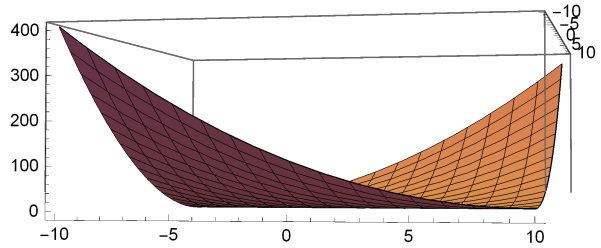
Solve and plot the following :

1. $u_x - u_y = 1$

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

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

```
Plot3D[u[x, y] /. sol, {x, -10, 10}, {y, -10, 10}]
```



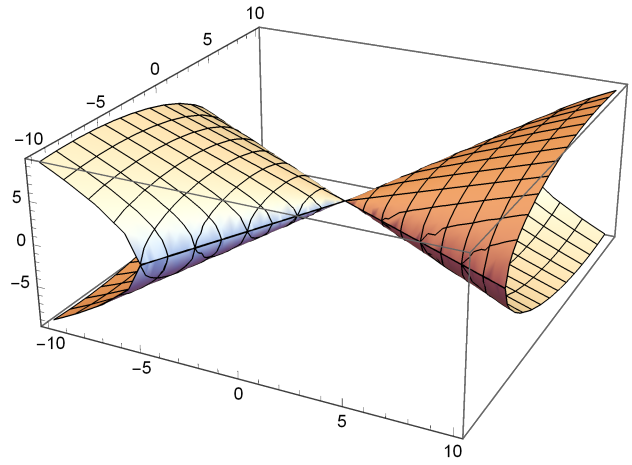
2. $u\,(x + y)\,u_x + u\,(x - y)\,u_y = x^2 + y^2$

```
sol = DSolve[{u[x, y] * (x + y) * ∂x u[x, y] + u[x, y] * (x - y) * ∂y u[x, y] == x^2 + y^2, u[x, 2 x] == 0},
    u[x, y], {x, y}] // Quiet
```

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

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

```
Plot3D[u[x, y] /. sol, {x, -10, 10}, {y, -10, 10}]
```



3. $yu_x + xu_y = u,\ u(x, 0) = x^3,\ u(0, y) = y^3$

```
DSolve[{y * ∂x u[x, y] + x * ∂y u[x, y] == u[x, y], u[0, y] == y^3}, u[x, y], {x, y}] &&
 DSolve[{y * ∂x u[x, y] + x * ∂y u[x, y] == u[x, y], u[x, 0] == x^3}, u[x, y], {x, y}]
```

$$\left\{\left\{u[x, y] \to -\frac{\left(-x^2+y^2\right)^2}{x+\sqrt{y^2}}\right\}, \left\{u[x, y] \to -\left(-x^2+y^2\right)\left(x+\sqrt{y^2}\right)\right\}\right\} \&\&$$

$$\left\{\left\{u[x, y] \to \frac{\left(-x^2+y^2\right)^2}{x+\sqrt{y^2}}\right\}, \left\{u[x, y] \to -\left(-x^2+y^2\right)\left(x+\sqrt{y^2}\right)\right\}\right\}$$