Tutorial 1

Name : Ritesh Jha

Class : SY-IT

Batch : B2

Roll No. : 16010423076

Q1)i)

In [12]:
```
t = var('t')
s = var('s')
f = t^5*sin(4*t)
f.laplace(t,s)
print("Laplace transform is : ")
show(f.laplace(t,s))
```

```
Laplace transform is :
```

$$\frac{15360\,s^5}{\left(s^2+16\right)^6}-\frac{15360\,s^3}{\left(s^2+16\right)^5}+\frac{2880\,s}{\left(s^2+16\right)^4}$$

Q1)ii)

In [13]:
```
f = (cos(3*t) - cos(4*t))/t^2
f.laplace(t,s)
print("Laplace transform is : ")
show(f.laplace(t,s))
```

```
Laplace transform is :
```

$$\frac{1}{2}\,\pi-\frac{1}{2}\,s\log\left(s^2+16\right)+\frac{1}{2}\,s\log\left(s^2+9\right)+3\,\arctan\left(\frac{1}{3}\,s\right)-4\,\arctan\left(\frac{1}{4}\,s\right)$$

Q1)iii)

In [14]:
```
f = exp(-5*t) * cos(3*t) + t^10
f.laplace(t,s)
print("Laplace transform is : ")
show(f.laplace(t,s))
```

Laplace transform is :

$$\frac{s+5}{s^2+10\,s+34}+\frac{3628800}{s^{11}}$$

Q2)i)

In [18]:
```
f(s) = (s^2 + 16*s - 24) / (s^4 + 20*s^2 + 64)
print("Inverse Laplace of the function "),show(f(s)), print("is: ")
show(inverse_laplace(f(s),s,t))
```

Inverse Laplace of the function

$$\frac{s^2+16\,s-24}{s^4+20\,s^2+64}$$

is:

$$-\frac{4}{3}\cos(4\,t)+\frac{4}{3}\cos(2\,t)+\frac{5}{6}\sin(4\,t)-\frac{7}{6}\sin(2\,t)$$

Q2)ii)

In [19]:
```
f(s) = (s+2) / ((s+3)*(s+1)^3)
print("Inverse Laplace of the function "),show(f(s)), print("is: ")
show(inverse_laplace(f(s),s,t))
```

Inverse Laplace of the function

$$\frac{s+2}{(s+3)(s+1)^3}$$

is:

$$\frac{1}{4}\,t^2e^{(-t)}+\frac{1}{4}\,te^{(-t)}-\frac{1}{8}\,e^{(-t)}+\frac{1}{8}\,e^{(-3\,t)}$$

Q3

In [22]:
```
x = function('x')(t)
de = diff(x,t,2) + 3*diff(x,t) + 2*x == 2*(t^2 + t + 1)
ode = desolve_laplace(de,x,ics=[0,2,0])
print("The differential equation solved using laplace transform = ")
show(ode)
```

```
The differential equation solved using laplace transform =
```

$$t^2 - 2\,t - e^{(-2\,t)} + 3$$