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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] → 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] → 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.

$$\text{Out[54]= } \left\{\left\{y[x] \to \text{Log}\left[3 e^x + \frac{x^3}{3} + C[1]\right]\right\}\right\}$$

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}]
```

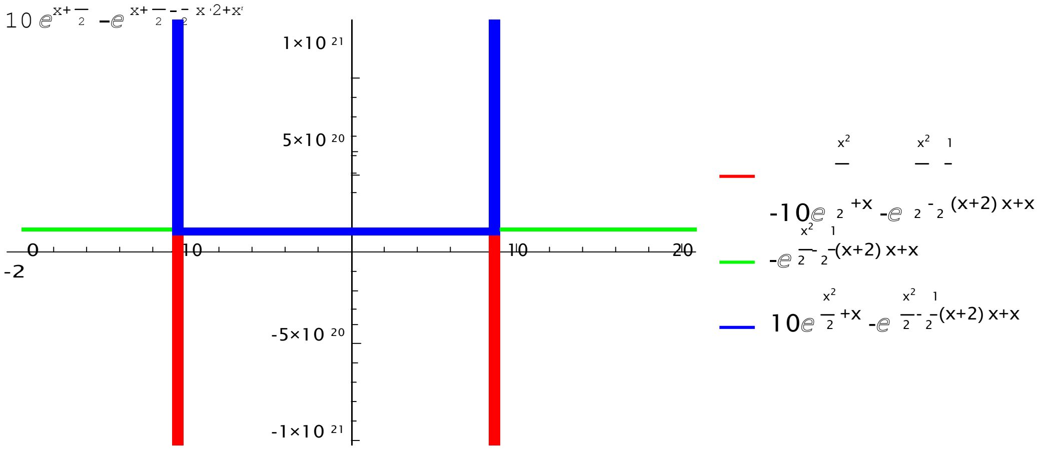
Out[55]= {{y[x]→ $-e^{x+\frac{x^2}{2}-\frac{1}{2}x(2+x)}+e^{x+\frac{x^2}{2}}C[1]$}}

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.

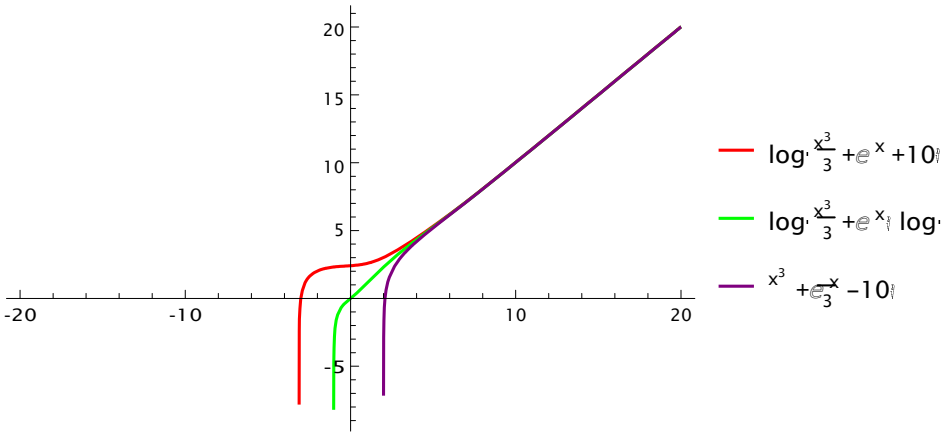
Out[36]= $\{\{y[x] \to \text{Log}[e^x + \frac{x^3}{3} + c_1]\}\}$

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

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

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

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}]
```

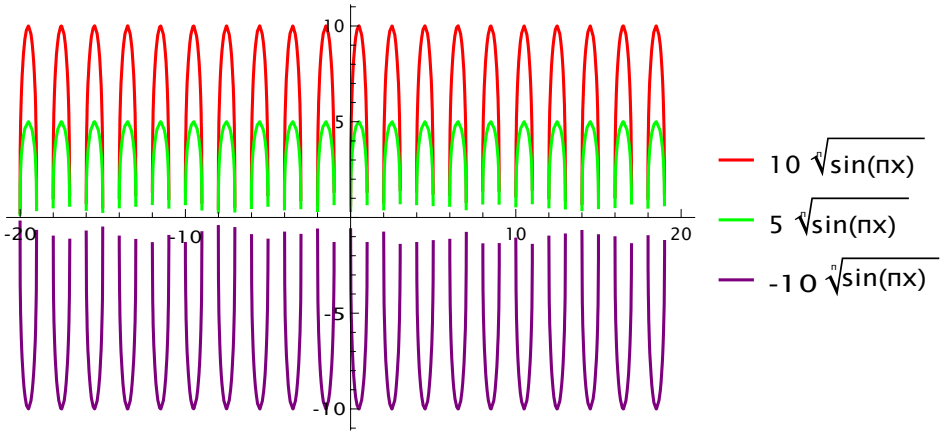
Out[41]= $\{\{y[x] \to 1 \, \text{Sin}[\pi x]^{\frac{1}{\pi}}\}\}$

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

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]=