

1. From $4m^2 + m = 0$ we obtain $m = 0$ and $m = -1/4$ so that $y = c_1 + c_2e^{-x/4}$.

3. From $m^2 - m - 6 = 0$ we obtain $m = 3$ and $m = -2$ so that $y = c_1e^{3x} + c_2e^{-2x}$.

5. From $m^2 + 8m + 16 = 0$ we obtain $m = -4$ and $m = -4$ so that $y = c_1e^{-4x} + c_2xe^{-4x}$.

7. From $12m^2 - 5m - 2 = 0$ we obtain $m = -1/4$ and $m = 2/3$ so that $y = c_1e^{-x/4} + c_2e^{2x/3}$.

9. From $m^2 + 9 = 0$ we obtain $m = 3i$ and $m = -3i$ so that $y = c_1 \cos 3x + c_2 \sin 3x$.

11. From $m^2 - 4m + 5 = 0$ we obtain $m = 2 \pm i$ so that $y = e^{2x}(c_1 \cos x + c_2 \sin x)$.

13. From $3m^2 + 2m + 1 = 0$ we obtain $m = -1/3 \pm \sqrt{2}i/3$ so that

$$y = e^{-x/3}[c_1 \cos(\sqrt{2}x/3) + c_2 \sin(\sqrt{2}x/3)].$$

15. From $m^3 - 4m^2 - 5m = 0$ we obtain $m = 0$, $m = 5$, and $m = -1$ so that

$$y = c_1 + c_2e^{5x} + c_3e^{-x}.$$

31. From $m^2 - 4m - 5 = 0$ we obtain $m = -1$ and $m = 5$, so that $y = c_1e^{-t} + c_2e^{5t}$. If $y(1) = 0$ and $y'(1) = 2$, then $c_1e^{-1} + c_2e^5 = 0$, $-c_1e^{-1} + 5c_2e^5 = 2$, so $c_1 = -e/3$, $c_2 = e^{-5}/3$, and $y = -\frac{1}{3}e^{1-t} + \frac{1}{3}e^{5t-5}$.