Week 03 Participation Assignment (2 of 3)

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Contents

1 Part 2

Identify the equation as homogeneous, Bernoulli, or of the form $y' = G(ax + by + c)$

1.1 a)

$$2xydx + (y^2 - x^2)dy = 0$$

$$\begin{aligned}(y^2 - x^2)dy &= -2xydx \\ \frac{dy}{dx} &= \frac{-2xy}{y^2 - x^2} \\ &= \frac{-2xy}{x^2(\frac{y^2}{x^2} - 1)} \\ &= \frac{-2y}{x(\frac{y^2}{x^2} - 1)}\end{aligned}$$

$$\boxed{\text{homogeneous}}$$

1.2 b)

$$(y - 4x - 1)^2 dx - dy = 0$$

$$\begin{aligned}dy &= (y - 4x - 1)^2 dx \\ \frac{dy}{dx} &= (y - 4x - 1)^2\end{aligned}$$

$$\boxed{y' = G(ax + by + c)}$$

1.3 c)

$$\frac{dy}{dx} + \frac{y}{x} - x^3 y^2 = 0$$

$$\frac{dy}{dx} + \left(\frac{1}{x}\right) y = (x^3)y^2$$

Bernoulli

1.4 d)

$$xdy - ydx = \sqrt{xy}dx$$

$$\begin{aligned}
(x)dy &= \sqrt{xy}dx + (y)dx \\
(x)dy &= dx\left(\sqrt{xy} + y\right) \\
\frac{dy}{dx} &= \frac{\left(\sqrt{xy} + y\right)}{x} \\
&= \frac{\sqrt{xy}}{x} + \frac{y}{x} \\
&= \frac{\sqrt{x^2\left(\frac{y}{x}\right)}}{x} + \frac{y}{x} \\
&= \frac{x\sqrt{\frac{y}{x}}}{x} + \frac{y}{x} \\
&= \sqrt{\frac{y}{x}} + \frac{y}{x}
\end{aligned}$$

homogeneous

$$\begin{aligned}
(x)\frac{dy}{dx} - y &= \sqrt{xy} \\
\frac{dy}{dx} - \left(\frac{1}{x}\right) y &= \frac{\sqrt{xy}}{x} \\
\frac{dy}{dx} - \left(\frac{1}{x}\right) y &= \left(\frac{\sqrt{x}}{x}\right) y^{1/2}
\end{aligned}$$

Bernoulli

1.5 e)

$$\frac{dy}{dx} = \sqrt{x+y} - 1$$

$$\frac{dy}{dx} = \sqrt{x(1+\frac{y}{x})} - 1$$

homogeneous

1.6 f)

$$\left(ye^{-2x} + y^3\right) dx - e^{-2x} dy = 0$$

$$\begin{aligned}
\left(e^{-2x}\right) dy &= \left(ye^{-2x} + y^3\right) dx \\
\frac{dy}{dx} &= \frac{ye^{-2x} + y^3}{e^{-2x}} \\
&= \frac{ye^{-2x}}{e^{-2x}} + \frac{y^3}{e^{-2x}} \\
&= y + \frac{y^3}{e^{-2x}} \\
\frac{dy}{dx} - y &= \left(\frac{1}{e^{-2x}}\right) y^3
\end{aligned}$$

Bernoulli