

Practical 1

Aim :- a) Solution of Cauchy problem for first order PDE.

b) Plotting the characteristics for the first order PDE.

c) Plot the integral surface of a given first order PDE with initial data.

```
In[ ]:= pde1 = D[u[x, y], x] + x * D[u[x, y], y] == 0;  
c1 = u[0, y] == Sin[y];  
sol1 = DSolve[{pde1, c1}, u[x, y], {x, y}]
```

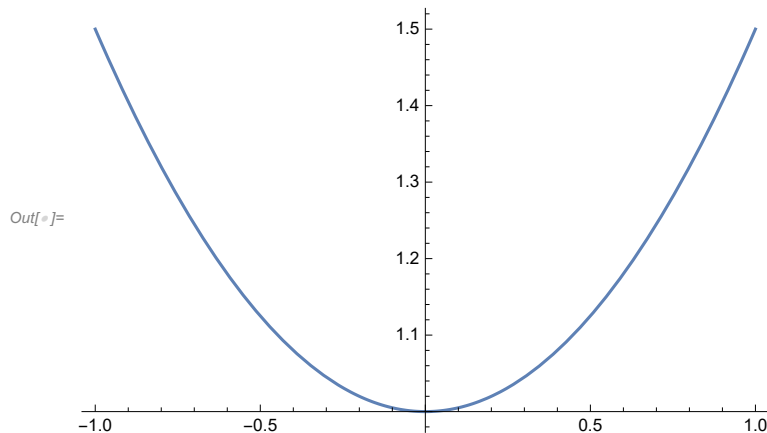
```
Out[ ]:= {{u[x, y] -> Sin[ $\frac{1}{2}(-x^2 + 2y)$ ]}}
```

(* Characteristic Plot *)

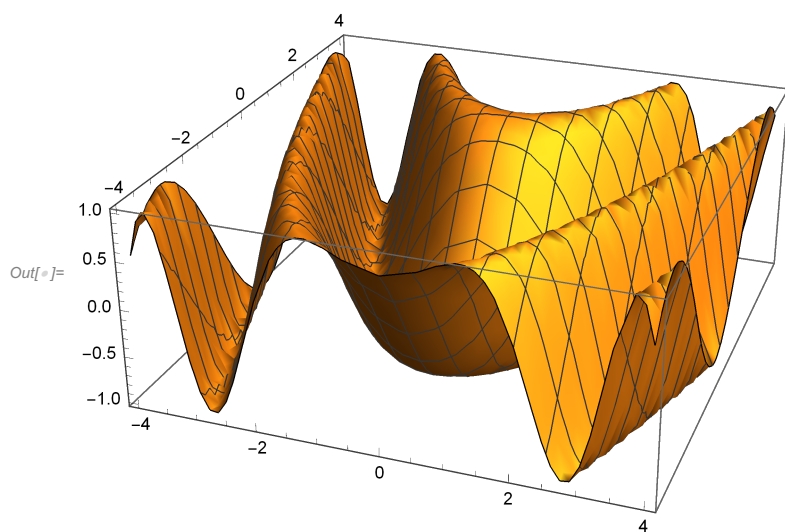
```
In[ ]:= ch = DSolve[{D[y[x], x] == x}, y[x], x] /. {C[1] -> 1}
```

```
Out[ ]:= {{y[x] ->  $1 + \frac{x^2}{2}$ }}
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In[ ]:= Plot[y[x] /. ch, {x, -1, 1}]
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```
In[ ]:= Plot3D[u[x, y] /. sol1, {x, -4, 4}, {y, -4, 4}]
```



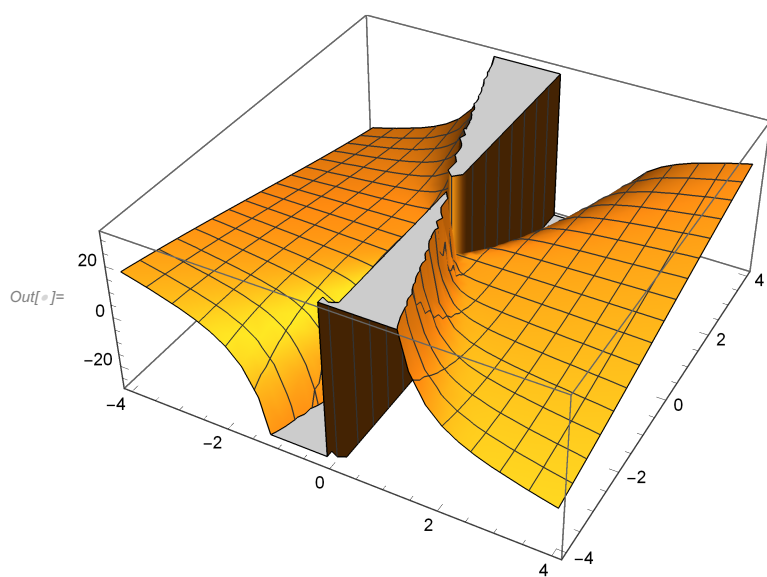
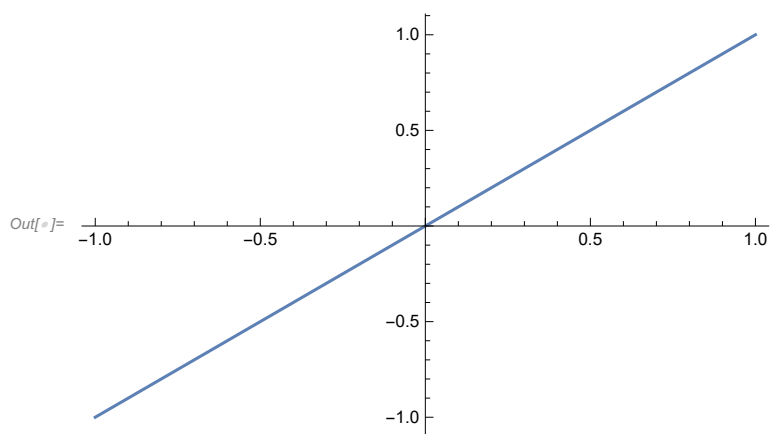
```
In[ ]:= ClearAll;
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In[ ]:= pde2 = x * D[u[x, y], x] + y * D[u[x, y], y] == 2 x * y;
c2 = u[x, x^2] == 2;
sol2 = DSolve[{pde2, c2}, u[x, y], {x, y}]
ch2 = DSolve[{D[y[x], x] ==  $\frac{y[x]}{x}$ }, y[x], x] /. {C[1] -> 1};
Plot[y[x] /. ch2, {x, -1, 1}]
Plot3D[u[x, y] /. sol2, {x, -4, 4}, {y, -4, 4}]

```

Out[]:= $\left\{ \left\{ u[x, y] \rightarrow \frac{2 x^3 + x^4 y - y^3}{x^3} \right\} \right\}$



```

In[ ]:= ClearAll;

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In[ ]:= pde3 = 3 * x * D[u[x, t], x] + t * D[u[x, t], t] == 0;
c3 = u[x, 1] == Exp[-x^2];
sol3 = DSolve[{pde3, c3}, u[x, t], {x, t}]
ch3 = DSolve[{D[t[x], x] ==  $\frac{t[x]}{3 x}$ }, t[x], x] /. {C[1] -> 1};
Plot[t[x] /. ch3, {x, -1, 1}]
Plot3D[u[x, t] /. sol3, {x, -4, 4}, {t, -4, 4}]

```

Out[]:= $\left\{ \left\{ u[x, t] \rightarrow e^{-\frac{x^2}{t^6}} \right\} \right\}$

