PRACTICAL 8

Plotting the integral surface of first order PDE with initial data

In[5]:=
```
pde1 = u[x, y](x + y) D[u[x, y], x] + u[x, y](x - y) * D[u[x, y], y] == x^2 + y^2
```

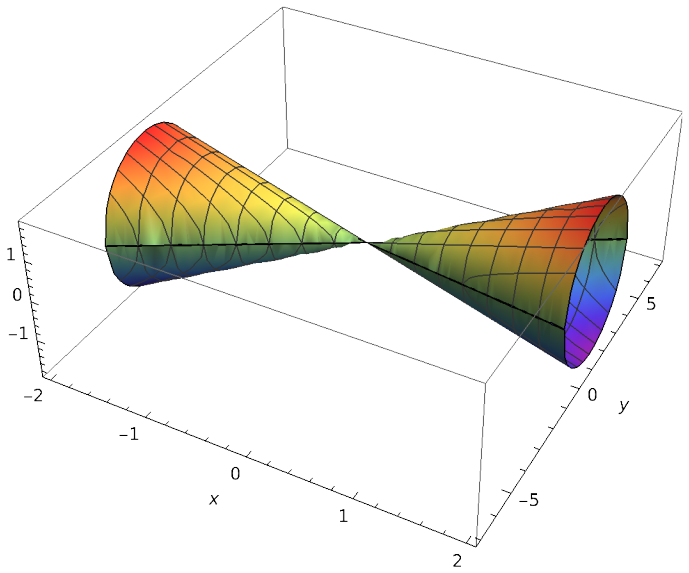
Out[5]=
$$(x - y)\, u[x, y]\, u^{(0,1)}[x, y] + (x + y)\, u[x, y]\, u^{(1,0)}[x, y] == x^2 + y^2$$

In[6]:=
```
sol1 = DSolve[{pde1, u[x, 2 x] == 0}, u[x, y], {x, y}]
```

Out[6]=
$$\left\{\left\{u[x, y] \to -\sqrt{\frac{2}{7}}\ \sqrt{2 x^2 + 3 x y - 2 y^2}\right\}, \left\{u[x, y] \to \sqrt{\frac{2}{7}}\ \sqrt{2 x^2 + 3 x y - 2 y^2}\right\},\right.$$
$$\left.\left\{u[x, y] \to -\sqrt{\frac{2}{7}}\ \sqrt{2 x^2 + 3 x y - 2 y^2}\right\}, \left\{u[x, y] \to \sqrt{\frac{2}{7}}\ \sqrt{2 x^2 + 3 x y - 2 y^2}\right\}\right\}$$

In[8]:=
```
Plot3D[u[x, y] /. sol1, {x, -2, 2}, {y, -7, 7},
 AxesLabel → Automatic, ColorFunction → "Rainbow"]
```

Out[8]=



In[9]:=
```
pde1 = D[u[x, y], x] - D[u[x, y], y] == 1
```

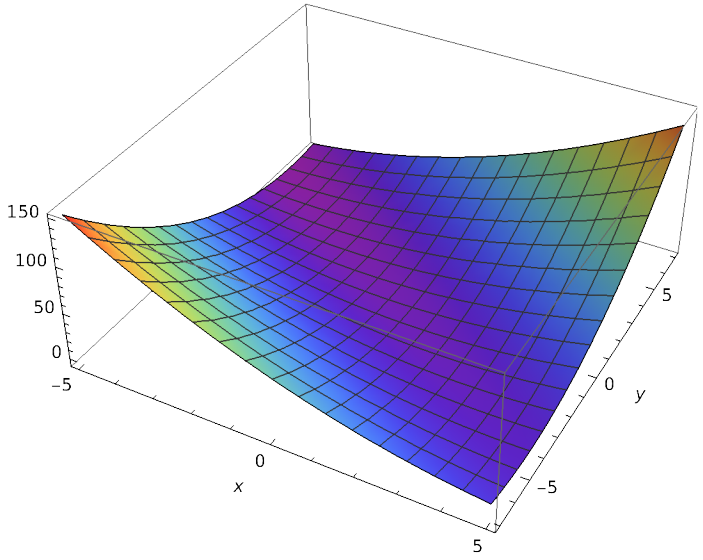
Out[9]=
$$-u^{(0,1)}[x, y] + u^{(1,0)}[x, y] == 1$$

In[10]:=
```
sol1 = DSolve[{pde1, u[x, 0] == x^2}, u[x, y], {x, y}]
```

Out[10]=
$$\{\{u[x, y] \to x^2 - y + 2 x y + y^2\}\}$$

In[11]:=
```
Plot3D[u[x, y] /. sol1, {x, -5, 5}, {y, -7, 7},
 AxesLabel → Automatic , ColorFunction → "Rainbow"]
```

Out[11]=



In[12]:=
```
pde1 = x D[u[x, y], x] + y D[u[x, y], y] == x Exp[-u[x, y]]
```

Out[12]=

$$y\, u^{(0,1)}[x, y] + x\, u^{(1,0)}[x, y] == e^{-u[x,y]}\, x$$

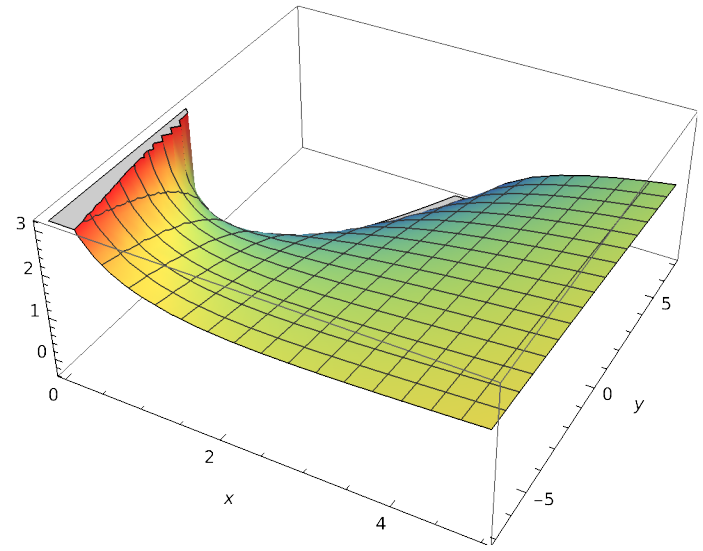
In[13]:=
```
sol1 = DSolve[{pde1, u[x, x^2] == 0}, u[x, y], {x, y}]
```

Out[13]=

$$\left\{\left\{u[x, y] \to \text{Log}\left[1 + x - \frac{y}{x}\right]\right\}\right\}$$

In[14]:=
```
Plot3D[u[x, y] /. sol1, {x, 0, 5}, {y, -7, 7},
 AxesLabel → Automatic , ColorFunction → "Rainbow"]
```

Out[14]=



In[15]:=
```
pde1 = 3 D[u[x, y], x] + 2 D[u[x, y], y] == 0
```

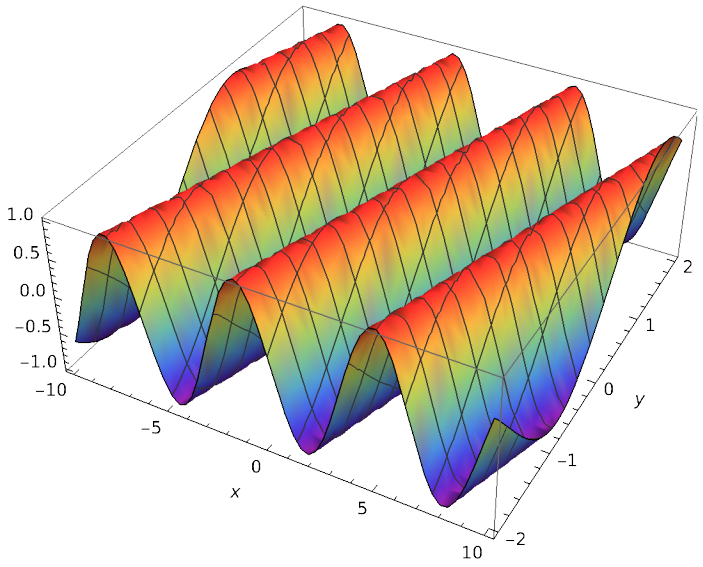
Out[15]= $2\,u^{(0,1)}[x, y] + 3\,u^{(1,0)}[x, y] == 0$

In[16]:=
```
sol1 = DSolve[{pde1, u[x, 0] == Sin[x]}, u[x, y], {x, y}]
```

Out[16]= $\left\{\left\{u[x, y] \to \text{Sin}\left[\frac{1}{2}(2\,x - 3\,y)\right]\right\}\right\}$

In[17]:=
```
Plot3D[u[x, y] /. sol1, {x, -10, 10}, {y, -2, 2},
 AxesLabel → Automatic, ColorFunction → "Rainbow"]
```

Out[17]=



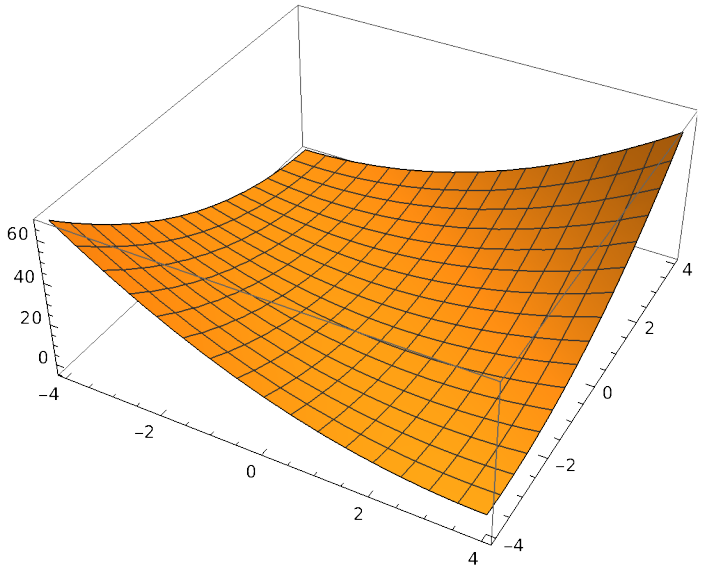
ux - uy = 1 , u(x, 0) = x^2

In[18]:=
```
sol = DSolve[{D[u[x, y], x] - D[u[x, y], y] == 1, u[x, 0] == x^2}, u[x, y], {x, y}]
```

Out[18]= $\{\{u[x, y] \to x^2 - y + 2\,x\,y + y^2\}\}$

In[19]:=
```
Plot3D[u[x, y] /. sol, {x, -4, 4}, {y, -4, 4}]
```

Out[19]=



$3\,ux + 2\,uy = 0,\ u(x, 0) = \text{Sin}\,x$

In[20]:=
```
sol = DSolve[{3 D[u[x, y], x] + 2 D[u[x, y], y] == 0, u[x, 0] == Sin[x]}, u[x, y], {x, y}]
```

Out[20]=

$$\left\{\left\{u[x, y] \to \text{Sin}\left[\frac{1}{2}(2x - 3y)\right]\right\}\right\}$$

In[21]:=
```
Plot3D[u[x, y] /. sol, {x, -5, 5}, {y, -5, 5}]
```

Out[21]=