```
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%Math 246
%Section 0423
%TA: Thien Ngo
%Matlab Project E
%April 15, 2018
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```
%Problem 12:
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```
%Part a;
syms y(t) Dy t;
eqn = diff(y,t,2) == (-2*Dy)+(-2*y)+sin(t);
Dy = diff(y,t);
cond = [y(0)==0, Dy(0)==0];
ySol(t) = dsolve(eqn,cond)
fplot(ySol,[0,15])
```

```
ySol(t) =

Dy*cos(2^(1/2)*t) - (2^(1/2)*sin(2^(1/2)*t))/2 + sin(2^(1/2)*t)*(cos(t - 2^(1/2)*t)/2 - cos(t
 + 2^(1/2)*t)/2 + (2^(1/2)*cos(t + 2^(1/2)*t))/4 + (2^(1/2)*cos(t - 2^(1/2)*t))/4 - Dy*sin(2^
(1/2)*t)) + cos(2^(1/2)*t)*(sin(t + 2^(1/2)*t)/2 + sin(t - 2^(1/2)*t)/2 - (2^(1/2)*sin(t + 2^
(1/2)*t))/4 + (2^(1/2)*sin(t - 2^(1/2)*t))/4 - Dy*cos(2^(1/2)*t))



Error using fplot>singleFplot (line 227)
Input must be a function or functions of a single variable.

Error in fplot>@(f)singleFplot(cax,{f},limits,extraOpts,args) (line 191)
        hObj = cellfun(@(f) singleFplot(cax,{f},limits,extraOpts,args),fn{1},'UniformOutput',
false);

Error in fplot>vectorizeFplot (line 191)
        hObj = cellfun(@(f) singleFplot(cax,{f},limits,extraOpts,args),fn{1},'UniformOutput',
false);

Error in fplot (line 161)
    hObj = vectorizeFplot(cax,fn,limits,extraOpts,args);

Error in Math246_ProjectE (line 16)
fplot(ySol,[0,15])
```

```
%Part b:
syms y(t) Dy t;
eqn = diff(y,t,2) == (-2*Dy)+(-2*y)+sin(t);
Dy = diff(y,t);
```

```
cond = [y(0)==0, Dy(0)==0];
ySol(t) = dsolve(eqn,cond)
x=ySol(pi)
fplot(x,[pi,15])
```

```
%Part c:
syms s t y Y
eqn = sym('D(D(y))(t) + 2*D(y)(t)+ 2*y(t) = 0');
lteqn = laplace(eqn, t, s);
neweqn = subs(lteqn, {'laplace(y(t),t,s)', 'y(0)', 'D(y)0)'}, {Y, 1, 0});
ytrans = simplify(solve(neweqn, Y));
y = ilaplace(ytrans, s, t)
%It is the same solution as part b
```

```
%Part d:
syms y(t) Dy t;
eqn = diff(y,t,2) == (-2*Dy)+(-2*y)+sin(t);
Dy = diff(y,t);
ySol(t) = dsolve(eqn)
%The asymptotic behavior increasing as t approaches infinity. Based on the
%information of the inhomgenous equation, the long term behavior of it is
%decreasing.
```

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%Problem 13
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```
%Part c:
syms s t y Y
eqn = sym('D(D(y))(t) +2*D(y)(t)+ (4/5)*y(t) = cos(t)');
lteqn = laplace(eqn, t, s);
neweqn = subs(lteqn, {'laplace(y(t),t,s)', 'y(0)', 'D(y)0)'}, {Y, 1, 0});
ytrans = simplify(solve(neweqn, Y));
y = ilaplace(ytrans, s, t)
```

```
%Part e:
syms s t y
eqn = sym('D(D(y))(t)+2*D(y)(t)+4*y(t) = sin(t)+dirac(t - 3*pi)');
lteqn = laplace(eqn, t, s);
neweqn = subs(lteqn, {'laplace(y(t),t,s)', 'y(0)', 'D(y)0)'}, {Y, 1, 0});
ytrans = simplify(solve(neweqn, Y));
y = ilaplace(ytrans, s, t)
```

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%Problem 14
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```
%Part a:
syms s t Y
h = ['heaviside(t - 5) + heaviside(t - 10)*(-1 - 1)'];
```

```
eqn = sym(['D(D(y))(t) + 6*D(y)(t) + 8*y(t) = ' h]);
lteqn = laplace(eqn, t, s);
neweqn = subs(lteqn, {'laplace(y(t),t,s)', 'y(0)', 'D(y)0)'}, {Y, 0, 2});
ytrans = simplify(solve(neweqn, Y));
y = ilaplace(ytrans, s, t)
```

```
%Part b:
syms s t Y
h = ['heaviside(t - 5) + heaviside(t - 10)*(-1 - 1)'];
eqn = sym(['D(D(y))(t) + 6*D(y)(t) + 8*y(t) = ' h]);
lteqn = laplace(eqn, t, s);
neweqn = subs(lteqn, {'laplace(y(t),t,s)', 'y(0)', 'D(y)0)'}, {Y, 0, 2});
ytrans = simplify(solve(neweqn, Y));
y = ilaplace(ytrans, s, t)
```

```
%Part c:
syms s t y Y
eqn = sym('D(D(y))(t) + 4*y(t) = dirac(t - 3*pi)');
lteqn = laplace(eqn, t, s);
neweqn = subs(lteqn, {'laplace(y(t),t,s)', 'y(0)', 'D(y)0)'}, {Y, 1, 0});
ytrans = simplify(solve(neweqn, Y));
y = ilaplace(ytrans, s, t)
```

```
%Part d:
syms s t Y
eqn = sym('D(D(y))(t) + 4*y(t) = dirac(t - 2*pi) - diract(t-8)');
lteqn = laplace(eqn, t, s);
neweqn = subs(lteqn, {'laplace(y(t),t,s)', 'y(0)', 'D(y)0)'}, {Y, 1, 0});
ytrans = simplify(solve(neweqn, Y));
y = ilaplace(ytrans, s, t)
```

```
%Problem 17:
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```
%Part a:
tic
odel = 'D2y + Dy + y = (t + 1)^3*exp(-t)*cos(t)*sin(3*t)';
dsolve(odel, 'y(0) = 1', 'Dy(0) = 0')
toc
```

```
%Part b:
tic
syms s t Y
eqn = sym('D(D(y))(t) + D(y)(t) + y(y) = (t + 1)^3*exp(-t)*cos(t)*sin(3*t)');
lteqn = laplace(eqn, t, s);
neweqn = subs(lteqn, {'laplace(y(t),t,s)' 'y(0)', 'D(y)(0)'}, {Y, 1, 0});
ytrans = simplify(solve(neweeqn, Y));
y1 = ilaplace(ytrans, s, t)
```

```
toc
```

```
%Part c:
figure;
ezplot(y, [0:.001:15])
ezplot(y1, [0:.001:15])
```

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