SHAHEED RAJGURU COLLEGE OF APPLIED SCIENCES FOR

WOMEN

PRACTICAL EXAMINATION

Semester III, GE-3 Differential Equations

2020


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Q1. Find the general solution of the linear system of equations

dx/dt = 2 x - y

dy/dt = x + 2 y

In[72]:=
```
eq1 = x '[t] == - y[t] + 2 * x[t]
eq2 = y '[t] == 2 * y[t] + x[t]
```

Out[72]= $x'[t] == 2\,x[t] - y[t]$

Out[73]= $y'[t] == x[t] + 2\,y[t]$

In[74]:=
```
sol = DSolve[{eq1, eq2}, {y[t], x[t]}, t]
```

Out[74]= $\{\{x[t] \to e^{2t}\, c_1 \,\text{Cos}[t] - e^{2t}\, c_2 \,\text{Sin}[t],\ y[t] \to e^{2t}\, c_2 \,\text{Cos}[t] + e^{2t}\, c_1 \,\text{Sin}[t]\}\}$

In[75]:=
```
sol[[1, 1]]
sol[[1, 2]]
```

Out[75]= $x[t] \to e^{2t}\, c_1 \,\text{Cos}[t] - e^{2t}\, c_2 \,\text{Sin}[t]$

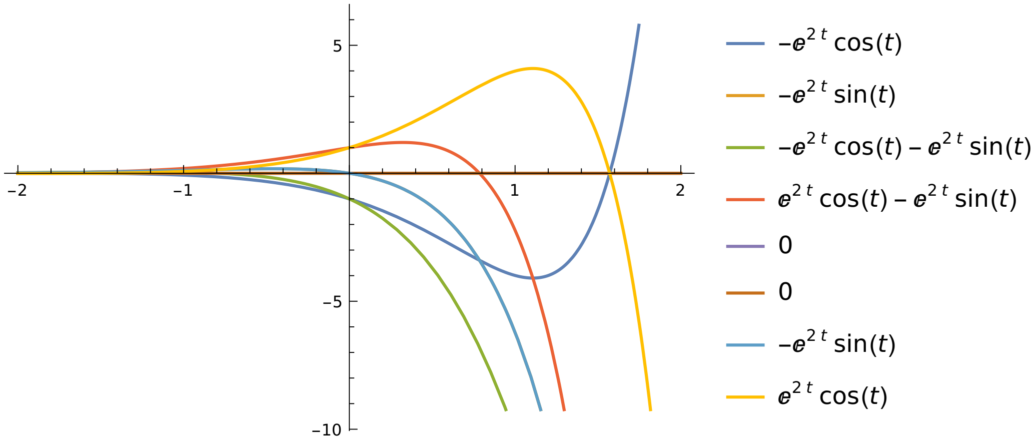
Out[76]= $y[t] \to e^{2t}\, c_2 \,\text{Cos}[t] + e^{2t}\, c_1 \,\text{Sin}[t]$

In[77]:=
```
tab = Table[{x[t] /. sol[[1, 1]], y[t] /. sol[[1, 2]]} /. {C[1] → i, C[2] → j},
   {i, -1, 0}, {j, 0, 1}] // Flatten
```

Out[77]= $\{-e^{2t}\,\text{Cos}[t],\ -e^{2t}\,\text{Sin}[t],\ -e^{2t}\,\text{Cos}[t] - e^{2t}\,\text{Sin}[t],\ e^{2t}\,\text{Cos}[t] - e^{2t}\,\text{Sin}[t],\ 0,\ 0,\ -e^{2t}\,\text{Sin}[t],\ e^{2t}\,\text{Cos}[t]\}$

In[78]:=
```
Plot[Evaluate[tab], {t, -2, 2}, PlotLegends → "Expressions"]
```

Out[78]=




Q3. Solve the differential equation by using method of variation of parameters

y''+y=sec x

In[44]:=
```
sol = DSolve[y''[x] + y[x] == 0, y[x], x]
```

Out[44]= {{y[x] → $c_1$ Cos[x] + $c_2$ Sin[x]}}

In[47]:=
```
y1 := Cos[x];
y2 := Sin[x];
```

In[49]:=
```
f := Sec[x];
```

In[50]:=
```
w = y1 * D[y2, x] - y2 * D[y1, x];
w = Simplify[w]
```

Out[51]= 1

In[52]:=
```
yp = -y1 * Integrate[y2 * (f / w), x] + y2 * Integrate[y1 * (f / w), x];
yp = Simplify[yp]
```

Out[53]= Cos[x] × Log[Cos[x]] + x Sin[x]

In[54]:=
```
Out[44] + Out[53]
```

Out[54]= {{Cos[x] × Log[Cos[x]] + (y[x] → $c_1$ Cos[x] + $c_2$ Sin[x]) + x Sin[x]}}

Q4. Determine and Plot the solution of Cauchy problem

ux + uy = 0 with u (0, y) = Cos y

In[55]:=
```
Eqn3 := D[u[x, y], x] + D[u[x, y], y] == 0
```

In[56]:=
```
Sol3 = DSolve[{Eqn3, u[0, y] == Cos[y]}, u[x, y], {x, y}]
```

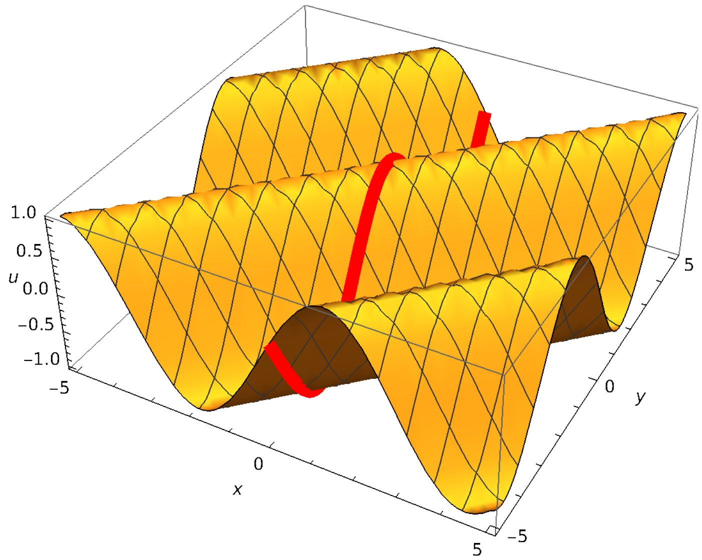
Out[56]= {{u[x, y] → Cos[x - y]}}

In[57]:=
```
p1 = Plot3D[u[x, y] /. Sol3, {x, -5, 5}, {y, -5, 5}, AxesLabel → {x, y, u}];
```

In[67]:=
```
p3 = ParametricPlot3D[{0, y, Cos[y]}, {y, -5, 5}, PlotStyle → {Red, Thickness[0.02]}];
```

In[68]:=
```
Show[p1, p3]
```

Out[68]=




In[69]:=
```
Soln1 = DSolve[y'[x] == 1, y[x], x](*Characteristic  Equation*)
```

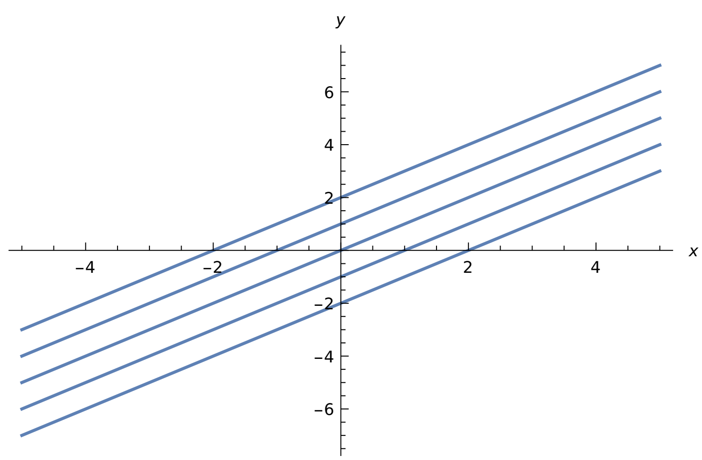
Out[69]= $\{\{y[x] \to x + c_1\}\}$

In[70]:=
```
Par1 = y[x] /. Soln1 /. C[1] → {-2, -1, 0, 1, 2}
```

Out[70]= {{-2 + x, -1 + x, x, 1 + x, 2 + x}}

In[71]:=
```
Plot[Par1, {x, -5, 5}, AxesLabel → {x, y}]
```

Out[71]=




Q2 Find general solution of the equation
y''-5y'+6y=e^x+e^4x

In[60]:=
```
sol = DSolve[y''[x] - 5 * y'[x] + 6 * y[x] == Exp[x] + Exp[4 x], y[x], x]
```

Out[60]= $\left\{\left\{y[x] \to \frac{1}{2} e^{x}\left(1+e^{3 x}\right)+e^{2 x} c_1+e^{3 x} c_2\right\}\right\}$

In[61]:=
```
sol1 = y[x] /. sol[[1]] /. {C[1] -> 1, C[2] -> 2}
```

Out[61]= $e^{2x} + 2e^{3x} + \frac{1}{2}e^{x}(1 + e^{3x})$

In[62]:=
```
sol2 = y[x] /. sol[[1]] /. {C[1] -> 2, C[2] -> 4}
```

Out[62]= $2e^{2x} + 4e^{3x} + \frac{1}{2}e^{x}(1 + e^{3x})$

In[63]:=
```
sol3 = y[x] /. sol[[1]] /. {C[1] -> 2, C[2] -> 3}
```

Out[63]= $2e^{2x} + 3e^{3x} + \frac{1}{2}e^{x}(1 + e^{3x})$

In[66]:=
```
Plot[{sol1, sol2, sol3}, {x, -2, 2},
 PlotStyle -> {{Red, Thickness[0.01]}, {Green, Thick}, {Blue,
   Thickness[0.01]}}, PlotLegends -> {sol1, sol2, sol3},
 Frame -> True,
 ImageSize -> 550]
```

Out[66]=