Consider the initial value problem \( y'' + y = f(t), \quad y(0) = 0, \quad y'(0) = 1, \) where \( f(t) = \begin{cases} 2t, & 0 \leq t \leq 1 \\ 2, & t > 1 \end{cases} \)

1. Sketch \( f(t) \), and write it using the Heaviside function.

2. Take the Laplace transform of the differential equation, and solve for \( Y(s) \).
3. Use partial fractions to decompose $Y(s)$ into four terms. [Note: \( \frac{1}{s^2(s^2+1)} = \frac{1}{s^2} - \frac{1}{s^2+1} \)]

4. Apply the inverse Laplace transform to each term and write the solution to the IVP using the Heavyside function.

5. Write the solution as a piecewise function (i.e., not using the Heavyside function).