Rhea Agarwal | BA(Hons) Economics | 20202948 |Practical- 3

Plotting third order solution family of Differential Equation

Question 1: Solve third order Differential Equation y''' - 5y'' + 8y' - 4y = 0 and Plot its three Solutions.

Solution :

In[150]:=
```
Sol = DSolve[y '''[x] - 5 y ''[x] + 8 y '[x] - 4 y[x] == 0, y[x], x]
Sol1 = y[x] /. Sol[[1]] /. {C[1] → 1, C[2] → 0.5, C[3] → 2 / 3}
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}
Plot[{Sol1, Sol2, Sol3}, {x, - 5, 3}, PlotRange → {- 30, 30},
PlotStyle → {{Red}, {Green}, {Purple}},
PlotLegends → {Sol1, Sol2, Sol3}]
```

Out[150]=

$$\{\{y[x] \to e^{x} c_1 + e^{2 x} c_2 + e^{2 x} x c_3\}\}$$

Out[151]=

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

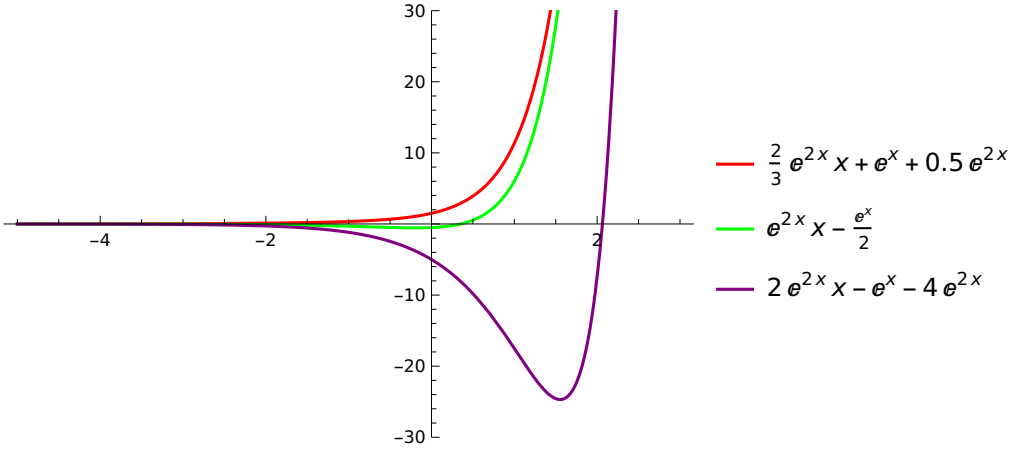
Out[152]=

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

Out[153]=

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

Out[154]=


30
20
10
−4
−2
2
−10
−20
−30
$\frac{2}{3}\,e^{2x}\,x + e^{x} + 0.5\,e^{2x}$
$e^{2x}\,x - \frac{e^{x}}{2}$
$2\,e^{2x}\,x - e^{x} - 4\,e^{2x}$

Question 2: Solve third order Differential Equation y''' + 3y'' - 25y' + 21y = 0 and Plot its any four Solutions.

Solution :

In[155]:=
```
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}]
```

Out[155]=
$$21\,y[x] - 25\,y'[x] + 3\,y''[x] + y^{(3)}[x]$$

Out[156]=
$$\{\{y[x] \to e^{-7x}\,c_1 + e^{x}\,c_2 + e^{3x}\,c_3\}\}$$

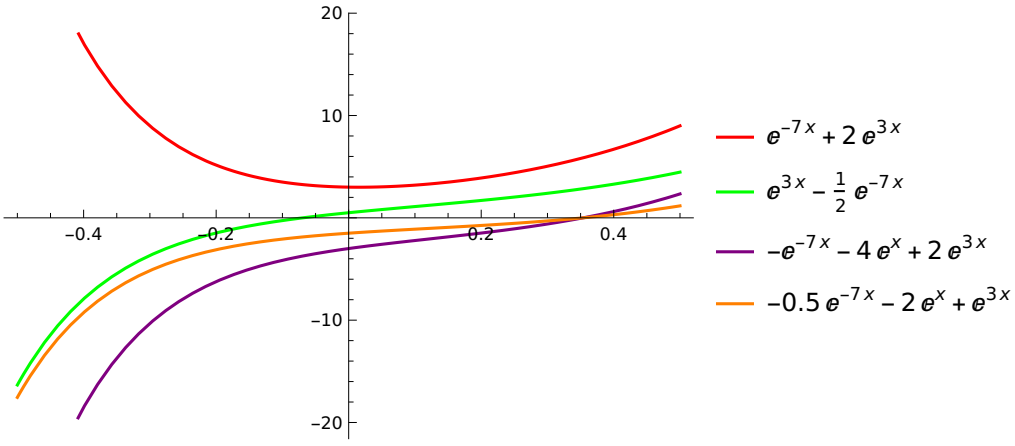
Out[157]=
$$e^{-7x} + 2\,e^{3x}$$

Out[158]=
$$-\frac{1}{2}\,e^{-7x} + e^{3x}$$

Out[159]=
$$-e^{-7x} - 4\,e^{x} + 2\,e^{3x}$$

Out[160]=
$$-0.5\,e^{-7x} - 2\,e^{x} + e^{3x}$$

Out[161]=



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

Solution :

In[162]:=
```
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}]
```

Out[162]=
$$28\, y[x] - 25\, y'[x] - 4\, y''[x] + y^{(3)}[x]$$

Out[163]=
$$\{\{y[x] \to e^{-4x} c_1 + e^{x} c_2 + e^{7x} c_3\}\}$$

Out[164]=
$$e^{-4x} + 2\, e^{7x}$$

Out[165]=
$$-2\, e^{-4x} + 10\, e^{x} + 3\, e^{7x}$$

Out[166]=
$$-e^{-4x} - 4\, e^{x} + 20\, e^{7x}$$

Out[167]=
$$-0.5\, e^{-4x} - 2\, e^{x} + e^{7x}$$

Out[168]=