Handout 9: Solving Second Order Differential Equations

Find the solution for each of the differential equations listed below. In each case you should create a characteristic equation, find the roots and use the roots to create your solution. You may use any convenient letter to represent the independent variable. (In the answers at the end we have used *t*.)

Use the initial values given to determine any arbitrary constants in the solutions. Answers are provided at the end so that you can check your work.

(a) $y'' - 2y' - 3y = 0$ $y(0) = 2$ $y'(0) = 14$

(b) $y'' + 4y' + 5y = 0$ $y(0) = 2$ $y'(0) = -5$

(c) $y'' + \pi \cdot y' = 0$ $y(0) = 3$ $y'(0) = -\pi$

(d) $10y'' + 5y' + 0.625y = 0$ $y(0) = 2$ $y'(0) = -4.5$

Answers

(a) $y(t) = 4e^{3t} - 2e^{-t}$ **(b)** $y(t) = 2e^{-2t}\cos(t) - e^{-2t}\sin(t)$

(c) $y(t) = 2 + e^{-\pi t}$ **(d)** $y(t) = 2e^{-t/4} - 4t \cdot e^{-t/4}$