14/01/20

PRACTICAL - 2

PLOTTING THE CHARACTERISTICS OF THE FIRST ORDER PDE

Q1. $xyu_x + \left(x^2 + y^2\right) u_y = 0$

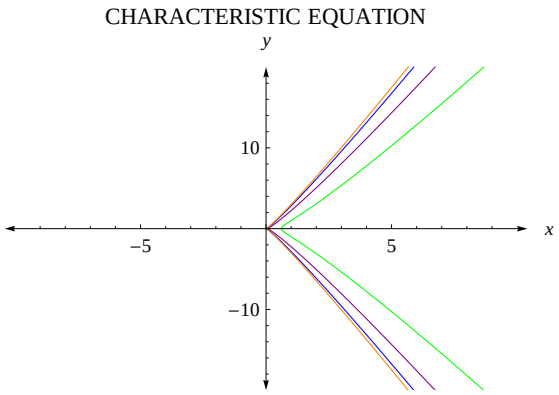
the characteristics are determined by

$$\frac{dx}{xy} = \frac{dy}{x^2 + y^2} = \frac{du}{0} \qquad -(1)$$

```
a = DSolve[y'[x] == (x^2 + (y[x])^2)/(x * y[x]), y, x];
Print["First characteristic curve is given by ", a[[1]]]
Print["Second characteristic curve is given by ", a[[2]]]
Plot[{y[x] /. {a[[1]], a[[2]]} /. C[1] → 1, y[x] /. {a[[1]], a[[2]]} /. C[1] → 8,
  y[x] /. {a[[1]], a[[2]]} /. C[1] → 5, y[x] /. {a[[1]], a[[2]]} /. C[1] → 9},
 {x, -10, 10}, PlotRange → {-20, 20}, PlotStyle → {Green, Blue, Purple, Orange},
 AxesStyle → Arrowheads[{-0.02, 0.02}],
 AxesLabel → {x, y}, PlotLabel → "CHARACTERISTIC EQUATION"]
```

First characteristic curve is given by $\left\{y \to \text{Function}\left[\{x\}, -x\sqrt{C[1] + 2\,\text{Log}[x]}\right]\right\}$

Second characteristic curve is given by $\left\{y \to \text{Function}\left[\{x\}, x\sqrt{C[1] + 2\,\text{Log}[x]}\right]\right\}$



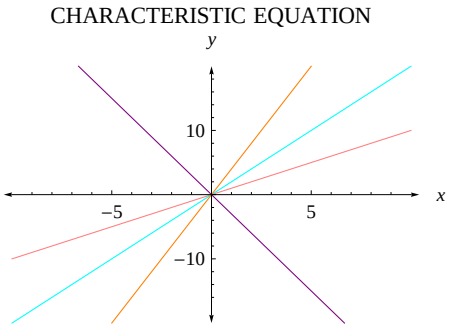
Q2. $xu_x + yu_y = 0$

the characteristics are determined by

$$\frac{dx}{x} = \frac{dy}{y} = \frac{du}{0} \qquad -(1)$$

```
h = DSolve[y'[x] == y[x]/x, y, x];
Print["Characteristic curve is given by ", h[[1]]]
Plot[{y[x] /. h[[1]] /. C[1] → 1, y[x] /. h[[1]] /. C[1] → 2,
  y[x] /. h[[1]] /. C[1] → -3, y[x] /. h[[1]] /. C[1] → 4}, {x, -10, 10},
 PlotRange → {-20, 20}, PlotStyle → {Pink, Cyan, Purple, Orange},
 AxesStyle → Arrowheads[{-0.02, 0.02}],
 AxesLabel → {x, y}, PlotLabel → "CHARACTERISTIC EQUATION"]
```

Characteristic curve is given by {y → Function[{x}, x C[1]]}



Q3. $u_x - u_y = 1$

the characteristics are determined by

$$\frac{dx}{1} = \frac{dy}{-1} = \frac{du}{1} \qquad -(1)$$

```
m = DSolve[y'[x] == -1, y, x];
Print["Characteristic curve is given by ", m[[1]]]
Plot[{y[x] /. m[[1]] /. C[1] → 1, y[x] /. m[[1]] /. C[1] → 2, y[x] /. m[[1]] /. C[1] → 3,
  y[x] /. m[[1]] /. C[1] → 4}, {x, -10, 10}, PlotRange → {-20, 20},
 PlotStyle → {Pink, Cyan, Purple, Orange}, AxesStyle → Arrowheads[{-0.02, 0.02}],
 AxesLabel → {x, y}, PlotLabel → "CHARACTERISTIC EQUATION"]
```

Characteristic curve is given by {y → Function[{x}, -x + C[1]]}