ODE

In [2]:
```
from sympy import Function, symbols, matrices, dsolve, classify_ode, Eq, E, pprint, simplify, sin, cos
```

In [3]:
```
#1
t = symbols('t')
y = Function('y')(t)
dydt = y.diff(t)
exprOne = Eq(dydt + 4*y, E**(2*t))
pprint(exprOne)
print(classify_ode(exprOne))
dsolve(exprOne)
```

```
        d           2⋅t
4⋅y(t) + ──(y(t)) = e
        dt
('1st_linear', 'Bernoulli', 'almost_linear', '1st_power_series', 'lie_group', 'nth_linear_constant_coeff_undetermined_coefficients', 'nth_linear_constant_
coeff_variation_of_parameters', '1st_linear_Integral', 'Bernoulli_Integral', 'almost_linear_Integral', 'nth_linear_constant_coeff_variation_of_parameters_
Integral')
```

Out[3]:
$$y(t) = \left(C_{1} + \frac{e^{6t}}{6}\right) e^{-4t}$$

In [4]:
```
#2
dyydtt = dydt.diff(t)
exprTwo = Eq(dyydtt + 2*dydt + y, 3*E**(-t))
pprint(exprTwo)
print(classify_ode(exprTwo))
dsolve(exprTwo)
```

```
                  2
        d        d                -t
y(t) + 2⋅──(y(t)) + ──(y(t)) = 3⋅e
        dt         2
                  dt
('nth_linear_constant_coeff_undetermined_coefficients', 'nth_linear_constant_coeff_variation_of_parameters', 'nth_linear_constant_coeff_variation_of_param
eters_Integral')
```

Out[4]:
$$y(t) = \left(C_{1} + t \left(C_{2} + \frac{3t}{2}\right)\right) e^{-t}$$

In [5]:
```
#3
exprThree = Eq(dyydtt + 4*y, 3*t**2)
pprint(exprThree)
print(classify_ode(exprThree))
dsolve(exprThree)
```

```
          2
        d             2
4⋅y(t) + ──(y(t)) = 3⋅t
          2
        dt
('nth_linear_constant_coeff_undetermined_coefficients', 'nth_linear_constant_coeff_variation_of_parameters', 'nth_linear_constant_coeff_variation_of_param
eters_Integral')
```

Out[5]:
$$y(t) = C_{1} \sin\left(2t\right) + C_{2} \cos\left(2t\right) + \frac{3t^{2}}{4} - \frac{3}{8}$$

In [9]:
```
#4
x = symbols('x')
y = Function('y')(x)
dydx = y.diff(x)

exprFour = Eq((4*y**2 - y)*dydx, 3*sin(x) + 5*E**(4*x))
pprint(exprFour)
print(classify_ode(exprFour))
print('\n')
print('solution to this takes so long for some reason')
print('try it yourself running dsolve(eq, hint=\'1st_exact\')')
print('maybe my comp is just too slow')
```

```
⎛   2          ⎞ d                4⋅x
⎝4⋅y (x) - y(x)⎠⋅──(y(x)) = 5⋅e    + 3⋅sin(x)
                 dx
('separable', '1st_exact', '1st_power_series', 'lie_group', 'separable_Integral', '1st_exact_Integral')


solution to this takes so long for some reason
try it yourself running dsolve(eq, hint='1st_exact')
maybe my comp is just too slow
```

In [13]:
```
#5
exprFive = Eq(y + (2*x*y - E**(-2*y)), 0)
pprint(exprFive)
print('function cannot be detected')
```

```
                   -2⋅y(x)
2⋅x⋅y(x) + y(x) - e        = 0
function cannot be detected
```

In [ ]:
```

```