Shounak Dutta 16010124080 B1 ITVC TUTORIAL 2

In [2]:
```
#Q1 (i)
var('t')
var('s')
f=(t**3)*cos(2*t)
f.laplace(t,s)
```

Out[2]:
```
48*s^4/(s^2 + 4)^4 - 48*s^2/(s^2 + 4)^3 + 6/(s^2 + 4)^2
```

In [3]:
```
show(f.laplace(t,s))
```

$$\frac{48\,s^4}{\left(s^2+4\right)^4}-\frac{48\,s^2}{\left(s^2+4\right)^3}+\frac{6}{\left(s^2+4\right)^2}$$

In [10]:
```
#(ii)
var('t')
var('s')
assume(s-2 > 0)
assume(s-3 > 0)
f_2=((exp(2*t)-exp(3*t))/t**2)
f_2.laplace(t,s)
# laplace(f_2, t, s)
```

Out[10]:
```
laplace(-(e^(3*t) - e^(2*t))/t^2, t, s)
```

In [11]:
```
show(f_2.laplace(t,s))
```

$$\mathcal{L}\left(-\frac{e^{(3\,t)}-e^{(2\,t)}}{t^2},t,s\right)$$

In [12]:
```
#(iii)
var('t')
var('s')
assume(s-5 > 0)
f_3=exp(-5*t)*sin(3*t)
f_3.laplace(t,s)
```

Out[12]:
```
3/(s^2 + 10*s + 34)
```

In [13]:
```
show(f_3.laplace(t,s))
```

$$\frac{3}{s^2+10\,s+34}$$

In [14]:
```
#Q2 (i)
F(s) = 1/((s**4)+(13*s**2)+36)
inverse_laplace(F(s),s,t)
```

Out[14]:
```
-1/15*sin(3*t) + 1/10*sin(2*t)
```

In [15]:
```
show(inverse_laplace(F(s),s,t))
```

$$-\frac{1}{15}\sin(3\,t)+\frac{1}{10}\sin(2\,t)$$

In [16]:
```
# (ii)
F_2(s)=(s+s**2)/((s**2+1)*(s**2+2*s+2))
inverse_laplace(F_2(s),s,t)
```

Out[16]:
```
-1/5*(3*cos(t) - sin(t))*e^(-t) + 3/5*cos(t) + 1/5*sin(t
```

In [17]:
```
show(inverse_laplace(F_2(s),s,t))
```

$$-\frac{1}{5}\,(3\,\cos(t)-\sin(t))e^{(-t)}+\frac{3}{5}\cos(t)+\frac{1}{5}\sin(t)$$

In [18]:
```
var('t s')
x0 = 1
x1 = 2
F = laplace(20*sin(2*t), t, s)
X = ((s^2*function('X')(s) - s*x0 - x1) - (s*function('X
Xs = solve(X, function('X')(s))[0].rhs()
x_t = inverse_laplace(Xs, s, t)
Xs, x_t
```

Out[18]:
```
((s^3 + s^2 + 4*s + 44)/(s^4 - s^3 + 2*s^2 - 4*s - 8),
 cos(2*t) + 8/3*e^(2*t) - 8/3*e^(-t) - 3*sin(2*t))
```

In [19]:
```
show(Xs)
show(x_t)
```

$$\frac{s^3+s^2+4\,s+44}{s^4-s^3+2\,s^2-4\,s-8}$$

$$\cos(2\,t)+\frac{8}{3}\,e^{(2\,t)}-\frac{8}{3}\,e^{(-t)}-3\,\sin(2\,t)$$

In [ ]: