Harshit Sahu | Bsc.(Hons) Computer Science | 20211414 | Practical – 3

Plotting third order solution family of Differential Equation.

Question 1 :

Solve third order Differential Equation y''' – 5 y'' + 8 y' – 4 y = 0 and Plot its three Solutions.

Solution :

```
Sol = DSolve[y'''[x] - 5 y''[x] + 8 y'[x] - 4 y[x] == 0, y[x], x]
```

$$\{\{y[x] \to e^{x} C[1] + e^{2x} C[2] + e^{2x} x C[3]\}\}$$

```
Sol1 = y[x] /. Sol[[1]] /. {C[1] → 1, C[2] → 0.5, C[3] → 2/3}
```

$$e^{x} + 0.5\, e^{2x} + \frac{2}{3} e^{2x} x$$

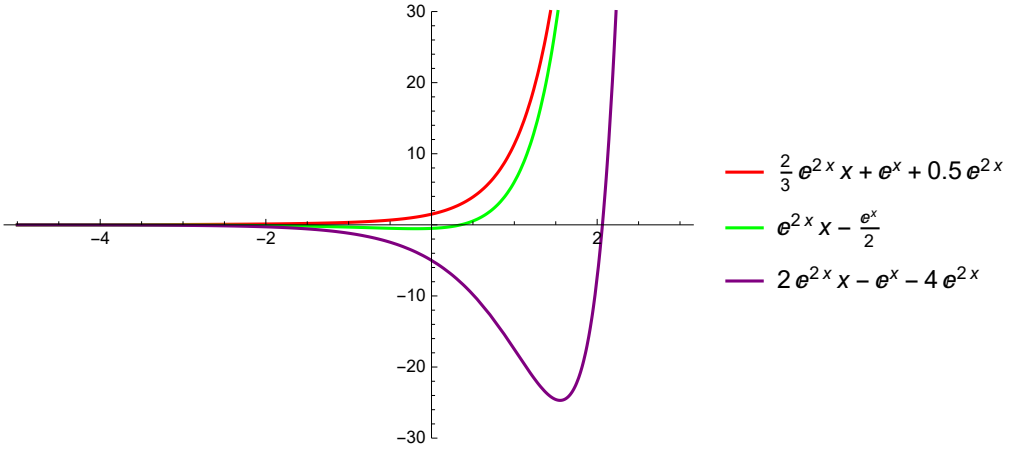
```
Sol2 = y[x] /. Sol[[1]] /. {C[1] → -1/2, C[2] → 0, C[3] → 1}
```

$$-\frac{e^{x}}{2} + e^{2x} x$$

```
Sol3 = y[x] /. Sol[[1]] /. {C[1] → -1, C[2] → -4, C[3] → 2}
```

$$-e^{x} - 4\, e^{2x} + 2\, e^{2x} x$$

```
Plot[{Sol1, Sol2, Sol3}, {x, -5, 3}, PlotRange → {-30, 30},
 PlotStyle → {{Red}, {Green}, {Purple}},
 PlotLegends → {Sol1, Sol2, Sol3}]
```



Question 2 :

Solve third order Differential Equation y''' + 3 y'' – 25 y' + 21 y = 0 and Plot its any four Solutions.Solution :

```
Eqn = y'''[x] + 3 * y''[x] - 25 * y'[x] + 21 * y[x]
Sol = DSolve[Eqn == 0, y[x], x]
Sol1 = y[x] /. Sol[[1]] /. {C[1] → 1, C[2] → 0, C[3] → 2}
Sol2 = y[x] /. Sol[[1]] /. {C[1] → -1/2, C[2] → 0, C[3] → 1}
Sol3 = y[x] /. Sol[[1]] /. {C[1] → -1, C[2] → -4, C[3] → 2}
Sol4 = y[x] /. Sol[[1]] /. {C[1] → -0.5, C[2] → -2, C[3] → 1}
Plot[{Sol1, Sol2, Sol3, Sol4}, {x, -0.5, 0.5},
 PlotStyle → {{Red}, {Green}, {Purple}, {Orange}},
 PlotLegends → {Sol1, Sol2, Sol3, Sol4}]
```

$$21\,y[x] - 25\,y'[x] + 3\,y''[x] + y^{(3)}[x]$$

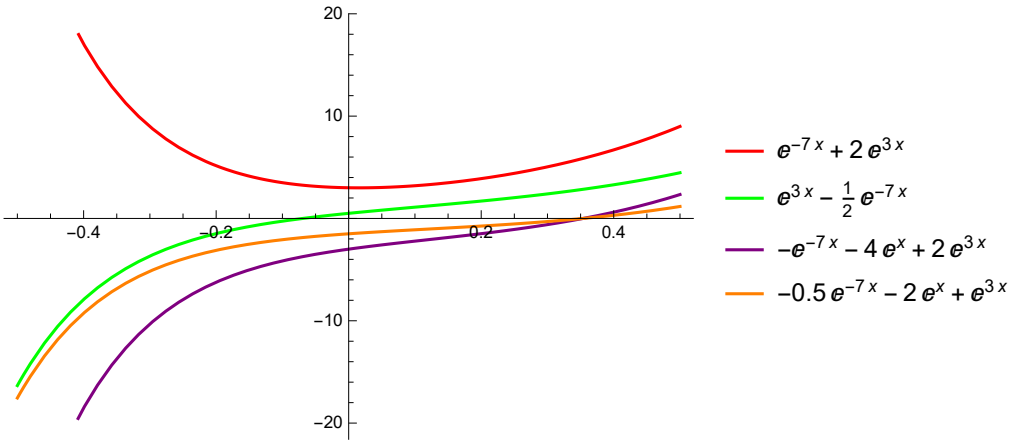
$$\{\{y[x] \to e^{-7x}\,C[1] + e^{x}\,C[2] + e^{3x}\,C[3]\}\}$$

$$e^{-7x} + 2\,e^{3x}$$

$$-\frac{1}{2}\,e^{-7x} + e^{3x}$$

$$-e^{-7x} - 4\,e^{x} + 2\,e^{3x}$$

$$-0.5\,e^{-7x} - 2\,e^{x} + e^{3x}$$



Question 3 :
Solve third order Differential Equation y''' – 4 y'' – 25 y' + 28 y = 0 and Plot its any four Solutions.

```
Eqn = y'''[x] - 4 * y''[x] - 25 * y'[x] + 28 * y[x]
Sol = DSolve[Eqn == 0, y[x], x]
Sol1 = y[x] /. Sol[[1]] /. {C[1] → 1, C[2] → 0, C[3] → 2}
Sol2 = y[x] /. Sol[[1]] /. {C[1] → -2, C[2] → 10, C[3] → 3}
Sol3 = y[x] /. Sol[[1]] /. {C[1] → -1, C[2] → -4, C[3] → 20}
Sol4 = y[x] /. Sol[[1]] /. {C[1] → -0.5, C[2] → -2, C[3] → 1}
Plot[{Sol1, Sol2, Sol3, Sol4}, {x, -0.5, 0.5},
 PlotStyle → {{Red}, {Green}, {Purple}, {Orange}},
 PlotLegends → {Sol1, Sol2, Sol3, Sol4}]
```

$$28\,y[x] - 25\,y'[x] - 4\,y''[x] + y^{(3)}[x]$$

$$\left\{\left\{y[x] \to e^{-4x}\,C[1] + e^{x}\,C[2] + e^{7x}\,C[3]\right\}\right\}$$

$$e^{-4x} + 2\,e^{7x}$$

$$-2\,e^{-4x} + 10\,e^{x} + 3\,e^{7x}$$

$$-e^{-4x} - 4\,e^{x} + 20\,e^{7x}$$

$$-0.5\,e^{-4x} - 2\,e^{x} + e^{7x}$$