University of Oum El Bouaghi

Faculty of Economic Sciences, Commercial Sciences and Management Sciences

First year, common trunk

Academic year : 2023-2024

Mathematics 2 Module
Series 01 (Ordinary Differential Equations).

Exercise 01. 1) Prove in each case that the given function is a solution of the accompanying equation :

$a)\ y' + y = e^{-x}$, $f(x) = xe^{-x}$

$b)\ y' = 1 - y$, $g(x) = \frac{1}{h(x)}, h(x) \neq 0$, such that $h(x)$ is the solution of : $y' = y - y^{\,2}$.

2) Find the value of the number a, b, c so that the function $p(x) = ax^2 + bx + c$ is a solution of the given ODE :

$$y' + y = x^2.$$

Exercise 02. Find the general solution by separation of variables:

$$1)\ y' = xy \quad , \quad 2)\ y' = x^2 y \quad , \quad 3)\ y' = (2x + 3x^2)(1 + y)$$

$$4)\ y' = \ln(x) y \quad , \quad 5)\ y' = \sin(x)\cos(x)\, y$$

Exercise 03. Solve each of the following or the solution satisfying the given initial condition.

1) $xy' \ln(x) = (3\ln(x) + 1)y,\ \ y(2) = 3.$

2) $(1 + e^x) y\, y' = e^x,\ \ y(0) = 1.$

3) $y'(x^2 - 1) - 2xy = 0$.

Exercise 04. Solve the following second-order ODE :

1. $y''(x) - 5\,y'(x) + 6\,y(x) = 0$
2. $y''(x) - y'(x) = 0$
3. $y''(x) + 4\,y'(x) + 4\,y(x) = 0$

4) $y'' + 3y' = 0,\ \ y(0) = 0,\ \ y(1) = 1$

Exercise 05. Find the solution of the following ODE :

1) $y'' - 3y' + 2y = x^2 - 3x.$
2) $y'' - 3y' + 2y = x^3.$
3) $y'' - 3y' = 2.$

------------------------ **Revision exercises** --

A) Solve :

1) $y'' + 2y' + y = 0,\ \ y(0) = 1,\ \ y'(0) = 0$

2. $y''(x) + 2\,y'(x) + y(x) = 4\,x\,e^x$

3) $y'' + y = 2cos^2(x).$

B) Find the ODE for which the function $y = c\, sin(x), c \in IR,$ is a solution.