1. Solve the following initial value problem:
$$y' = y^2 \sin x, \ y(0) = 1.$$

2. Solve the following initial value problem:
$$y' = e^{y-x}, \ y(1) = 1.$$

3. Solve the following initial value problem:
$$y' = \frac{y}{x} + \frac{y^2}{x^2}, \ y(1) = -1$$

4. Give the general solution for the following differential equation:
$$y' - \frac{2}{x} \cdot y = x^2 + 1.$$

5. Give the general solution for the following differential equation:
$$xy' = 3y + x^4.$$

6. Give the general solution for the following differential equation:
$$e^x(y' + y) = 1.$$

7. Give the general solution for the following differential equation:
$$(2x - 3y) + (2y - 3x)y' = 0.$$

8. Give the equilibrium solution of the following differential equation, describe them from stability point of view and sketch their graphs:
$$y' = (2 - y) \ln y.$$

9. Solve the following initial value problem:
$$y''y - (y')^2 = 0, \qquad y(0) = 0, \ y'(0) = 3.$$

10. Give the general solution for the following differential equation:
$$y'' + y' - 2y = e^{-t}.$$

11. Give the general solution for the following differential equation: :
$$y'' - y = \cos x$$

12. Give the general solution for the following differential equation: :
$$y'' + y = \cos x$$

13. Give the general solution for the following differential equation: :
$$y'' + 2y' + 2y = \cos x - 2 \sin x.$$

14. Give the general solution for the following differential equation:
$$y'' - 2y' + y = e^x$$

15. One solution of the differential equation
$$x^2 y'' - 3xy' + 4y = 0$$
is $y_1 = x^2$. Find the general solution.

16. Solve the differential equation
$$y'' - y = e^x$$
by applying the variation of parameters (or, variation of constants) method.

17. Solve the differential equation
$$y'' - y = e^x$$
by applying the trial function (or, undetermined coefficients) method.