**Problems 1,2:** Use Laplace transforms to solve the initial value problem

    **1.** $y'' + y = \sin t$,    $y(0) = 1$,    $y'(0) = 2$

    **2.** $y'' - 4y' + 4y = t^2 e^{2t}$,    $y(0) = 0$,    $y'(0) = 0$

**Problems 3,4:** Express the function $f(t)$ in terms of the Heaviside function $\mathscr{U}$ and then find the Laplace transform $\mathscr{L}\{f\}$.

    **3.** $f(t) = \begin{cases} 2 & 0 \le t < 3 \\ -2 & 3 \le t \end{cases}$

    **4.** $f(t) = \begin{cases} 0 & 0 \le t < 3\pi/2 \\ \sin t & 3\pi/2 \le t \end{cases}$

**Problems 5-7:** Use Laplace transforms to solve the initial-value problems.

    **5.** $y'' + 4y = f(t)$,    $y(0) = 0$,    $y'(0) = -1$,    where $f(t) = \begin{cases} 1 & 0 \le t < 1 \\ 0 & 1 \le t \end{cases}$

    **6.** $y'' + 2y + y = f(t)$,    $y(0) = 2$,    $y'(0) = 1$,    where $f(t) = \begin{cases} 0 & 0 \le t < 3 \\ 2(t - 3) & 3 \le t \end{cases}$

    **7.** $y'' + y = \sin t + \delta(t - \pi)$,    $y(0) = 0$,    $y'(0) = 0$