

Laboratory 5: Solving Differential Equations with MAPLE

1. Find the general solution of the differential equations:

(a) $y' = 2x(1 + y^2)$

(b) $(x^2 - 1)y' + 2xy^2 = 0$

(c) $2x^2y' = x^2 + y^2$

(d) $y' = -\frac{x+y}{y}$

(e) $y' + y \operatorname{tg} x = \frac{1}{\cos x}$

(f) $y' + \frac{2}{x}y = x^3$

(g) $y'' + y = \sin x + \cos x$

(h) $y'' - y = e^{2x}$

(i) $y'' + 4y = \frac{1}{\cos 2x}$

(j) $y'' - y' = \frac{1}{1+e^x}$

2. Solve the following IVPs and draw the solution graph:

(a) $y' = 1 + y^2, y(0) = 1$

(b) $y' = \frac{1}{1-x^2}y + 1 + x, y(0) = 0$

(c) $y' - 2y = -x^2, y(0) = \frac{1}{4}$

(d) $y'' - 5y' + 4y = 0, y(0) = 5, y'(0) = 8;$

(e) $y'' - 4y' + 5y = 2x^2e^x, y(0) = 2, y'(0) = 3;$

(f) $y'' + 4y = 4(\sin 2x + \cos 2x), y(\pi) = y'(\pi) = 2\pi;$

3. Consider the differential equation

$$y'(x) + \frac{k}{x}y(x) = x^3,$$

where $k \in \mathbb{R}$. Find the general solution

(a) Find the general solution

(b) For $k = 1$ draw the solution curves

(c) For $k = 1$ solve the IVP $\begin{cases} y'(x) + \frac{k}{x}y(x) = x^3 \\ y(1) = 0 \end{cases}$ and draw the graph of solution

(d) Use `animate` command to see the dependence of the solution with respect to the parameter k .