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> restart:

with(PDEtools, casesplit, declare):
with(DEtools, gensys):

with(DifferentialGeometry):

with(JetCalculus):
with(LieAlgebras):
with(GroupActions):

DGsetup([x,y,z,u], Rquatre):      Repere_xyzu := evalDG([D_x,
D_y,D_z,D_u]);

FF := x^2+y^2-(1/2)*x^4-x^2*y^2-(1/2)*y^4+(1/2)*x^6+(3/2)*x^4*
y^2+(3/2)*x^2*y^4+(1/2)*y^6;

```

$$\text{Repere_xyzu} := [\partial_x, \partial_y, \partial_z, \partial_u]$$

$$FF := x^2 + y^2 - \frac{1}{2} x^4 - x^2 y^2 - \frac{1}{2} y^4 + \frac{1}{2} x^6 + \frac{3}{2} x^4 y^2 + \frac{3}{2} x^2 y^4 + \frac{1}{2} y^6 \quad (1)$$

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> e[1] := evalDG((u+1)*D_x+0*D_y+0*D_z+2*x*D_u);
e[2] := evalDG(0*D_x+(u+1)*D_y+0*D_z+2*y*D_u);
e[3] := evalDG(0*D_x+0*D_y+D_z+0*D_u);

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e[4] := evalDG(y*D_x-x*D_y+0*D_z+0*D_u);
e[5] := evalDG(0*D_x+0*D_y+x*D_z+0*D_u);
e[6] := evalDG(0*D_x+0*D_y+y*D_z+0*D_u);
e[7] := evalDG(0*D_x+0*D_y+z*D_z+0*D_u);
e[8] := evalDG(0*D_x+0*D_y+u*D_z+0*D_u);

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$$e_1 := (u+1) \partial_x + 2x \partial_u$$

$$e_2 := (u+1) \partial_y + 2y \partial_u$$

$$e_3 := \partial_z$$

$$e_4 := y \partial_x - x \partial_y$$

$$e_5 := x \partial_z$$

$$e_6 := y \partial_z$$

$$e_7 := z \partial_z$$

$$e_8 := u \partial_z$$

(2)

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> algebre_lie := LieAlgebraData([seq(e[i], i=1..8)]);
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  DGsetup(algebre_lie):
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  LD := LeviDecomposition();
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  resolvable := Query("Solvable");
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  semi_simple := Query("Semisimple");
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  MultiplicationTable("LieTable");
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algebre_lie := $[e1, e2] = -2 e4, [e1, e3] = 0, [e1, e4] = -e2, [e1, e5] = e3 + e8,$
 $[e1, e6] = 0, [e1, e7] = 0, [e1, e8] = 2 e5, [e2, e3] = 0, [e2, e4] = e1, [e2, e5]$
 $] = 0, [e2, e6] = e3 + e8, [e2, e7] = 0, [e2, e8] = 2 e6, [e3, e4] = 0, [e3, e5]$
 $] = 0, [e3, e6] = 0, [e3, e7] = e3, [e3, e8] = 0, [e4, e5] = e6, [e4, e6] = -e5,$
 $[e4, e7] = 0, [e4, e8] = 0, [e5, e6] = 0, [e5, e7] = e5, [e5, e8] = 0, [e6, e7]$
 $] = e6, [e6, e8] = 0, [e7, e8] = -e8$

LD := $[[e3, e5, e6, e7, e8], [e1, e2, e4]]$

resolvable := false

semi_simple := false

L1	<i>e1</i>	<i>e2</i>	<i>e3</i>	<i>e4</i>	<i>e5</i>	<i>e6</i>	<i>e7</i>	<i>e8</i>
<i>e1</i>	0	$-2 e4$	0	$-e2$	$e3 + e8$	0	0	$2 e5$
<i>e2</i>	$2 e4$	0	0	<i>e1</i>	0	$e3 + e8$	0	$2 e6$
<i>e3</i>	0	0	0	0	0	0	<i>e3</i>	0
<i>e4</i>	<i>e2</i>	$-e1$	0	0	<i>e6</i>	$-e5$	0	0
<i>e5</i>	$-e3 - e8$	0	0	$-e6$	0	0	<i>e5</i>	0
<i>e6</i>	0	$-e3 - e8$	0	<i>e5</i>	0	0	<i>e6</i>	0
<i>e7</i>	0	0	$-e3$	0	$-e5$	$-e6$	0	$-e8$
<i>e8</i>	$-2 e5$	$-2 e6$	0	0	0	0	<i>e8</i>	0

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