Using MATLAB for Laplace Transforms

Examples:

1. You can compute Laplace transform using the symbolic toolbox of MATLAB. If you want to compute the Laplace transform of $x(t) = t$, you can use the following MATLAB program.

```
>> f=t;
>> syms f t
>> f=t;
>> laplace(f)

ans =1/s^2
```

where f and t are the symbolic variables, f the function, t the time variable.

2. The inverse transform can also be computed using MATLAB. If you want to compute the inverse Laplace transform of $F(s) = \dfrac{24}{s(s+8)}$, you can use the following command lines.

```
>> syms F S
>> F=24/(s*(s+8));
>> ilaplace(F)

ans =

3-3*exp(-8*t)
```

3. We can also do inverse Laplace transform using partial fraction expansion, and MATLAB can help you with that. If you want to find the partial-fraction expansion of $Y(s) = \dfrac{4s^2 + 4s + 4}{s^2(s^2 + 3s + 2)}$, the following MATLAB program gives you the coefficients in the expansion. You write the coefficients of the numerator and the denominator in separate vectors and MATLAB gives you the coefficients with the corresponding poles in the expansion.

```
>> n=[0 0 4 4 4];
>> d=[1 3 2 0 0];
>> [r,p,k]=residue(n,d)

r =

    -3
     4
    -1
     2


p =

    -2
    -1
     0
     0
```

Therefore, the partial fraction expansion is:

$$\frac{-3}{s+2}+\frac{4}{s+1}-\frac{1}{s}+\frac{2}{s^2}$$