Real, Distinct Roots
1. Find the general solution to: \(3y'' + 2y' - 25y = 0\).

2. Solve the following IVP
\[9y'' - y = 0 \quad \text{with} \quad y(1) = -8, \quad y'(1) = 2\]

3. Solve the following IVP
\[3y'' - 14y' + 8y = 0 \quad \text{with} \quad y(0) = -2, \quad y'(0) = 4\]

4. Solve the following IVP in terms of \(\beta\) and determine the value of \(\beta\) for which the solution will stay finite at \(t \to \infty\). Clearly describe your reasoning for your work in determine the value of \(\beta\).
\[y'' + 9y' - 22y = 0 \quad \text{with} \quad y(0) = -\beta, \quad y'(0) = 4 + 3\beta\]

Complex Roots
For problems 5 & 6 solve the given IVP.
5. \(y'' + 2y' + 10y = 0\) \(\text{with} \quad y\left(\frac{\pi}{2}\right) = 0, \quad y'\left(\frac{\pi}{2}\right) = -6\)

6. \(4y'' - 4y' + 101y = 0\) \(\text{with} \quad y(0) = -3, \quad y'(0) = 0\)

Double Roots
For problems 7 & 8 solve the given IVP
7. \(y'' - 18y' + 81y = 0\) \(\text{with} \quad y(-2) = 1, \quad y'(-2) = 8\)

8. \(4y'' + 20y' + 25y = 0\) \(\text{with} \quad y(0) = 3, \quad y'(0) = -15\)