MATH.2360 Engineering Differential Equations

MATLAB commands related to the Laplace Transform

Type the following command in the command window, which will open a mupad notebook:

```
>>mupad
```

Try entering the following commands in the mupad notebook to see how MATLAB can be used to find the Laplace transform or inverse transform of a given function. These commands will generate the Laplace transforms of $t - 2e^{3t}$ and $u(t-\pi)\sin(t-\pi)$ and the inverse transform of $3/s^4$.

DO NOT USE A PERIOD BEFORE * OR / OR ^
NONE OF YOUR ANSWERS SHOULD CONTAIN $\delta(t)$.
Notice that in the `laplace` command the second and third arguments are `t` and `s`, but in the `ilaplace` command the order is reversed.

```
laplace(t - 2*exp(3*t), t, s) %The laplace command finds the laplace transform
laplace(heaviside(t-PI)*sin(t-PI),t,s)  %PI must be capitalized. heaviside(t-PI) means u(t-π)
ilaplace(3/s^4, s, t) %The ilaplace command finds the inverse laplace transform
```

Homework problems you can solve using the laplace and ilaplace commands:

7.1 Please write down your answers and turn them in with the rest of the section 7.1 homework.

Find the Laplace transforms of the following functions:

1) $\sqrt{t} + 3t$ 2) $t - 2e^{3t}$ 3) $1 + \cosh(5t)$

Find the inverse Laplace transforms of the following functions:

1) $\dfrac{3}{s^4}$ 2) $\dfrac{1}{s} - \dfrac{2}{s^{5/2}}$ 3) $\dfrac{3}{s-4}$ 4) $\dfrac{5-3s}{s^2+9}$ 5) $\dfrac{10s-3}{25-s^2}$

7.3 These are all the homework problems from section 7.3.

Find the Laplace transforms of the following functions:

1) $t^4 e^{\pi t}$, 2) $e^{-2t}\sin(3\pi t)$

Find the inverse Laplace transform of the following functions:

1) $\dfrac{3}{2s-4}$ 2) $\dfrac{1}{s^2+4s+4}$ 3) $\dfrac{3s+5}{s^2-6s+25}$ 4) $\dfrac{1}{s^2-4}$ 5) $\dfrac{5-2s}{s^2+7s+10}$

6) $\dfrac{1}{s^3-5s^2}$

7.5 Please write down your answers and turn them in with the rest of the section 7.5 homework.

Find the inverse Laplace transforms of the following functions:

1) $\dfrac{e^{-3s}}{s^2}$ 2) $\dfrac{e^{-\pi s}}{s^2+1}$ 3) $\dfrac{s\left(1+e^{-3s}\right)}{s^2+\pi^2}$

You can also use the laplace command to find the answers to problems 13 and 17 after you write the given functions in terms of unit step functions.