

MATLAB ASSIGNMENT-9
DIFFERENTIAL EQUATIONS BY LAPLACE TRANSFORMS

NAME: - ANSHIL SETH
REG NO.: - 18BCI0173
SLOT: - L15 +L16
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FACULTY: - PROF. POORNIMA T

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QUESTIONS:-

2. Solve the following:

(a) $\frac{d^2y}{dx^2} + xy = 0$

(b) $\frac{d^2y}{dx^2} + x^2y = 0$

(c) $y'' + xy' + y = 0.$

(d) $(1 - x^2)y'' + 2y = 0; y(0) = 4, y'(0) = 5$

3. The half-life of radium is 1600 years, i.e., it takes 1600 years for half of any quantity to decay. If a sample initially contains 50 g, how long will it be until it contains 45 g by power series method?

Answer:-

2

(a)

CODE:-

```
syms x a0 a1 a2 a3
a = [a0 a1 a2 a3];
y = sum(a.*(x).^[0:3]);
dy = diff(y);
d2y = diff(dy);
gde = collect(d2y+x*y,x);
cof=coeffs(gde,x);
A2=solve(cof(1),a2);
A3=solve(cof(2),a3);
y=subs(y,a2,A2);
y=subs(y,a3,A3);
y=coeffs(y,[a1 a0]);
disp('Solution is')
disp(['y=A(',char(y(1)),'+...)+B(',char(y(2)),'+ ...'])
```

INPUT AND OUTPUT :-

Solution is

$$y=A(1 - x^3/6+...)+B(x+ ...)$$

2

(b)

CODE :-

```
syms x a0 a1 a2 a3
a = [a0 a1 a2 a3];
y = sum(a.*(x).^[0:3]);
dy = diff(y);
d2y = diff(dy);
gde = collect(d2y+(x^2)*y,x);
cof=coeffs(gde,x);
A2=solve(cof(1),a2);
A3=solve(cof(2),a3);
y=subs(y,a2,A2);
y=subs(y,a3,A3);
y=coeffs(y,[a1 a0]);
disp('Solution is')
disp(['y=A(',char(y(1)),'+...)+B(',char(y(2)),'+ ...']])
```

INPUT AND OUTPUT :-

Solution is

$$y=A(1+...)+B(x+ ...)$$

2

(c)

CODE :-

```
syms x a0 a1 a2 a3
a = [a0 a1 a2 a3];
y = sum(a.*(x).^[0:3]);
dy = diff(y);
d2y = diff(dy);
gde = collect(d2y+x*dy+y,x);
cof=coeffs(gde,x);
A2=solve(cof(1),a2);
A3=solve(cof(2),a3);
y=subs(y,a2,A2);
y=subs(y,a3,A3);
y=coeffs(y,[a1 a0]);
disp('Solution is')
disp(['y=A(',char(y(1)),'+...)+B(',char(y(2)),'+ ...']])
```

INPUT & OUTPUT :-

Solution is

$$y=A(1 - x^2/2+...)+B(x - x^3/3+ ...)$$

2

(d)

CODE :-

```
syms x a0 a1 a2 a3
a = [a0 a1 a2 a3];
y = sum(a.*(x).^[0:3]);
dy = diff(y);
d2y = diff(dy);
gde = collect((1-x.^2)*d2y+(2*y),x);
cof=coeffs(gde,x);
A2=solve(cof(1),a2);
A3=solve(cof(2),a3);
y=subs(y,a2,A2);
y=subs(y,a3,A3);
y=coeffs(y,[a1 a0]);
disp('Solution is')
disp(['y=A(',char(y(1)),'+...)+B(',char(y(2)),'+ ...']])
```

INPUT & OUTPUT:-

```
untitled
Solution is
y=A(1 - x^2+...)+B(x - x^3/3+ ...)
```

3

CODE : -

```
syms x a0 a1 a2 a3
a = [a0 a1 a2 a3];
y = sum(a.*(x).^[0:3]);
dy = diff(y);
gde = collect(dy-y,x);
cof=coeffs(gde,x)
A2=solve(cof(1),a1);
A3=solve(cof(2),a2);
A4=solve(cof(3),a3);
y=subs(y,{a1,a2,a3},{A2,A3,A4});

y=coeffs(y,[a0]);
disp('Solution is')
disp(['y=A(',char(y(1)),'+...)+B(',char(y(2)),'+ ...']])
```

INPUT & OUTPUT :-

```
cof =

[ a1 - a0, 2*a2 - a1, 3*a3 - a2, -a3]

Solution is
y=A((a1*x^2)/2 + (a2*x^3)/3+...)+B(x + 1+ ...)
>>
```

-----THANK YOU-----

