IIITDM KANCHEEPURAM

MA1001 Differential Equations

Problem Set 1

1. Verify that the following functions (explicit or implicit) are solutions of the corresponding differential equations:

   (a) $y = c_1 e^{2x} + c_2 e^{-2x}$ $\quad y'' - 4y = 0$

   (b) $y = \sin^{-1} xy$ $\quad xy' + y = y'\sqrt{1 - x^2y^2}$

   (c) $x + y = \tan^{-1} y$ $\quad 1 + y^2 + y^2y' = 0$

2. Find the general solution of each of the following differential equations:

   (a) $y' = \log y$

   (b) $y' = xe^{x^2}$

   (c) $y' = \sin^{-1} x$

   (d) $(1 + x^3)y' = x$

   (e) $(1 + x^2)y' = \tan^{-1} x$

3. Find the general solution of each of the following differential equations by the variables separable method:

   (a) $xy' = (1 - x^2)\tan y$

   (b) $(1 + x^2)dy + (1 + y^2)dx = 0$

   (c) $y \log y dx - xdy = 0$

4. For each of the following differential equations, find the particular solution that satisfies the given initial condition:

   (a) $x(x^2 - 4)y' = 1$, $y = 0$ when $x = 1$.

   (b) $(x + 1)(x^2 + 1)y' = 2x^2 + x$, $y = 1$ when $x = 0$.

5. For each of the following differential equations, find the integral curve that passes through the given point:

   (a) $3\cos 3x \cos 2y\, dx - 2\sin 3x \sin 2y\, dy = 0$, $(\pi/12, \pi/8)$.

   (b) $y' = e^x \cos x$, $(0, 0)$.