MATH142

Essentials of Engineering Mathematics

Problem 1

Show that the equation is separable and find the general solution.

$$2\frac{dy}{dx} = \left(y^2 - 1\right)\sin x.$$

Problem 2

Solve the initial value problem for the linear equation below

$$\frac{dy}{dx} = -\frac{1}{x}y + \sin x, \qquad y(\pi) = 1.$$

Problem 3

Show that the differential equation is exact and find the general solution.

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

Problem 4

Show that the differential equation is NOT exact and transform it into an exact equation.

$$\left(x^3 y - y\right) dx - x dy = 0$$

Problem 5

(a) Solve the homogeneous equation

$$\frac{dy}{dx} = \frac{x^2 + y^2}{xy}.$$

(b) Find an explicit solution of the initial value problem

$$\frac{dy}{dx} = \frac{x^2 + y^2}{xy}, \quad y(e) = 2e.$$

Problem 6

Find the general solution of the Bernoulli equation

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