Problem 1.
Find the initial value of $df(t)/dt$ when the Laplace transform of $\ddot{f} + \dot{f} + f = \beta$ is given by

$$F(s) = L[f(t)] = \frac{2s + 1}{s^2 + s + 1}$$

And $\beta$ is a constant. What is the value of $f(0)$?

Problem 2.
Find the inverse Laplace transform of

$$F(s) = \frac{5(s + 2)}{s^2(s + 1)(s + 4)}$$

Problem 3.
Find the inverse Laplace transform of

$$F(s) = \frac{s^3 + 5s^2 + 9s + 7}{(s^2 + 3s + 2)}$$

Problem 4.
Find the inverse Laplace transform of

$$F(s) = \frac{2(s + 6)}{(s^2 + 2s + 5)}$$

Problem 5.
Find the inverse Laplace transform of

$$F(s) = \frac{s^2 + 2s + 3}{(s + 1)^3}$$

Problem 6.
Find the solution to the differential equation

$$\ddot{x} + 3\dot{x} + 2x = 0, \quad x(0) = a, \quad \dot{x}(0) = b$$

Problem 7.
Solve the following differential equation:

$$\ddot{x} + 2\dot{x} + 5x = 3, \quad x(0) = 0, \quad \dot{x}(0) = 0$$

Problem 8.
Solve the following differential equation:

$$\ddot{x} + 2\dot{x} + 9x = e^{-t}, \quad x(0) = 0, \quad \dot{x}(0) = 0$$

the forcing function $e^{-t}$ is given at $t = 0$ when the system is at rest.