Part I Problems

Problems 1 and 2 are about the system

\[ p(D)x = f(t) \]  

(1)

with rest IC’s and with input \( f(t) \).

**Problem 1:** In each of the following cases, find \( p(D) \) such that \( w(t) \) is the system unit impulse response.

(a) \( w(t) = e^{-at} \).
(b) \( w(t) = \frac{1}{3} e^{-t/2} \sin t \).
(c) \( w(t) = 1 \).

**Problem 2:** For \( p(D) = D^2 + 4 \):

(a) Find the system function \( W(s) \);
(b) Find the weight function \( w(t) \);
(c) Write down the convolution integral formula for the solution to the IVP (1).