In [1]:
```
from sympy import *
```

Example 1: y'' + 4y = csc(2t)

In [2]:
```
t=symbols('t')
y=Function('y')
deqH=diff(y(t),t,2)+4*y(t)
yh=dsolve(deqH,y(t))
print('The solution to the homogeneous ODE is',yh)
deqNH=deqH-csc(2*t)
ysoln=dsolve(deqNH,y(t))
print('The solution to the nonhomogeneous ODE is',ysoln)
```

```
The solution to the homogeneous ODE is Eq(y(t), C1*sin(2*t) + C2*cos(2*t))
The solution to the nonhomogeneous ODE is Eq(y(t), (C1 - t/2)*cos(2*t) + (C
2 + log(sin(2*t))/4)*sin(2*t))
```

Example 2: t^2y'' - t(t+2)y' + (t+2)y = 3t^3, t>0

In [6]:
```
# ODE cannot be solved explicitly in Python
# Show t and te^t are solutions
t=symbols('t')
y1=t
y2=t*exp(t)
print('For y1=t, LHS =',t**2*diff(y1,t,2)-t*(t+2)*diff(y1,t)+(t+2)*y1)
print('For y2=te^t, LHS =',(t**2*diff(y2,t,2)-t*(t+2)*diff(y2,t)+(t+2)*y2).
simplify())
g=3*t
W=wronskian([y1,y2],t).simplify()
print('The Wronskian is',W)
u1p=-y2*g/W
u2p=y1*g/W
print("u1'=",u1p,"and u2'=",u2p)
u1=integrate(u1p,t)
u2=integrate(u2p,t)
print('So u1=',u1,'and u2=',u2)
yp=u1*y1+u2*y2
print('and yp=',yp)
# Check
print('For yp, LHS =',(t**2*diff(yp,t,2)-t*(t+2)*diff(yp,t)+(t+2)*yp).simpl
ify())
```

```
For y1=t, LHS = 0
For y2=te^t, LHS = 0
The Wronskian is t**2*exp(t)
u1'= -3 and u2'= 3*exp(-t)
So u1= -3*t and u2= -3*exp(-t)
and yp= -3*t**2 - 3*t
For yp, LHS = 3*t**3
```

In [ ]:

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