

212 Lab #7 Key

My comments are in blue.

```
>> syms x y t s
```

1.

a.

```
>> laplace(t^4,t,s)
```

ans =

$24/s^5$

b.

```
>> laplace(exp(-5*t),t,s)
```

ans =

$1/(s + 5)$

c.

```
>> laplace(t*exp(2*t)+3,t,s)
```

ans =

$1/(s - 2)^2 + 3/s$

d.

```
>> laplace(cos(t)*sin(t)^2,t,s)
```

ans =

$(2*s)/(s^4 + 10*s^2 + 9)$

e.

```
>> laplace(exp(-t)*sin(4*t),t,s)
```

ans =

$4/((s + 1)^2 + 16)$

f.

```
>> laplace(cosh(t),t,s)
```

ans =

$s/(s^2 - 1)$

g.

```
>> laplace(exp(9*t)*sinh(t),t,s)
```

```
ans =
```

```
1/((s - 9)^2 - 1)
```

h.

```
>> laplace(t^(5/2),t,s)
```

```
ans =
```

```
(15*pi^(1/2))/(8*s^(7/2))
```

i.

```
>> laplace(t^2*sin(pi*t),t,s)
```

```
ans =
```

```
(8*pi*s^2)/(pi^2 + s^2)^3 - (2*pi)/(pi^2 + s^2)^2
```

j.

```
>> laplace(sin(3*t+3),t,s)
```

```
ans =
```

```
(3*cos(3) + s*sin(3))/(s^2 + 9)
```

```
>>
```

2.

a.

```
>> ilaplace(1/s^2,s,t)
```

```
ans =
```

```
t
```

b.

```
>> ilaplace((2*s+3)/(s^2+1),s,t)
```

```
ans =
```

```
2*cos(t) + 3*sin(t)
```

c.

```
>> ilaplace((7*s-11)/((s-5)^2+9),s,t)
```

```
ans =
```

$$7*\exp(5*t)*(cos(3*t) + (8*\sin(3*t))/7)$$

d.

```
>> ilaplace(120/(s-2)^4,s,t)
```

ans =

$$20*t^3*\exp(2*t)$$

e. You need to declare the new unknown 'a' before using it.

```
>> syms a
```

```
>> ilaplace(a*s/(s^2+4)^2,s,t)
```

ans =

$$(a*t*\sin(2*t))/4$$

```
>>
```

3.

a.

```
>> eqn1=sym('D(D(y))(t)+5*D(y)(t)+6*y(t)=exp(-t)');
```

```
>> lteqn1=laplace(eqn1,t,s)
```

lteqn1 =

$$5*s*\text{laplace}(y(t), t, s) - D(y)(0) - 5*y(0) - s*y(0) + s^2*\text{laplace}(y(t), t, s) + 6*\text{laplace}(y(t), t, s) == 1/(s + 1)$$

```
>> syms Y
```

```
>> Yeqn1=subs(lteqn1,{'laplace(y(t),t,s}','y(0)','D(y)(0)'},{Y,1,0})
```

Yeqn1 =

$$6*Y - s + 5*Y*s + Y*s^2 - 5 == 1/(s + 1)$$

```
>> Ytrans1=simplify(solve(Yeqn1,Y))
```

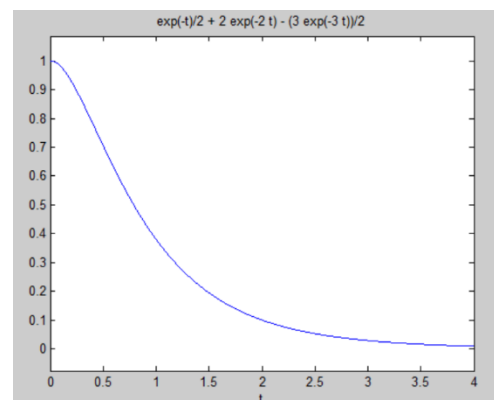
Ytrans1 =

$$(s^2 + 6*s + 6)/((s + 1)*(s + 2)*(s + 3))$$

```
>> y=ilaplace(Ytrans1,s,t)
```

y =

$$\exp(-t)/2 + 2*\exp(-2*t) - (3*\exp(-3*t))/2$$



```
>> ezplot(y,[0,4])
>>
```

b.

```
>> eqn2=sym('D(D(y))(t)+2*D(y)(t)-5*y(t)=sin(2*t)-t');
>> lteqn2=laplace(eqn2,t,s)
```

lteqn2 =

$$2*s*\text{laplace}(y(t), t, s) - D(y)(0) - 2*y(0) - s*y(0) + s^2*\text{laplace}(y(t), t, s) - 5*\text{laplace}(y(t), t, s) == 2/(s^2 + 4) - 1/s^2$$

```
>> Yeqn2=subs(lteqn2,{'laplace(y(t),t,s}','y(0)','D(y)(0)'},{Y,1,3})
```

Yeqn2 =

$$2*Y*s - s - 5*Y + Y*s^2 - 5 == 2/(s^2 + 4) - 1/s^2$$

```
>> Ytrans2=simplify(solve(Yeqn2,Y))
```

Ytrans2 =

$$(s + 2/(s^2 + 4) - 1/s^2 + 5)/(s^2 + 2*s - 5)$$

```
>> y=ilaplace(Ytrans2,s,t)
```

y =

$$t/5 - (4*\cos(2*t))/97 - (9*\sin(2*t))/97 + (2331*\exp(-t))*(\cosh(6^{1/2}*t) + (9571*6^{1/2}*\sinh(6^{1/2}*t))/13986))/2425 + 2/25$$

```
>> ezplot(y,[0,4])
>>
```

c.

```
>> eqn3=sym('D(D(y))(t)+D(y)(t)=t*cos(t)');
>> lteqn3=laplace(eqn3,t,s)
```

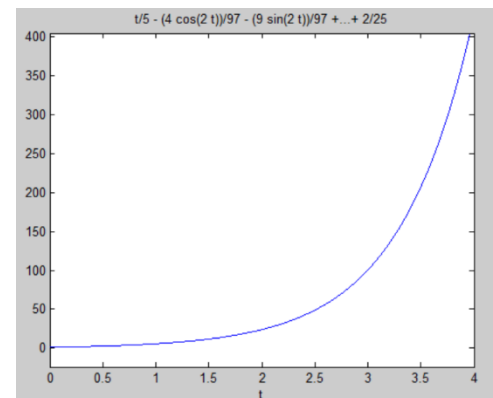
lteqn3 =

$$s*\text{laplace}(y(t), t, s) - D(y)(0) - y(0) - s*y(0) + s^2*\text{laplace}(y(t), t, s) == (2*s^2)/(s^2 + 1)^2 - 1/(s^2 + 1)$$

```
>> Yeqn3=subs(lteqn3,{'laplace(y(t),t,s}','y(0)','D(y)(0)'},{Y,2,-4})
```

Yeqn3 =

$$Y*s - 2*s + Y*s^2 + 2 == (2*s^2)/(s^2 + 1)^2 - 1/(s^2 + 1)$$



```
>> Ytrans3=simplify(solve(Yeqn3,Y))
```

```
Ytrans3 =
```

```
((s - 1)*(2*s^4 + 4*s^2 + s + 3))/(s*(s^2 + 1)^2*(s + 1))
```

```
>> y=ilaplace(Ytrans3,s,t)
```

```
y =
```

```
4*exp(-t) + cos(t) + sin(t)/2 - (t*cos(t))/2 + (t*sin(t))/2 - 3
```

```
>> ezplot(y,[0,4])
```

```
>>
```

