```
% CPE 3102 - FEEDBACK AND CONTROL SYSTEMS
% Group 3   TTh 10:30 AM - 1:30 PM LB265 TC
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% LE2 | Symbolic Math and LTI system Analysis in MATLAB

clear
clc

syms x(t) X(s)
```

Equation 1

```
eqn1 = diff(x, t, 2) + 6 * diff(x, t) + 8 * x == 6 * sin(4*t)

% perform laplace transform
eqn1LT = laplace(eqn1)
eqn1LT = subs(eqn1LT, laplace(x(t), t, s), X(s))

% initial conditions 0
eqn1LT = subs(eqn1LT, x(0), 0);
eqn1LT = subs(eqn1LT, subs(diff(x(t), t), t, 0), 0)

% solve for X(s)
eqn1LTsol = solve(eqn1LT, X(s))

% perform the inverse transform
xt1 = ilaplace(eqn1LTsol)
pretty(xt1)
```

```
eqn1(t) =

8*x(t) + 6*diff(x(t), t) + diff(x(t), t, t) == 6*sin(4*t)


eqn1LT =

6*s*laplace(x(t), t, s) - 6*x(0) - s*x(0) - subs(diff(x(t), t), t, 0) +
s^2*laplace(x(t), t, s) + 8*laplace(x(t), t, s) == 24/(s^2 + 16)


eqn1LT =

8*X(s) - 6*x(0) - s*x(0) - subs(diff(x(t), t), t, 0) + 6*s*X(s) + s^2*X(s)
== 24/(s^2 + 16)


eqn1LT =

8*X(s) + 6*s*X(s) + s^2*X(s) == 24/(s^2 + 16)
```

```
eqn1LTsol =

24/((s^2 + 16)*(s^2 + 6*s + 8))


xt1 =

(3*exp(-2*t))/5 - (9*cos(4*t))/40 - (3*exp(-4*t))/8 - (3*sin(4*t))/40

exp(-2 t\
) 3   cos(4 t) 9   exp(-4 t) 3   sin(4 t) 3
----------- - ---------- - ----------- - ----------
     5            40            8            40
```

Equation 2

```
eqn2 = diff(x, t, 2) + 8 * diff(x, t) + 25 * x == 10

% perform laplace transform
eqn2LT = laplace(eqn2)
eqn2LT = subs(eqn2LT, laplace(x(t), t, s), X(s))

% initial conditions 0
eqn2LT = subs(eqn2LT, x(0), 0);
eqn2LT = subs(eqn2LT, subs(diff(x(t), t), t, 0), 0)

% solve for X(s)
eqn2LTsol = solve(eqn2LT, X(s))

% perform the inverse transform
xt2 = ilaplace(eqn2LTsol)
pretty(xt2)


eqn2(t) =

25*x(t) + 8*diff(x(t), t) + diff(x(t), t, t) == 10


eqn2LT =

8*s*laplace(x(t), t, s) - 8*x(0) - s*x(0) - subs(diff(x(t), t), t, 0) +
s^2*laplace(x(t), t, s) + 25*laplace(x(t), t, s) == 10/s


eqn2LT =

25*X(s) - 8*x(0) - s*x(0) - subs(diff(x(t), t), t, 0) + 8*s*X(s) + s^2*X(s)
== 10/s


eqn2LT =
```

```
25*X(s) + 8*s*X(s) + s^2*X(s) == 10/s
```

```
eqn2LTsol =

10/(s*(s^2 + 8*s + 25))
```

```
xt2 =

2/5 - (2*exp(-4*t)*(cos(3*t) + (4*sin(3*t))/3))/5
```

```
                /             s\
in(3 t)  4  \
    exp(-4 t) | cos(3 t) + ---------- | 2
2             \                  3     /
- - ------------------------------------
5                     5
```

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