1. Use the definition to find the Laplace transforms of
   (a) $f(t) = e^{at}$ where a is a non zero real number.
   (b) $f(t) = \begin{cases} 5-t & 0 \leqslant t < 2 \\ 3t & 2 \leqslant t. \end{cases}$

2. Find the inverse Laplace transform of
   (a) $F(s) = \dfrac{4}{(s-2)^5}$.
   (b) $F(s) = \dfrac{8s^2 - 4s + 12}{s(s^2+4)}$.
   (c) $F(s) = \dfrac{2s-3}{s^2+2s+10}$.

3. Use the Laplace transform to solve the given initial value problem
   (a) $y'' + 3y' + 2y = 4t, \quad y(0) = 1, \quad y'(0) = 0.$
   (b) $y'' + 9y = \cos 2t, \quad y(0) = 0, \quad y'(0) = 1.$

4. Express $f(t)$ in terms of the unit step function $u_c(t)$ and find its Laplace transform.
   (a) $f(t) = \begin{cases} t^2, & 0 \leqslant t < 2 \\ e^t, & 2 \leqslant t \end{cases}$.
   (b) $f(t) = \begin{cases} 2, & 0 \leqslant t < 3 \\ 5t^2, & 3 \leqslant t < 8 \\ 3\cos(t-8), & 8 \leqslant t \end{cases}$.

5. Find the inverse Laplace transform of the given functions
   (a) $F(s) = \dfrac{s + 3se^{-5s}}{s^2 - 4s + 3}$
   (b) $F(s) = \dfrac{(2s-1)e^{-s}}{s^2 - 2s + 2}$.

6. Find the solution to the given initial value problem
   (a) $y'' + 3y' + 2y = \begin{cases} 1, & 0 \leqslant t < 10 \\ 0, & 10 \leqslant t \end{cases}, \quad y(0) = 0, \quad y'(0) = 0.$
   (b) $y'' + 4y = u_\pi(t) - u_{3\pi}(t), \quad y(0) = 1, \quad y'(0) = -2$
   (c) $y'' + 2y' + 5y = \sin(t) + u_\pi(t)\cos(t-\pi), \quad y(0) = 0, \quad y'(0) = 0.$