

## Part I Problems

Problems 1 and 2 are about the system

$$p(D)x = f(t) \tag{1}$$

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).

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