

DIFFERENTIAL EQUATIONS I Homework 1 04.10.2016

1. Derive the differential equation which has as general solution the function y defined by the given equation.

a) $x - y^4 = cy^3$ b) $x + y = \tan(x + c)$ c) $x \sin y = e^{cx}$

d) $y = c_1 e^x + c_2 e^x + x$ e) $y = c_1 e^{-2x} + c_2 e^x$ f) $y = c_1 \cos 2x + c_2 \sin 2x$

g) $y = e^{-x}(c_1 \cos x + c_2 \sin x)$ h) $y = x(c_1 \cos x + c_2 \sin x)$

2. Find the general solution of the given differential equations.

a) $x \sec y dx + (1 + x) dy = 0$ b) $xy dx + (1 + x)^2 dy = 0$

c) $(xy^2 + x) dx - (x^2 y - y) dy = 0$ d) $(\tan x) \frac{dy}{dx} = 1 + y$

e) $x \frac{dy}{dx} + y = y^2$ f) $\sin x \cos^2 y dx + \cos^2 x dy = 0$

g) $y dx + x dy = xy(dy - dx)$ h) $y dx = xy dx + x^2 dy$

3. Solve the initial value problem.

a) $e^y \left(\frac{dy}{dx} + 1 \right) = 1$, $y(0) = 1$ b) $(y^2 + 1) dx = \frac{dy}{x^3(x-1)}$, $y(2) = 0$

c) $(y^3 + 2y) dx = (3x + x^2) dy$, $y(1) = 1$

4. Find the general solution of the given differential equations. Find the singular solution if exist.

a) $x dy - y dx = \sqrt{xy} dx$ b) $\frac{dy}{dx} = \frac{2x - y}{x + 4y}$

c) $x \frac{dy}{dx} - y + \sqrt{y^2 - x^2} = 0$ d) $(y^2 + x^2) dx - xy dy = 0$

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

$$\text{f)} \quad x \frac{dy}{dx} - y - x \sin\left(\frac{y}{x}\right) = 0$$

$$\text{g)} \quad \frac{dy}{dx} = \frac{y}{x} + \cosh\left(\frac{y}{x}\right) = 0$$

5. Solve the initial value problem.

$$\text{a)} \quad \left(\frac{x}{y} + \frac{y}{x}\right) dy + dx = 0, \quad y(0) = -1 \quad \text{b)} \quad \left(xe^{\frac{y}{x}} + y\right) dx - xdy = 0, \quad y(1) = 0 \quad \text{c)}$$

$$\frac{dy}{dx} = \frac{x+y}{x-y}, \quad y(1) = 0$$

$$\text{d)} \quad \frac{dy}{dx} = \frac{y}{x} + \tan\left(\frac{y}{x}\right) = 0, \quad y(6) = \pi$$

$$\text{e)} \quad \frac{dy}{dx} = \frac{y}{x - 2\sqrt{x^2 + y^2}}, \quad y(0) = 1$$

$$\text{f)} \quad y^2(ydx - xdy) + x^3dx = 0, \quad y(1) = 3$$

6. Find the general solution of the given differential equations. Find the singular solution if exist.

$$\text{a)} \quad (x+y)dx - (x-y+2)dy = 0$$

$$\text{b)} \quad xdx + (x-2y+2)dy = 0$$

$$\text{c)} \quad (2x-y+1)dx + (x+y)dy = 0$$

$$\text{d)} \quad (x-y)dx + (y-x+1)dy = 0$$

$$\text{e)} \quad \frac{dy}{dx} = \frac{x+y-1}{x-y-1}$$

$$\text{f)} \quad (x+y)dx + (2x+2y-1)dy = 0$$

$$\text{g)} \quad (x-y+1)dx + (x-y-1)dy = 0$$

$$\text{g)} \quad (x+2y+2)dx - (2x+y-1)dy = 0$$

7. Solve the initial value problem.

$$\text{a)} \quad (3x-y+1)dx + (x-3y-5)dy = 0, \quad y(0) = 0$$

$$\text{b)} \quad (3x+y)dx + (4x-2y+1)dy = 0, \quad y\left(-\frac{1}{6}\right) = 0$$

$$\text{c)} \quad (2x+y)dx + (4x-2y+1)dy = 0, \quad y(0) = \frac{1}{2}$$

Yrd.Doç. Dr. Cemal ÇİÇEK