PW/TP 1-2: Ordinary Differential Equations (CH2)

Exercise 1. Solve $(1 - x^2)y' = 4y; \ y(0) = 1$.

Exercise 2. Solve $(2y \sin x + 3y^4 \sin x \cos x)dx - (4y^3 \cos^2 x + \cos x)dy = 0$.

Exercise 3. Solve $x\dfrac{dy}{dx} + y = x^3 y^2$.

Exercise 4. Solve $x^2 \dfrac{dy}{dx} = x^2 + 3xy + y^2$.

Exercise 5. Solve $(xp - y)^2 = p^2 - 1$ with $p = y'$.

Exercise 6. Find the differential equation for (a) the family of straight lines which intersect at the point $(2, 1)$ and (b) the family of circles tangent to the x axis and having unit radius.

Exercise 7. Find differential equations for the following families of curves: (a) $x^2 + cy^2 = 1$, (b) $y^2 = ax + b$.

Exercise 8. Solve the following differential equations:

1. $x^3 y''' = 1 + x^4; \quad y(1) = y'(1) = y''(1) = 0$

2. $(x^2 + x - y^2)dx - ydy = 0$

3. $2x^2 y' = xy + y^3$

4. $xy'' - 3y' = x^2$

5. $\dfrac{dy}{dx} = \dfrac{3 - 4xy^2}{4x^2 y + 6y^2}; \quad y(1) = -1$

6. $y'^2 + (y - 1)y' - y = 0$

7. $xy' - 4y = x$

8. $(3y - 2xy^3)dx + (4x - 3x^2 y^2)dy = 0$

9. $y = px + 2p^2$, with $p = y'$

10. $(2y \sin x + 3y^4 \sin x \cos x)dx - (4y^3 \cos^2 x + \cos x)dy = 0$

11. $\dfrac{dy}{dx} = \dfrac{2y}{x} - \dfrac{y^2}{x^2}$

12. $(x - y)y' + 3y - 5x = 0$

13. $y'' + 4y = 0$

14. $\dfrac{dy}{dx} = x^2 + 2xy + y^2 + 2x + 2y; \quad y(0) = 0$

15. $x^2 y = x^3 p - yp^2$, with $p = y'$

16. $\dfrac{dy}{dx} + 2y \cot x = \csc x$

17. $\dfrac{dy}{dx} = \dfrac{x\sqrt{1 - y^2}}{y\sqrt{1 - x^2}}$

18. $(ye^x - e^{-y})dx + (xe^{-y} + e^x)dy = 0$