NAME :

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MATLAB lab 3

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Solve the equations 1–3

1. $y''-y'-2y=4x2$

2. $y''-y'-2y=e3x$

3. $y''-y'-2y=siN2x$

For each of the question take y(0)=1 and y(1)=0

•Modify the program in such a way that you can give the conditions y(0)=1 and y'(0)=2 .

CODE:

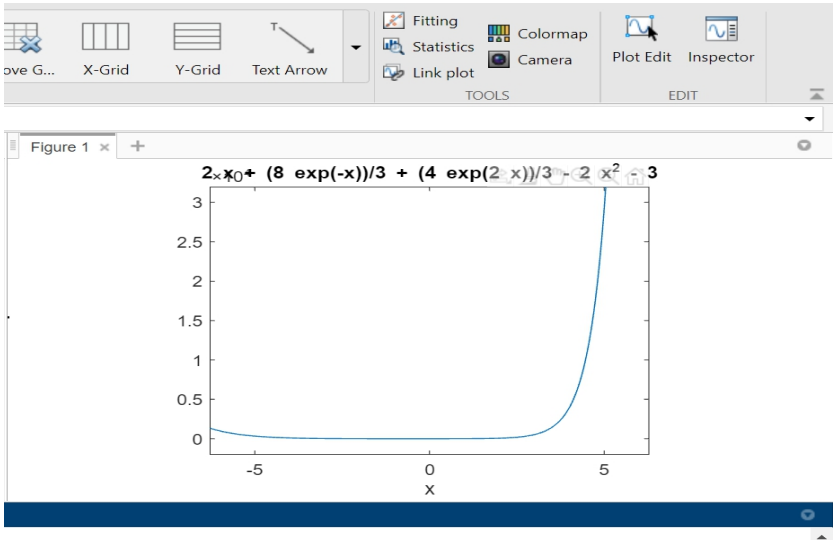
Modified:

```
clc
clear all
close all
syms x r c1 c2
p1=input('Enter the coefficient of D2y:');
p2=input('Enter the coefficient of Dy:');
p3=input('Enter the coefficient of y:');
eq=p1*r^2+p2*r+p3; %auxiliary equation
r=solve(eq,r); %solve for 'r' in 'eq' and store in 'eq'
p=real(r(1)); %real part of r(1)
q=imag(r(1)); %imaginary part of r(1)
if q~=0 % complex roots
y1=exp(p*x)*cos(q*x);
y2=exp(p*x)*sin(abs(q)*x);
elseif r(1)==r(2) % real and equal roots
```

```
 y1=exp(r(1)*x);
 y2=x*exp(r(1)*x);
else % real and distinct roots
 y1=exp(r(1)*x);
 y2=exp(r(2)*x);
end
y_c=c1*y1+c2*y2 %complementary function
W=simplify(y1*diff(y2)-y2*diff(y1));
%Wronskian(y1,y2)-refer to rough notes
f=input('Enter the non homogeneous part:');
y_p=-y1*int(y2*f/W)+y2*int(y1*f/W); %Refer to rough notes
y=simplify(y_c+y_p) %general soln
disp('The general solution of the given ODE is')
disp(y)
%IVP
a=input('Enter the value of a:');
b=input('Enter the value of b:');
c=input('Enter the value of y(a):');
d=input('Enter the value  of y(b):');
eq1=subs(y,x,a)-c; %substitute occurences of x in y with a
eq2=subs(diff(y),x,b)-d;
[c1,c2]=solve(eq1,eq2);
y_total=subs(y);
disp('The general solution of the given boundary problem is')
disp(y_total)
ezplot(y_total) %plotting general solution within a and b
```

1. $y''-y'-2y=4x2$

graph:



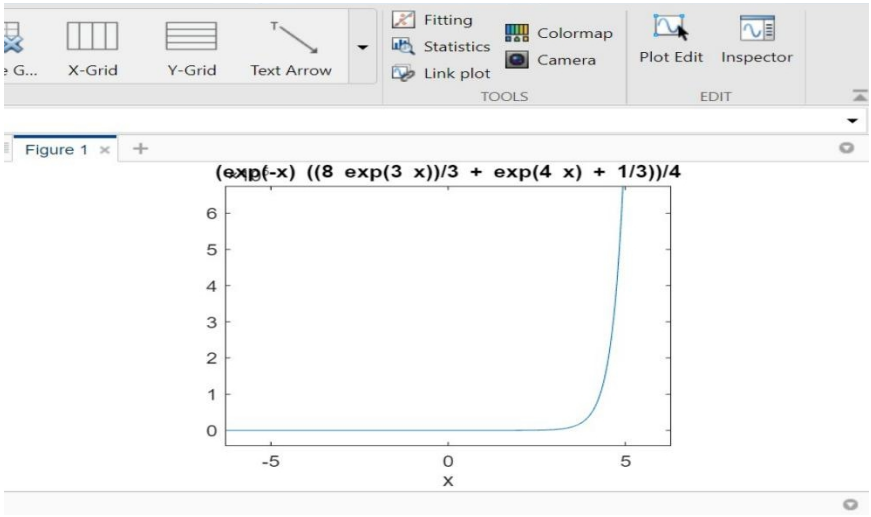
Command window:

```
COMMAND WINDOW
Enter the coefficient of D2y:
1
Enter the coefficient of Dy:
-1
Enter the coefficient of y:
-2

y_c =

c1*exp(-x) + c2*exp(2*x)

Enter the non homogeneous part:
4*x*x

y =

2*x - 2*x^2 + c1*exp(-x) + c2*exp(2*x) - 3
```

```
The general solution of the given ODE is
2*x - 2*x^2 + c1*exp(-x) + c2*exp(2*x) - 3

Enter the value of a:
00
Enter the value of b:
0
Enter the value of y(a):
1
Enter the value of y(b):
2
The general solution of the given boundary problem is
2*x + (8*exp(-x))/3 + (4*exp(2*x))/3 - 2*x^2 - 3

>>
```

2. $y''-y'-2y=e3x$

Graph:

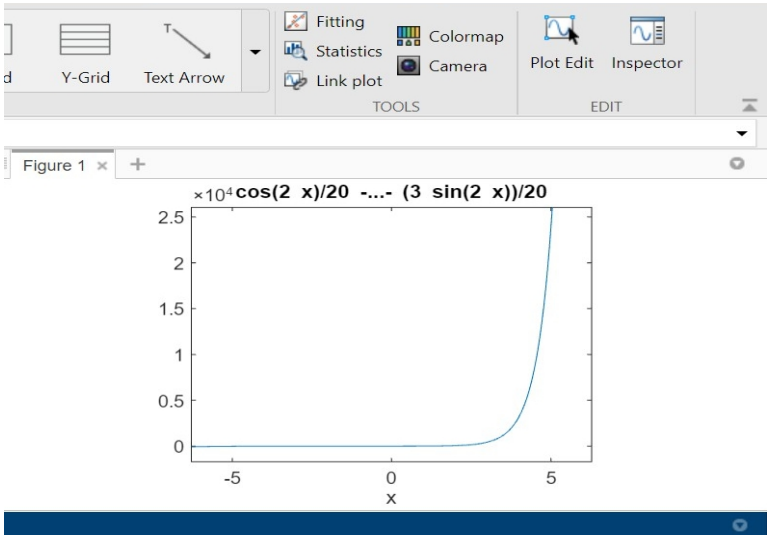


Command window:

```
COMMAND WINDOW
Enter the coefficient of D2y:
1
Enter the coefficient of Dy:
-1
Enter the coefficient of y:
-2

y_c =

c1*exp(-x) + c2*exp(2*x)

Enter the non homogeneous part:
exp(3*x)

y =

(exp(-x)*(4*c1 + exp(4*x) + 4*c2*exp(3*x)))/4
```

```
The general solution of the given ODE is
(exp(-x)*(4*c1 + exp(4*x) + 4*c2*exp(3*x)))/4

Enter the value of a:
0
Enter the value of b:
0
Enter the value of y(a):
1
Enter the value of y(b):
2
The general solution of the given boundary problem is
(exp(-x)*((8*exp(3*x))/3 + exp(4*x) + 1/3))/4

>>
```

3. $y''-y'-2y=\sin 2x$



Command window:

```
COMMAND WINDOW
Enter the coefficient of D2y:
1
Enter the coefficient of Dy:
-1
Enter the coefficient of y:
-2

y_c =

c1*exp(-x) + c2*exp(2*x)

Enter the non homogeneous part:
sin(2*x)

y =

cos(2*x)/20 - (3*sin(2*x))/20 + c1*exp(-x) + c2*exp(2*x)
```

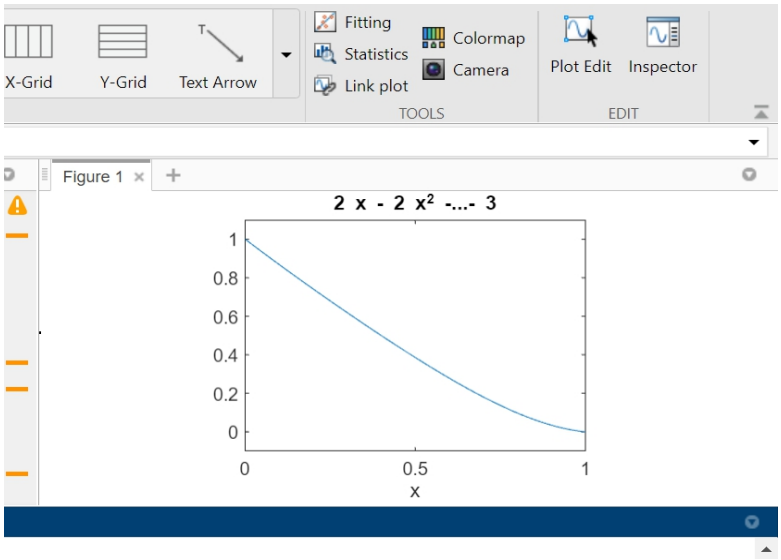
```
The general solution of the given ODE is
cos(2*x)/20 - (3*sin(2*x))/20 + c1*exp(-x) + c2*exp(2*x)

Enter the value of a:
0
Enter the value of b:
0
Enter the value of y(a):
1
Enter the value of y(b):
2
The general solution of the given boundary problem is
cos(2*x)/20 - (2*exp(-x))/15 + (13*exp(2*x))/12 - (3*sin(2*x))/20

>>
```

UNMODIFIED:

```
clc
clear all
close all
syms x r c1 c2
p1=input('Enter the coefficient of D2y:');
p2=input('Enter the coefficient of Dy:');
p3=input('Enter the coefficient of y:');
eq=p1*r^2+p2*r+p3; %auxiliary equation
r=solve(eq,r); %solve for 'r' in 'eq' and store in 'eq'
p=real(r(1)); %real part of r(1)
q=imag(r(1)); %imaginary part of r(1)
if q~=0 % complex roots
y1=exp(p*x)*cos(q*x);
y2=exp(p*x)*sin(abs(q)*x);
elseif r(1)==r(2) % real and equal roots
 y1=exp(r(1)*x);
 y2=x*exp(r(1)*x);
else % real and distinct roots
 y1=exp(r(1)*x);
 y2=exp(r(2)*x);
end
y_c=c1*y1+c2*y2 %complementary function
```

```
W=simplify(y1*diff(y2)-y2*diff(y1)); %Wronskian(y1,y2)-refer to rough
notes
f=input('Enter the non homogeneous part:');
y_p=-y1*int(y2*f/W)+y2*int(y1*f/W); %Refer to rough notes
y=simplify(y_c+y_p) %general soln
disp('The general solution of the given ODE is')
disp(y)
%IVP
a=input('Enter the value of a:');
b=input('Enter the value of b:');
c=input('Enter the value of y(a):');
d=input('Enter the value of y(b):');
eq1=subs(y,x,a)-c; %substitute occurences of x in y with a
eq2=subs(y,x,b)-d;
[c1,c2]=solve(eq1,eq2);
y_total=subs(y);
disp('The general solution of the given boundary problem is')
disp(y_total)
ezplot(y_total,[a,b]) %plotting general solution within a and b
```

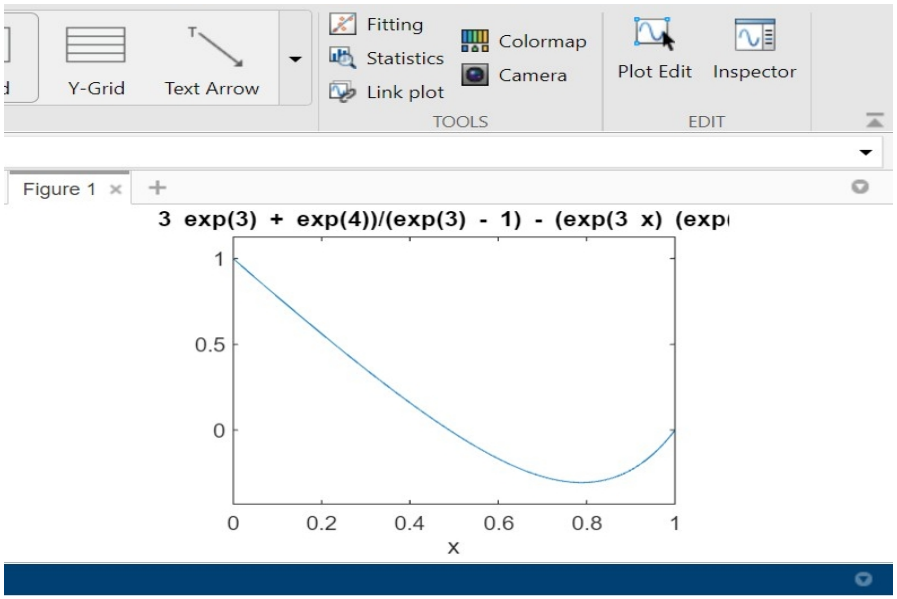
1. $y''-y'-2y=4x2$

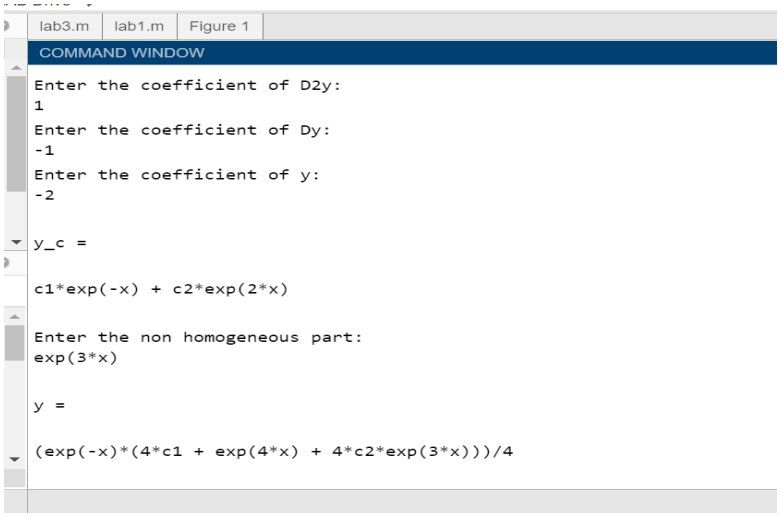



```
COMMAND WINDOW
Enter the coefficient of D2y:
1
Enter the coefficient of Dy:
-1
Enter the coefficient of y:
-2

y_c =

c1*exp(-x) + c2*exp(2*x)

Enter the non homogeneous part:
4*x*x
```

```
lab3.m | lab1.m | Figure 1
COMMAND WINDOW
y =


2*x - 2*x^2 + c1*exp(-x) + c2*exp(2*x) - 3

The general solution of the given ODE is
2*x - 2*x^2 + c1*exp(-x) + c2*exp(2*x) - 3

Enter the value of a:
0
Enter the value of b:
1
Enter the value of y(a):
1
Enter the value of y(b):
0
The general solution of the given boundary problem is
2*x - 2*x^2 - (exp(-x)*(3*exp(1) - 4*exp(3)))/(exp(3) - 1) + (exp(2*x)*(3*exp(1) - 4))/(exp(3) - 1) - 3

>>
```

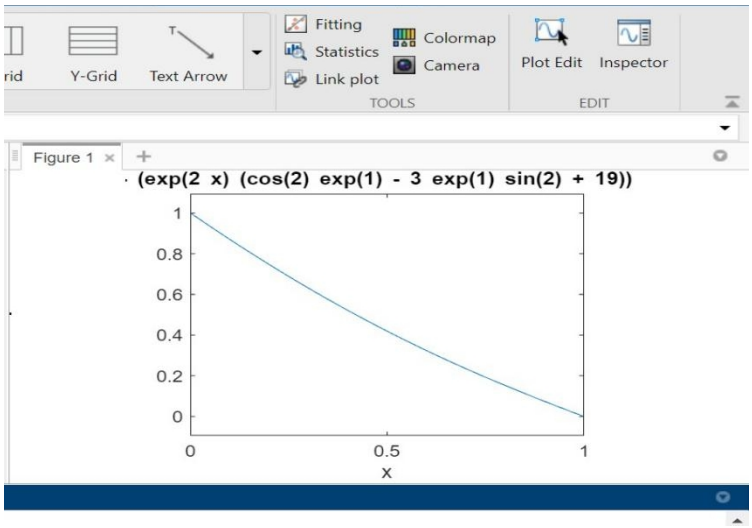
2. $y''-y'-2y=e3x$






```
The general solution of the given ODE is
(exp(-x)*(4*c1 + exp(4*x) + 4*c2*exp(3*x)))/4

Enter the value of a:
0
Enter the value of b:
1
Enter the value of y(a):
1
Enter the value of y(b):
0
The general solution of the given boundary problem is
(exp(-x)*(exp(4*x) + (3*exp(3) + exp(4))/(exp(3) - 1) - (exp(3*x)*(exp(4) + 3))/(exp(3) - 1)))/4

>>
```

3. $y''-y'-2y=\sin 2x$




```
COMMAND WINDOW
Enter the coefficient of D2y:
1
Enter the coefficient of Dy:
-1
Enter the coefficient of y:
-2

y_c =

c1*exp(-x) + c2*exp(2*x)

Enter the non homogeneous part:
sin(2*x)

y =

cos(2*x)/20 - (3*sin(2*x))/20 + c1*exp(-x) + c2*exp(2*x)
```

```
COMMAND WINDOW
cos(2*x)/20 - (3*sin(2*x))/20 + c1*exp(-x) + c2*exp(2*x)

The general solution of the given ODE is
cos(2*x)/20 - (3*sin(2*x))/20 + c1*exp(-x) + c2*exp(2*x)

Enter the value of a:
0
Enter the value of b:
1
Enter the value of y(a):
1
Enter the value of y(b):
0
The general solution of the given boundary problem is
cos(2*x)/20 - (3*sin(2*x))/20 + (exp(-x)*(19*exp(3) + cos(2)*exp(1) - 3*exp(1)*sin(2)))/(20*(exp(3) - 1)) - (exp(2*x)*(cos(2)*exp(1) - 3

>>
```