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

Example 1: Find the fundamental set of solutions to the ODE y'' + 2y' + y = 0

In [2]:
```
t=symbols('t')
y=Function('y')
deq=diff(y(t),t,2)+2*diff(y(t),t)+y(t)
ysoln=dsolve(deq,y(t))
print('The solution to the ODE is',ysoln)
```

```
The solution to the ODE is Eq(y(t), (C1 + C2*t)*exp(-t))
```

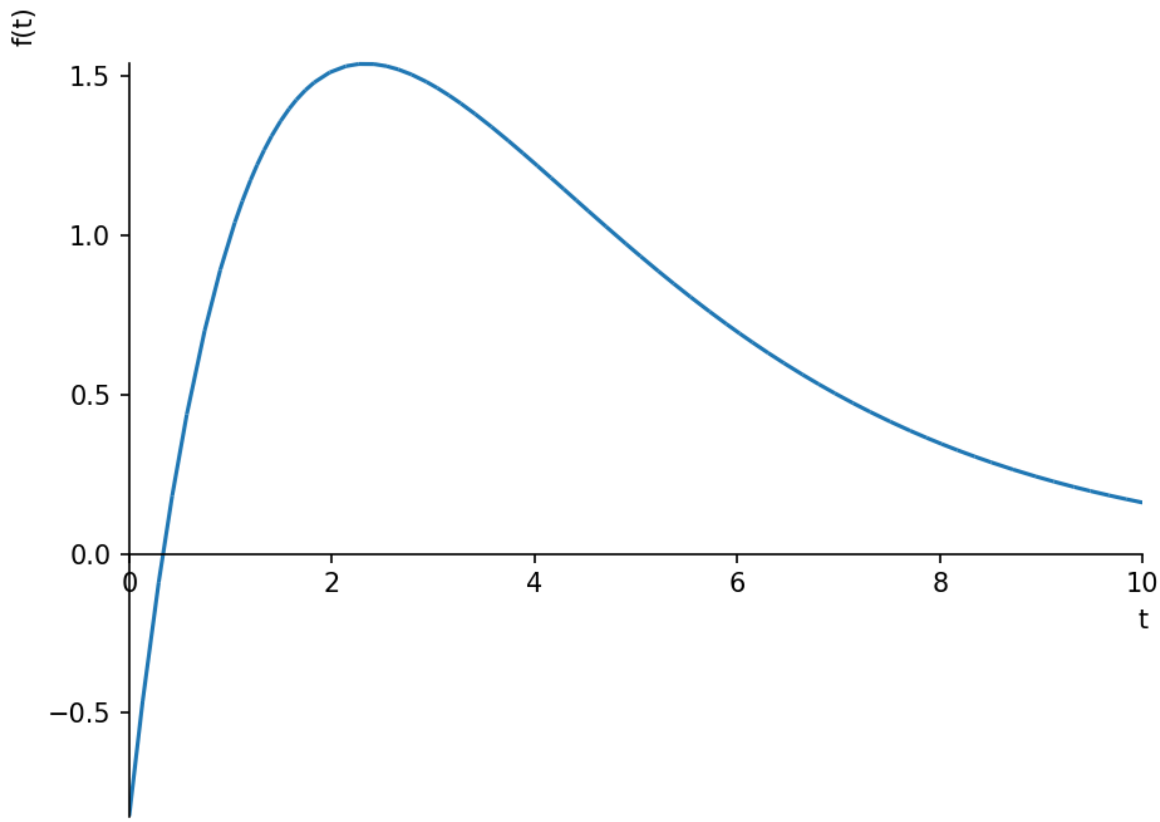
Example 2: Solve the IVP 4y'' + 4y' + y = 0, y(1)=1, y'(1)=1. Plot the solution and describe its behavior as t-->oo

In [3]:
```
t=symbols('t')
y=Function('y')
deq=4*diff(y(t),t,2)+4*diff(y(t),t)+y(t)
ysoln=dsolve(deq,y(t),ics={y(1):1,diff(y(t),t).subs(t,1):1})
print('The solution is',ysoln)
```

```
The solution is Eq(y(t), (3*t*exp(1/2)/2 - exp(1/2)/2)/sqrt(exp(t)))
```

In [4]:
```
matplotlib notebook
```

In [6]:
```
yplot=ysoln.rhs
plot(yplot,(t,0,10))
print('The function approaches 0 because of the e^(-1/2t).')
```




```
The function approaches 0 because of the e^(-1/2t).
```

t^2 y'' + 2t y' - 2y = 0, t>0 Verify y1 and y2 form a Fundamental Set of solutions

In [9]:
```
t=symbols('t')
y=Function('y')
deq=t**2*diff(y(t),t,2)+2*t*diff(y(t),t)-2*y(t)
ysoln=dsolve(deq,y(t))
print('The solution to the ODE is',ysoln)
# Use Wronskian to show Fundamental Set
y1=t**(-2)
y2=t
Wronsk=wronskian([y1,y2],t)
print('The Wronskian is',Wronsk)
is0=solve(Wronsk)
print('The Wronskian is zero when t=',is0,'so the solutions form a Fundamen
tal Set.')
```

```
The solution to the ODE is Eq(y(t), C1/t**2 + C2*t)
The Wronskian is 3/t**2
The Wronskian is zero when t= [] so the solutions form a Fundamental Set.
```

In [ ]:

```

```