Rhea Agarwal | BA(Hons)Economics | 20202948 | Practical- 1

Plotting Of First Order Solution Of Family Of Differential Equation

Solving first Order Ordinary Differential Equation:

QUES 1 : Solve First Order Differential Equation
y '[x] -6 x ^ 2 - 2 x - 3 = 0.
SOL :

In[51]:=
```
DSolve[y '[x] - 6 x ^ 2 - 2 x - 3 == 0, y[x], x]
```

Out[51]= $\{\{y[x] \to 3\,x + x^2 + 2\,x^3 + c_1\}\}$

QUES 2 : Solve First Order Differential Equation
y'[x] -3 x ^ 2 - 2 x - 1 = 0.
SOL :

In[52]:=
```
DSolve[y '[x] - 3 x ^ 2 - 2 x - 1 == 0, y[x], x]
```

Out[52]= $\{\{y[x] \to x + x^2 + x^3 + c_1\}\}$

QUES 2 : Solve First Order Differential Equation
y'[x] -3Exp[x-y]-x^2*Exp[-y]=0
SOL :

In[54]:=
```
DSolve[y '[x] - 3 Exp[x - y[x]] - x ^ 2 * Exp[-y[x]] == 0, y[x], x]
```

Solve: Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information.

Out[54]= $\left\{\left\{y[x] \to \text{Log}\left[3\,e^x + \frac{x^3}{3} + c_1\right]\right\}\right\}$

Plotting of solutions of first order differential equation :

QUES 1: Solve the first order differential equation y ' [x] - 1 - x - y [x] - x *y [x] = 0 and plot its three solutions

SOL :

In[55]:=

```
Sol = DSolve[y '[x] – 1 – x – y[x] – x * y[x] == 0, y[x], x]
Sol1 = y[x] /. Sol[[1]] /. {C[1] → –10}
Sol2 = y[x] /. Sol[[1]] /. {C[1] → 0}
Sol3 = y[x] /. Sol[[1]] /. {C[1] → 10}
Plot[{Sol1, Sol2, Sol3}, {x, –20, 20},
PlotStyle → {{Red}, {Green}, {Blue}},
PlotLegends → {Sol1, Sol2, Sol3}]
```

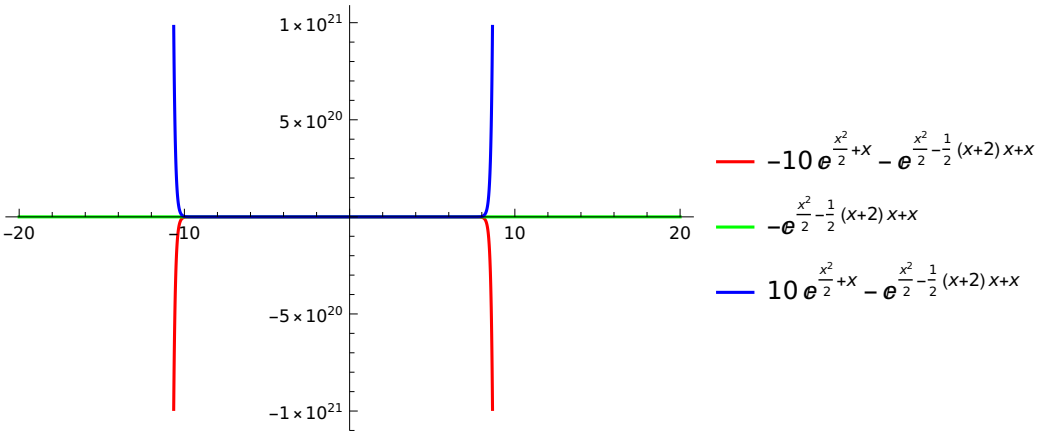
Out[55]= $\left\{\left\{y[x] \to -e^{x+\frac{x^2}{2}-\frac{1}{2}x(2+x)} + e^{x+\frac{x^2}{2}} C_1\right\}\right\}$

Out[56]= $-10\, e^{x+\frac{x^2}{2}} - e^{x+\frac{x^2}{2}-\frac{1}{2}x(2+x)}$

Out[57]= $-e^{x+\frac{x^2}{2}-\frac{1}{2}x(2+x)}$

Out[58]= $10\, e^{x+\frac{x^2}{2}} - e^{x+\frac{x^2}{2}-\frac{1}{2}x(2+x)}$

Out[59]=



QUES 2: Solve the first order differential equation y '[x]-Exp[x-y] - x^2*Exp[-y] = 0 and plot its three solutions

SOL :

In[36]:=
```
Sol = DSolve[y '[x] – Exp[x – y[x]] – x ^ 2 * Exp[–y[x]] == 0, y[x], x]
Sol1 = y[x] /. Sol[[1]] /. {C[1] → 10}
Sol2 = y[x] /. Sol[[1]] /. {C[1] → 0}
Sol3 = y[x] /. Sol[[1]] /. {C[1] → –10}
Plot[{Sol1, Sol2, Sol3}, {x, –20, 20},
PlotStyle → {{Red}, {Green}, {Purple}},
PlotLegends → {Sol1, Sol2, Sol3}]
```

Solve: Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information.

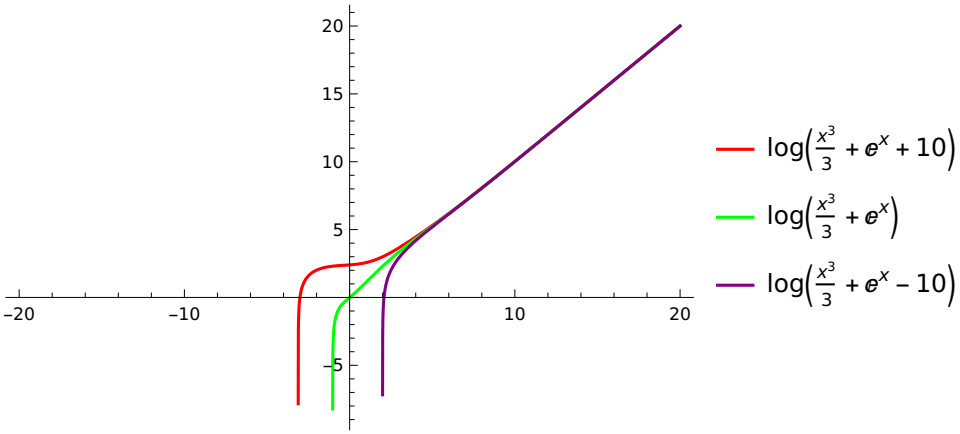
Out[36]= $\left\{\left\{y[x] \to \text{Log}\left[e^x + \frac{x^3}{3} + C_1\right]\right\}\right\}$

Out[37]= $\text{Log}\left[10 + e^x + \frac{x^3}{3}\right]$

Out[38]= $\text{Log}\left[e^x + \frac{x^3}{3}\right]$

Out[39]= $\text{Log}\left[-10 + e^x + \frac{x^3}{3}\right]$

Out[40]=



QUES 3 : Solve the first order differential equation y '[x]*Sin[Pi*x]-y[x]*Cos[Pi*x]=0 and plot its three solutions

SOL :

In[41]:=
```
Sol = DSolve[y '[x] * Sin[Pi * x] - y[x] * Cos[Pi * x] == 0, y[x], x]
Sol1 = y[x] /. Sol[[1]] /. {C[1] → 10}
Sol2 = y[x] /. Sol[[1]] /. {C[1] → 5}
Sol3 = y[x] /. Sol[[1]] /. {C[1] → -10}
Plot[{Sol1, Sol2, Sol3}, {x, -20, 20},
PlotStyle → {{Red}, {Green}, {Purple}},
PlotLegends → {Sol1, Sol2, Sol3}]
```

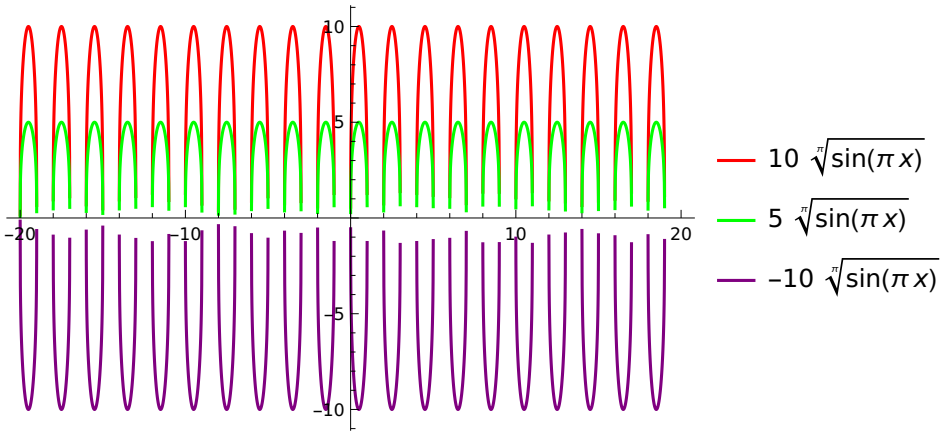
Out[41]= $\left\{\left\{y[x] \to c_1 \, \text{Sin}[\pi \, x]^{\frac{1}{\pi}}\right\}\right\}$

Out[42]= $10 \, \text{Sin}[\pi \, x]^{\frac{1}{\pi}}$

Out[43]= $5 \, \text{Sin}[\pi \, x]^{\frac{1}{\pi}}$

Out[44]= $-10 \, \text{Sin}[\pi \, x]^{\frac{1}{\pi}}$

Out[45]=



QUES 4 : Solve the first order differential equation y'[x]*(x-1)-2x*y[x]=0 and plot its three solutions

SOL :

In[46]:=
```
Sol = DSolve[y '[x] * (x - 1) - 2 x * y[x] == 0, y[x], x]
Sol1 = y[x] /. Sol[[1]] /. {C[1] → 10}
Sol2 = y[x] /. Sol[[1]] /. {C[1] → 1}
Sol3 = y[x] /. Sol[[1]] /. {C[1] → -10}
Plot[{Sol1, Sol2, Sol3}, {x, -20, 20},
PlotStyle → {{Red}, {Green}, {Purple}},
PlotLegends → {Sol1, Sol2, Sol3}]
```

Out[46]= $\{\{y[x] \to e^{2\,(x+\text{Log}[-1+x])}\, C_1\}\}$

Out[47]= $10\, e^{2\,(x+\text{Log}[-1+x])}$

Out[48]= $e^{2\,(x+\text{Log}[-1+x])}$

Out[49]= $-10\, e^{2\,(x+\text{Log}[-1+x])}$

Out[50]=