
MATH 2400: Suggested Homework 1

For each of the following differential equations, find the order of the equation and classify it as ordinary (ODE) or partial (PDE) differential equation.

1. $y' = x + y$

2. $xy'' + y = \sin x$

3. $u_x = u_{yy}$

4. $\frac{\partial^3 y}{\partial x^3} + \frac{\partial^2 y}{\partial z^2} = y$

Find the general solutions of the following first-order linear differential equations:

5. $y' + y = xe^{-x} + 1$

6. $xy' + 2y = \sin x$

7. $y' + 2xy = 2xe^{-x^2}$

8. $(1 + x^2)y' + 4xy = \frac{1}{(1 + x^2)^2}$

Find the solutions of the following problems:

9. $y' + \frac{2}{x}y = \frac{\cos x}{x^2}, \quad y(\pi) = 0$

10. $x^2y' + 3xy = \frac{\sin x}{x}, \quad y(\pi) = 0$

11. $xy' + y = e^x, \quad y(1) = 1$

12. $y' + y = \frac{1}{1 + x^2}, \quad y(0) = 0$

13. Find the general solution of the equation

$$y' - \frac{1}{x}y = x$$

What happens to all the solutions as $x \rightarrow 0$?