

# **gfun[indicialpolynomial]** Indicial polynomial of a linear differential equation at a point

## Calling Sequences

```
indicialpolynomial(deq, y(z), pt)
indicialpolynomial(dop, [Dz,z], pt)
indicialpolynomial(listcoeffs, z, pt)
```

## Parameters

deq - a linear differential equation with polynomial coefficients with or without initial conditions;

y(z) - the unknown function and its variable;

dop - a linear differential operator in Dz, with coefficients that are polynomials in z

[Dz,z] - the corresponding variables;

listcoeffs - a list of polynomials in z representing the coefficients of a linear differential equation

z - the corresponding variable

pt - either infinity or a rational number or a RootOf of an irreducible polynomial

## Description

- This command computes the indicial polynomial as [DEtools\[indicialegl\]](#), with a different syntax and sometimes much faster.
- This command is part of the gfun package, so it can be used in the form `indicialpolynomial(..)` only after executing the command `with(gfun)`. However, it can always be accessed through the long form of the command by using `gfun[indicialpolynomial](..)`.

## Examples

```
> with(gfun):
> f:=exp(z):
> deq:=hosexprtodiffeq(f,y(z));
      deq := { \frac{d}{dz} y(z) - y(z), y(0) = 1 }      (4.1)
> indicialpolynomial(deq,y(z),infinity);
      1      (4.2)
```

$$\begin{aligned} &> \text{indicialpolynomial}(\text{deq}, y(z), 0); \\ & \qquad \qquad \qquad z \qquad \qquad \qquad (4.3) \end{aligned}$$

$$\begin{aligned} &> \text{deq} := \{(20*z^6+12*z^5)*y(z)+(4*z^7+z^2+3*z-9)*\text{diff}(y(z),z)+(z^3-3*z) \\ & \quad -3*z)*\text{diff}(\text{diff}(y(z),z),z), y(0) = 1\}; \\ \text{deq} & := \left\{ (20 z^6 + 12 z^5) y(z) + (4 z^7 + z^2 + 3 z - 9) \left( \frac{d}{dz} y(z) \right) + (z^3 - 3 z) \left( \frac{d^2}{dz^2} \right. \right. \\ & \quad \left. \left. y(z) \right), y(0) = 1 \right\} \end{aligned} \qquad (4.4)$$

$$\begin{aligned} &> \text{indicialpolynomial}(\text{deq}, y(z), \text{RootOf}(z^2-3)); \\ & \qquad \qquad \qquad z^2 + \left( \frac{37 \text{RootOf}(\_Z^2 - 3)}{2} - 2 \right) z \qquad \qquad \qquad (4.5) \end{aligned}$$

$$\begin{aligned} &> \text{dop} := (2*z-2)*Dz-1; \\ & \qquad \qquad \qquad \text{dop} := (2 z - 2) Dz - 1 \qquad \qquad \qquad (4.6) \end{aligned}$$

$$\begin{aligned} &> \text{indicialpolynomial}(\text{dop}, [Dz, z], 1); \\ & \qquad \qquad \qquad z - \frac{1}{2} \qquad \qquad \qquad (4.7) \end{aligned}$$

$$\begin{aligned} &> L := [5, 72*z-42, 36*z^2-36]; \\ & \qquad \qquad \qquad L := [5, 72 z - 42, 36 z^2 - 36] \qquad \qquad \qquad (4.8) \end{aligned}$$

$$\begin{aligned} &> \text{indicialpolynomial}(L, z, 1); \\ & \qquad \qquad \qquad -\frac{7}{12} z + z^2 \qquad \qquad \qquad (4.9) \end{aligned}$$

See Also  
[DEtools\[indicialeq\]](#), [gfun](#)