
# ENGINEERING MATHEMATICS-I
# MATLAB

Department of Science and Humanities

## Higher order differential equations

Solve: $y'' + 5y = 0.$

```
syms y(x)
ode = diff(y,x,2) + 5*y == 0;
ySol(x) = dsolve(ode)
```

Output: $ySol(x) = c_1\cos(\sqrt{5}x) - c_2\sin(\sqrt{5}x)$

## Higher order differential equations

Solve: $y'' + 7y = 0$.

```
syms y(x)
ode = diff(y,x,2) + 7*y == 0;
ySol(x) = dsolve(ode)
```

Output: $ySol(x) = c_1\cos(\sqrt{7}x) - c_2\sin(\sqrt{7}x)$

## Higher order differential equations

Solve: $y'' + 18y = 0.$

```
syms y(x)
ode = diff(y,x,2) + 18*y == 0;
ySol(x) = dsolve(ode)
```

Output: $ySol(x) = c_1\cos(3\sqrt{2}x) - c_2\sin(3\sqrt{2}x)$

## Higher order differential equations

Solve : $12y''+10y'-8y=0.$

```
syms y(x)
ode = 12*diff(y,x,2) + 10*diff(y,x,1) - 8*y == 0;
ySol(x) = dsolve(ode)
```

Output: $ySol(x) = c_1 e^{-4x/3} + c_2 e^{\frac{x}{2}}$

## Higher order differential equations

Solve : $8y''+2y'-y=0.$

```
syms y(x)
ode = 8*diff(y,x,2) + 2*diff(y,x,1) - y == 0;
ySol(x) = dsolve(ode)
```

Output: $\mathrm{ySol}(x) = c_1 e^{-x/2} + c_2 e^{x/4}$

## Higher order differential equations

Solve $\frac{d^4y}{dx^4} + 8\frac{d^2y}{dx^2} + 16y = 0$

```
syms y(x)
ode = diff(y,4) + 8*diff(y,2) + 16*y == 0;
ySol(x) = dsolve(ode)
```

Output : $ysol(x) = c_1\cos(2x) - c_3\sin(2x) + c_2 x\cos(2x) - c_4 x\sin(2x)$

## Higher order differential equations

Solve $\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} + 3y = 0$

```
syms y(x)
ode = diff(y,x,3) -2*diff(y,x,2) + 3*y == 0;
ySol(x) = dsolve(ode)
```

Output

$$C_1 e^{-x} + C_2 e^{\frac{3x}{2}} \cos\left(\frac{\sqrt{3}\,x}{2}\right) - C_3 e^{\frac{3x}{2}} \sin\left(\frac{\sqrt{3}\,x}{2}\right)$$

## Higher order differential equations

Solve : $(D^3\text{-}3D^2\text{+}4)x=0$.

```
syms y(x)
ode = diff(y,x,3) - 3*diff(y,x,2) + 4*y == 0;
ySol(x) = dsolve(ode)
```

Output: $C_1 e^{2x} + C_3 e^{-x} + C_2 x e^{2x}$

## Higher order differential equations

Solve : $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = e^{5x}$

```
syms y(x)
ode = diff(y, x, 2) - 4*diff(y, x) + 3*y == exp(5*x);
ySol(x) = dsolve(ode)
```

Output: $e^{5x/8} + c_1 e^{x} + c_2 e^{3x}$

## Higher order differential equations

Solve : $y'' + 2y' + y = 2x + x^2$

```
syms y(x)
ode = diff(y, x, 2) + 2*diff(y, x) + y == 2*x + x^2;
ySol(x) = dsolve(ode)
```

Output $$x^2 - 2x + C_1 e^{-x} + C_2 x e^{-x} + 2$$

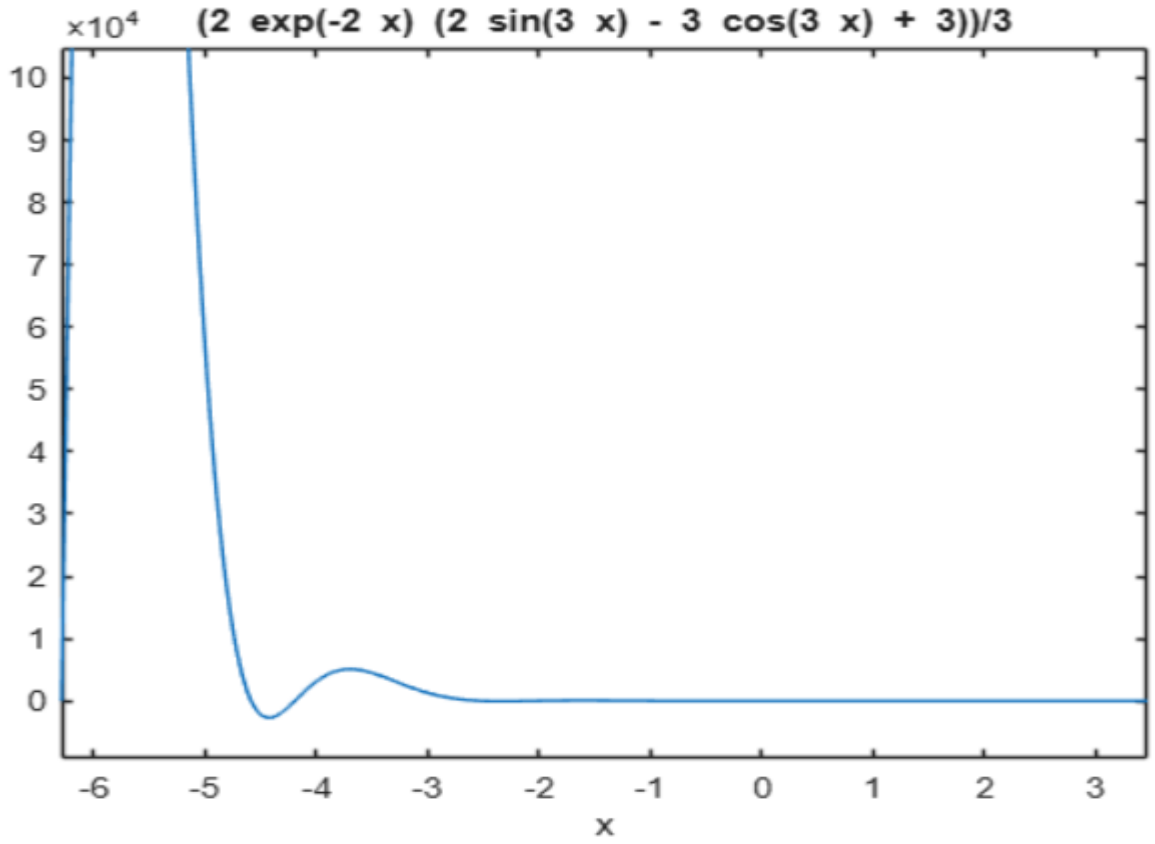
## Higher order differential equations

**Solve :** $y''+4y'+13y=18e^{-2x},\ y(0)=0, y'(0)=4$

```
syms y(x)
Dy = diff(y, x);
D2y = diff(y, x, 2);
ode = D2y + 4*Dy + 13*y == 18*exp(-2*x);
conds = [y(0) == 0, Dy(0) == 4];
ySol(x) = dsolve(ode, conds);
disp(ySol)
ezplot(ySol)
```

# Higher order differential equations

Output : $ysol(x) = \frac{2e^{-2x}(2\sin(3x) - 3\cos(3x) + 3)}{3}$



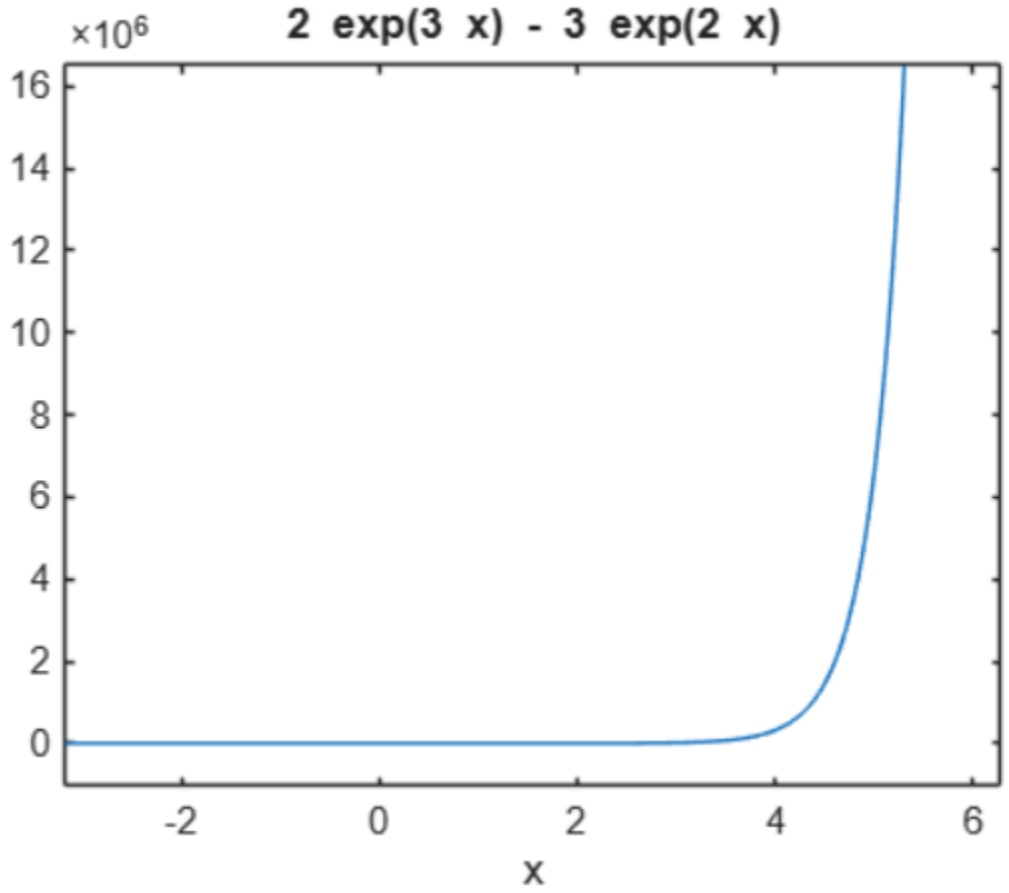
## Higher order differential equations

Solve : $y'' - 5y' + 6y = 0,\ y(0) = -1, y'(0) = 0.$

```
syms y(x)
ode = diff(y,x,2) - 5*diff(y,x) + 6*y == 0;
Dy = diff(y,x);
D2y = diff(y,x,2);
cond1 = y(0) == -1;
cond2 = Dy(0) == 0;
ySol(x) = dsolve(ode, cond1, cond2);
disp(ySol)
ezplot(ySol)
```

# Higher order differential equations

Output: $\mathrm{ySol} = 2e^{3x} - 3e^{2x}$



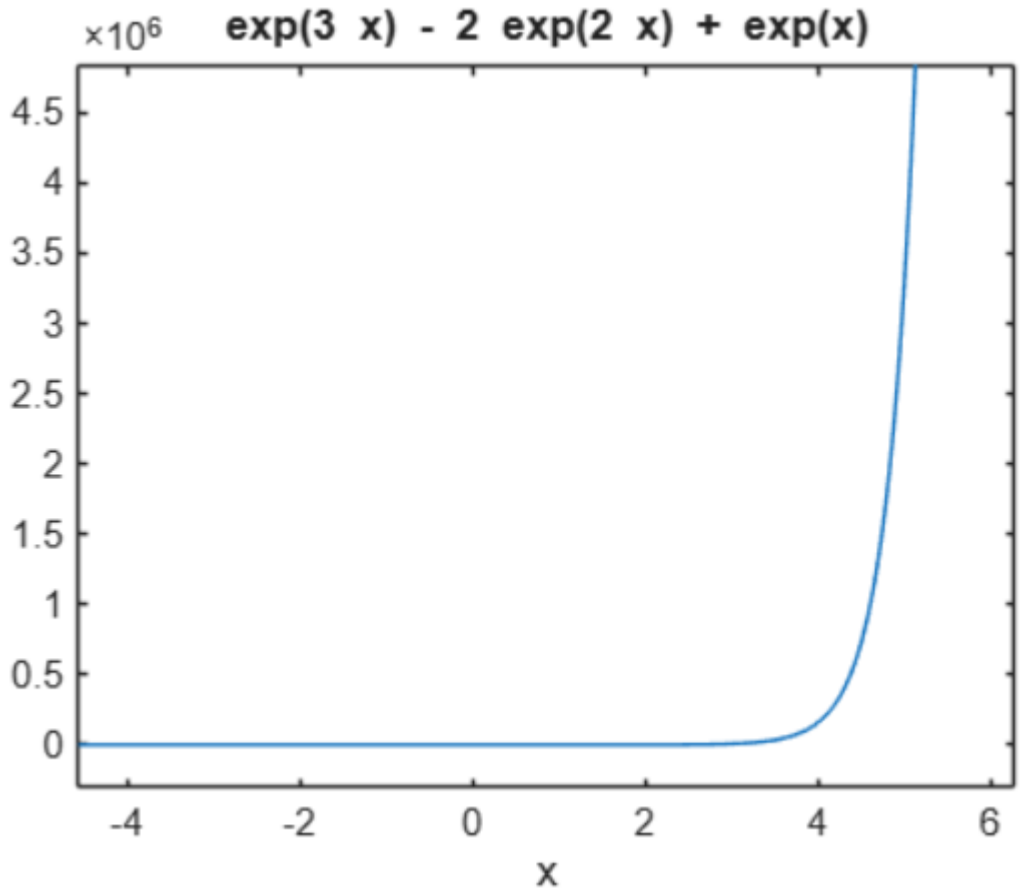
## Higher order differential equations

Solve : $y'''-6y'' + 11y' - 6y = 0, y(0) = 0, y'(0) = 0, y''(0) = 2.$

```
syms y(x)
ode = diff(y,x,3) - 6*diff(y,x,2) + 11*diff(y,x) - 6*y == 0;
Dy = diff(y,x);
D2y = diff(y,x,2);
cond1 = y(0) == 0;
cond2 = Dy(0) == 0;
cond3 = D2y(0) == 2;
ySol(x) = dsolve(ode, cond1, cond2, cond3);
disp(ySol)
ezplot(ySol)
```

# Higher order differential equations

Output : $e^{3x} - 2e^{2x} + e^{x}$



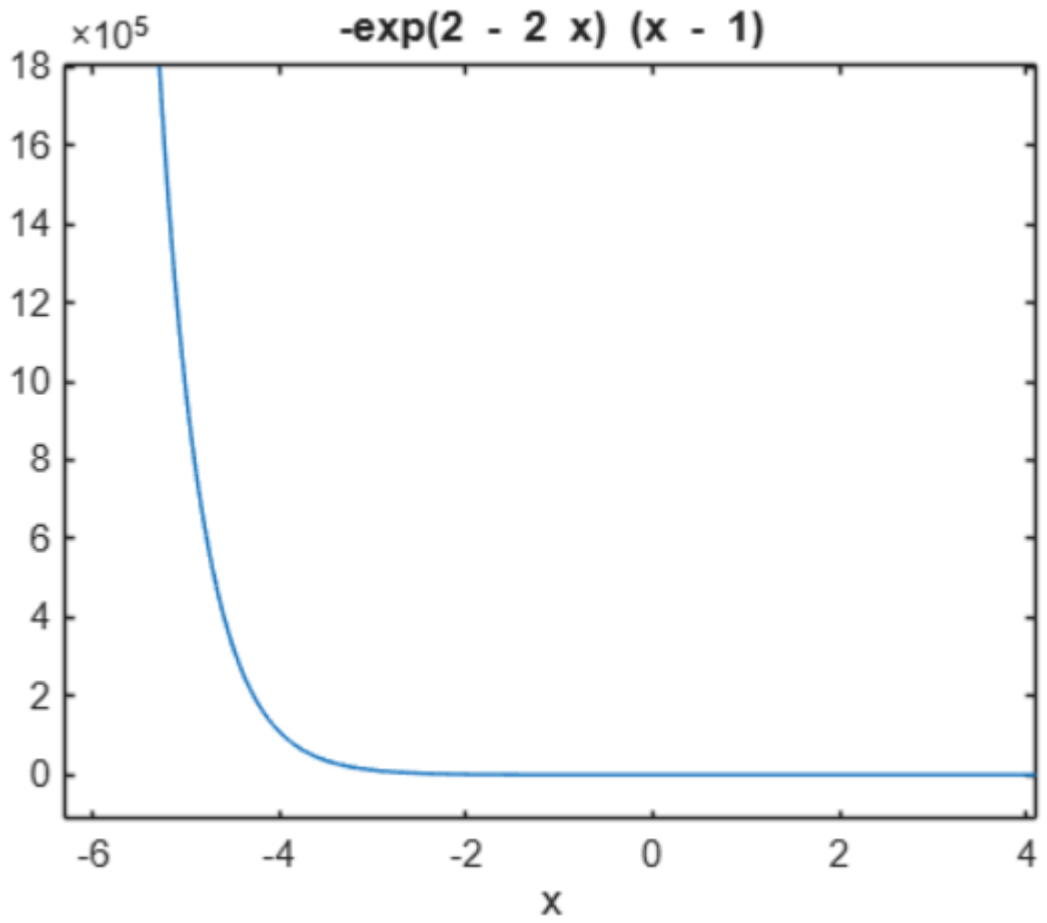
## Higher order differential equations

Solve : y'' + 4y' + 4y = 0 with y(1)=0, y'(1)=-1.

```
syms y(x)
ode = diff(y,x,2) + 4*diff(y,x) + 4*y == 0;
Dy = diff(y,x);
cond1 = y(1) == 0;
cond2 = Dy(1) == -1;
ySol(x) = dsolve(ode, cond1, cond2);
ySol = simplify(ySol);
disp(ySol)
ezplot(ySol)
```

Output $-e^{2-2x}$ (x-1)

# Higher order differential equations



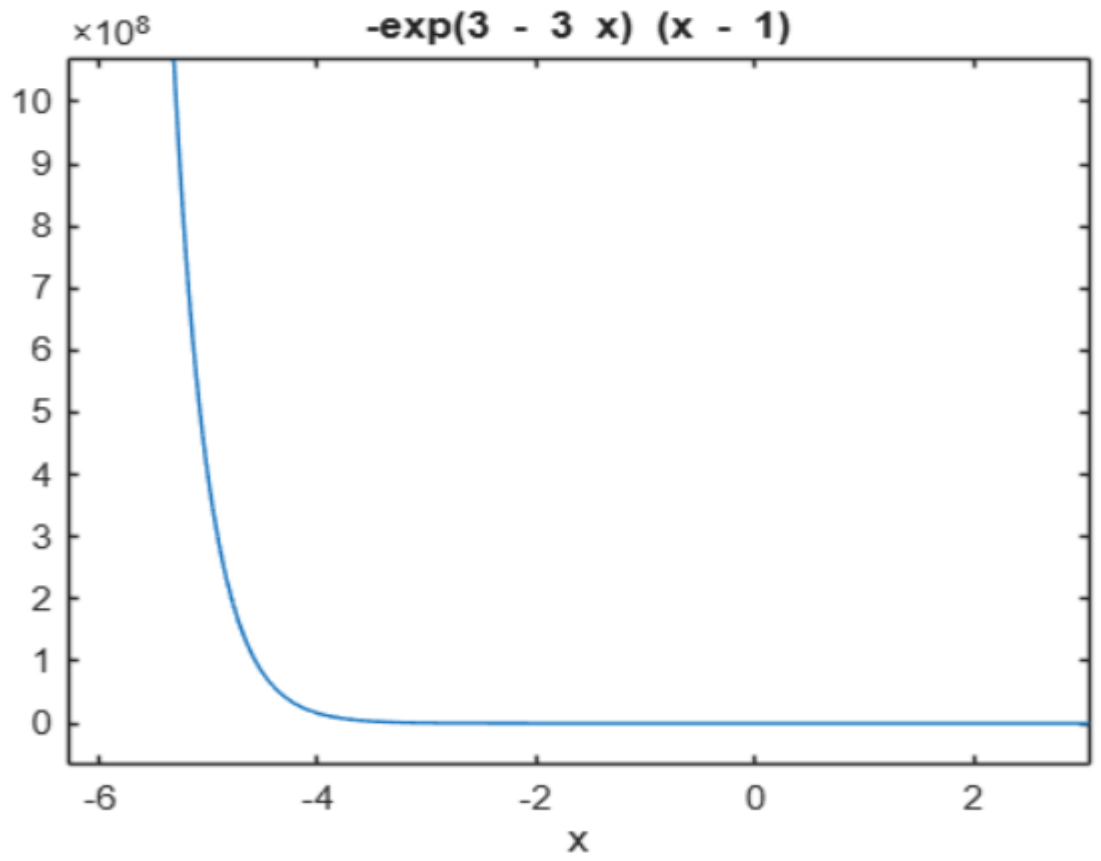
## Higher order differential equations

Solve  y'' + 6y' + 9y = 0 with y(1)=0, y'(1)=-1

```
syms y(x)
ode = diff(y,x,2) + 6*diff(y,x) + 9*y == 0;
Dy = diff(y,x);
cond1 = y(1) == 0;
cond2 = subs(Dy, x, 1) == -1;
ySol(x) = dsolve(ode, [cond1 cond2]);
ySol = simplify(ySol);
disp(ySol(x));
disp(ySol)
ezplot(ySol)
```

# Higher order differential equations

Output $-e^{3-3x}$(x-1)




# THANK YOU

## Department of Science and Humanities