$

```
> seq('f'(i) = f(i), i = 0 .. 10);
```

$$f(0) = 0, f(1) = 0, f(2) = 0, f(3) = 0, f(4) = 0, f(5) = 0, f(6) = 0, f(7) = 0, f(8) = 0, f(9) = 0, f(10) = 0 \qquad (2.6)$$

3

```
> eq3 := (-1 + x + x^2 + O(x^3)) * theta(y(x), x, 2) + (-2 + O(x^3)) * theta(y(x), x, 1) + (x + 6*x^2)
    *y(x);
```

$$eq3 := \left(-1 + x + x^2 + O\left(x^3\right)\right) \theta(y(x), x, 2) + \left(-2 + O\left(x^3\right)\right) \theta(y(x), x, 1) + \left(6 x^2 + x\right) y(x) \tag{3.1}$$

```
> LaurentSolution(eq3, y(x), 'top' = 2, 'threshold' = 'h3');
```

$$\left[\frac{\_c_1}{x^2} - \frac{5 \_c_1}{x} + \_c_2 + O(x), \_c_2 + \frac{x \_c_2}{3} + \frac{5 x^2 \_c_2}{6} + O\left(x^3\right) \right] \tag{3.2}$$

```
> h3
```

$$FAIL \tag{3.3}$$

```
> LaurentSolution(eq3, y(x), 'top' = 5, 'threshold' = 'h3');
```

$$\left[\frac{\_c_1}{x^2} - \frac{5 \_c_1}{x} + \_c_2 + O(x), \_c_2 + \frac{x \_c_2}{3} + \frac{5 x^2 \_c_2}{6} + \frac{13 x^3 \_c_2}{30} + O\left(x^4\right) \right] \tag{3.4}$$

```
> h3
```

$$3 \tag{3.5}$$

```
> eq4 := (-1 + x + x^2 + 9*x^3 + O(x^4)) * theta(y(x), x, 2) + (-2 + (x^3)/2 + O(x^4)) * theta(y(x), x,
    1) + (x + 6*x^2) * y(x);
```

$$eq4 := \left(-1 + x + x^2 + 9 x^3 + O\left(x^4\right)\right) \theta(y(x), x, 2) + \left(-2 + \frac{x^3}{2} + O\left(x^4\right)\right) \theta(y(x), x, 1) + \left(6 x^2 \right. \tag{4.1}$$
$$\left. + x\right) y(x)$$

```
> LaurentSolution(eq4, y(x), 'top' = 5, 'threshold' = 'h4')
```

$$\left[\frac{\_c_1}{x^2} - \frac{5 \_c_1}{x} + \_c_2 + \frac{x \_c_2}{3} + O\left(x^2\right), \_c_2 + \frac{x \_c_2}{3} + \frac{5 x^2 \_c_2}{6} + \frac{13 x^3 \_c_2}{30} + \frac{95 x^4 \_c_2}{144} + O\left(x^5\right) \right] \tag{4.2}$$

```
> h4
```

$$4 \tag{4.3}$$

5

```
> eq5 := (-1 + x + x^2 + RootOf(z^2-2, z, index=2) * x^3 + O(x^4)) * theta(y(x), x, 2) + (-2 + 2
    *RootOf(z^2-2, z, index=2) *
    x^3 + O(x^4)) * theta(y(x), x, 1) + (x + 6*x^2) * y(x);
```

$$eq5 := \left(-1 + x + x^2 + RootOf\left(\_Z^2 - 2, index = 2\right) x^3 + O\left(x^4\right)\right) \theta(y(x), x, 2) + \left(-2 + 2 RootOf\left(\_Z^2 - 2,\right. \tag{5.1}$$
$$\left. index = 2\right) x^3 + O\left(x^4\right)\right) \theta(y(x), x, 1) + \left(6 x^2 + x\right) y(x)$$

```
> LaurentSolution(eq5, y(x), 'top' = 5, 'threshold' = 'h5');
```

$$\left[\frac{\_c_1}{x^2} - \frac{5 \_c_1}{x} + \_c_2 + x \left(\frac{\_c_2}{3} - \frac{35 \_c_1}{3} \right) + O\left(x^2\right), \_c_2 + \frac{x \_c_2}{3} + \frac{5 x^2 \_c_2}{6} + \frac{13 x^3 \_c_2}{30} \right. \tag{5.2}$$
$$\left. + x^4 \left(\frac{19 \_c_2}{36} + \frac{RootOf\left(\_Z^2 - 2, index = 2\right) \_c_2}{24} \right) + O\left(x^5\right) \right]$$

```
> h5
```

$$4 \tag{5.3}$$

6

```
> eq6 := (-1 + x + x^2 + Sum((-1)^i * x^i/i!, i = 3 .. infinity)) * theta(y(x), x, 2) + (-2 + 2 * (Sum((-1)^i
    *x^i/i!, i = 3 .. infinity))) * theta(y(x), x, 1) + (x + 6*x^2) * y(x);
```

$$\tag{6.1}$$

$$eq6 := \left(-1 + x + x^2 + \left(\sum_{i=3}^{\infty} \frac{(-1)^i x^i}{i!}\right)\right) \theta(y(x), x, 2) + \left(-2 + 2\left(\sum_{i=3}^{\infty} \frac{(-1)^i x^i}{i!}\right)\right) \theta(y(x), x, 1) + \left(6 x^2 \right.$$

$$\left. + x\right) y(x) \tag{6.1}$$

> $LaurentSolution(eq6, y(x), 'top' = 5, 'threshold' = 'h6');$

$$\left[\frac{\_c_1}{x^2} - \frac{5 \_c_1}{x} + \_c_2 + x\left(\frac{\_c_2}{3} - \frac{35 \_c_1}{3}\right) + x^2\left(\frac{5 \_c_2}{6} - \frac{145 \_c_1}{48}\right) + x^3\left(\frac{13 \_c_2}{30} - \frac{103 \_c_1}{16}\right) \right. \tag{6.2}$$

$$+ x^4\left(\frac{25 \_c_2}{48} - \frac{2131 \_c_1}{576}\right) + x^5\left(\frac{2057 \_c_2}{5040} - \frac{4303 \_c_1}{960}\right) + O(x^6), \_c_2 + \frac{x \_c_2}{3} + \frac{5 x^2 \_c_2}{6}$$

$$\left. + \frac{13 x^3 \_c_2}{30} + \frac{25 x^4 \_c_2}{48} + \frac{2057 x^5 \_c_2}{5040} + O(x^6) \right]$$

> $h6$

$$FAIL \tag{6.3}$$

>