

1. Solve these separable ODEs:

- a)  $xy' = y, \quad y(2) = 3$
- b)  $xy' - xy = y, \quad y\left(\frac{1}{2}\right) = \frac{1}{2}$
- c)  $ydy + (xy^2 - 8x)dx = 0, \quad y(1) = 3$
- d)  $x(1 + y)y' + y = 0, \quad y(1) = 1$

2. Solve the following inhomogeneous linear first-order ODEs by method of variation of constants

- a)  $y' + y = e^x$
- b)  $y' + y \cos x = \sin 2x$
- c)  $(x \ln x)y' + y \tanh x = \ln x$
- d)  $2xy' + y = 2x^{5/2}$

3. Solve the following first-order ODEs using the method of integrating factors and others

- a)  $y' + y = xy^{2/3}$
- b)  $3xy^2y' + 3y^3 = 1$
- c)  $(x - y)dy + (y + x + 1)dx = 0$
- d)  $y' = \cos(x + y)$

4. Solve the following linear second-order homogeneous ODEs

- a)  $y'' + y' - 2y = 0$
- b)  $y'' + y = 0$
- c)  $y'' - 2y' = 0$
- d)  $y'' + 2y' + 2y = 0$

5. Solve the following linear second-order non-homogeneous ODEs

- a)  $y'' - 4y = 10$
- b)  $y'' + y' - 2y = e^{2x}$
- c)  $y'' - 16y = 40e^{4x}$
- d)  $y'' + 16y = 16 \cos 4x$