INSTRUCTIONS: PLEASE READ CAREFULLY
Write your name and section number above. 5 pts will deducted if either is missing or illegible.
Write your final answers in the space provided. Show your work on attached sheets.
Place your table of Laplace transforms cheat sheet at the end and staple together in the upper-left corner.

Problem 1: (40 points) Use Laplace transforms to solve the initial value problem

$$y'' + 2y' + 10y = 2\delta(t - 2), \quad y(0) = y'(0) = 0$$

Problem 2: (40 points) Determine the Laplace transform or inverse Laplace transform.

(a) $\mathscr{L}^{-1}\{e^{-cs}\} =$

(b) $\mathscr{L}^{-1}\left\{\dfrac{1}{(s-2)(s+3)}\right\} =$

(c) $\mathscr{L}^{-1}\left\{e^{-bs}\dfrac{1}{(s-c)^m}\right\} =$ for positive integer m

(d) $\mathscr{L}\left\{\mathscr{U}(t - \pi/2)\sin 2t\right\} =$

Problem 3: (20 points) Express the following functions in terms of Heaviside functions.

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

(b) $f(t) = \begin{cases} t^2 - 2 & 0 \le t < 5 \\ 0 & 5 \le t \end{cases}$

Extra credit: (10 points) Consider these two initial value problems. You do not need to solve for $y(t)$.

(a) $y'' + y = \delta(t), \quad y(0) = 0, \quad y'(0) = 0$

(b) $y'' + y = 0, \quad\quad y(0) = 0, \quad y'(0) = 1$

There is something quite strange about these problems. What is it? Does this indicate a problem with the method of Laplace transforms? Explain.