

## Review

1. Solve the initial value problem

$$y' = x^2y + 2xy + 2y, y(0) = 3.$$

2. Solve the differential equation

$$\frac{dy}{dx} = 2xe^{x^2+y}.$$

3. Solve the initial value problems

$$\begin{aligned}y' + 3y &= 4, & y(0) &= 5, \\y' + \frac{1}{t+1}y &= 1, & y(0) &= 0, \\y' - y \tan t &= \sec t, & y(\pi/4) &= 1, \\ty' + 2y &= 4t^2, & y(1) &= 2.\end{aligned}$$

7. For each of the following differential equations determine if it is exact or not. If it is not exact, see if you can find an integrating factor, then solve it:

$$\begin{aligned}\frac{dy}{dx} &= \frac{9x^2 - 2xy}{x^2 + 2y + 1}, \\(3x^2y + 2xy + y^3)dx &+ (x^2 + y^2)dy = 0, \\\frac{x^2 + y^2}{x + 1}dx &+ 2ydy = 0, \\2xy^2 + 4 &= (6 - 2x^2y)y'\end{aligned}$$

11. Solve the differential equations

$$\begin{aligned}y'' + 11y' + 30y &= 0, \\y'' - 12y' + 36y &= 0, \\y'' + y' + y &= 0.\end{aligned}$$

12. Solve the initial value problems

$$\begin{aligned}y'' - 4y &= 0, & y(0) &= 2, y'(0) = 5, \\y'' - 4y' + 4y &= 0, & y(0) &= 4, y'(0) = -1.\end{aligned}$$

13. Solve the differential equations

$$y'' + 2y' + y = e^t,$$

$$y'' - 6y' = \sin 2t,$$

$$y'' + 6y' + 13y = t + 5,$$

$$y'' + y = \sec^2 t,$$

$$y'' - 2y' + y = \frac{e^t}{t^2 + 1}$$

$$y'' + 3y' + 2y = \frac{1}{1 + e^x}.$$

14. Solve the differential equations

$$x^2 y'' - 3xy' + 10y = 0,$$

$$x^2 y'' - 5xy' + 12y = 0.$$

15. Solve the initial value problems

$$\begin{aligned} x^2 y'' + 3xy' + y &= 0, & y(1) &= 0, y'(1) = 1, \\ x^2 y'' + 5xy' + 3y &= 0, & y(1) &= -3, y'(1) = 1. \end{aligned}$$

16. Using the method of the Laplace transform, solve the following initial value problems

$$y'' + 4y = \sin 2t, \quad y(0) = 1, y'(0) = 0,$$

$$y'' + 4y' = \begin{cases} e^t & t < 2, \\ 0 & t \geq 2 \end{cases}, \quad y(0) = 0, y'(0) = 1,$$

$$y' - 5y = \begin{cases} t & t < 3, \\ 0 & t \geq 3 \end{cases}, \quad y(0) = -1, y'(0) = 0,$$

$$y''' - 2y'' - y' + 2y = 0, \quad y(0) = 1, y'(0) = 2, y''(0) = -1,$$

$$y''' + y'' + y' + y = e^{-t}, \quad y(0) = y'(0) = y''(0) = 0.$$