

Problem 1

$$(1) \quad Y(s) = H(s) X(s)$$

$$s^2 Y(s) + 3s Y(s) + 2Y(s) = 2s X(s) + 3X(s)$$

$$y''(t) + 3y'(t) + 2y(t) = 2x'(t) + 3x(t)$$

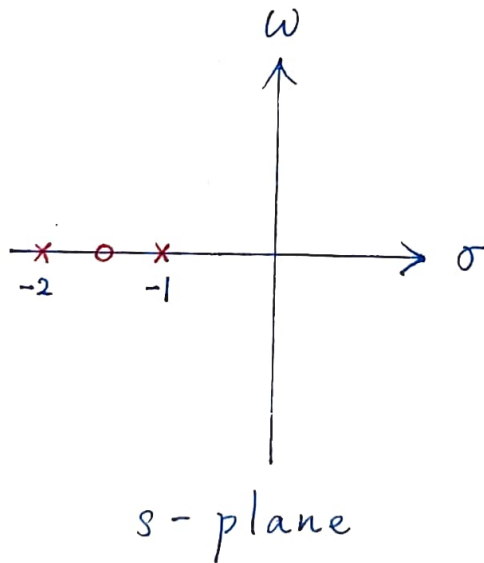
$$(2) \text{ pole: } s^2 + 3s + 2 = 0$$

$$(s+1)(s+2) = 0$$

$$s = -1, -2$$

$$\text{zero: } 2s + 3 = 0$$

$$s = \frac{-3}{2}$$

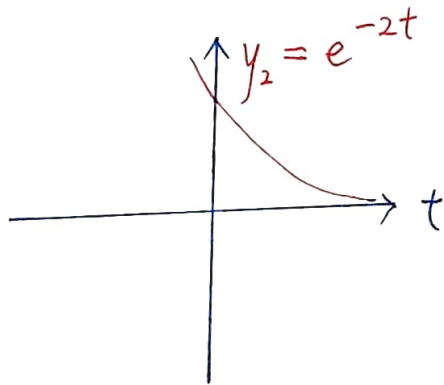
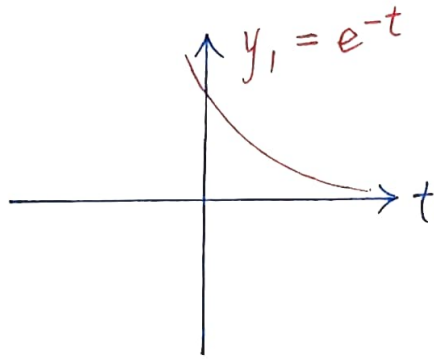


Problem 1 (continued)

(3) pole : $-1, -2$

$$y_h = c_1 e^{-1t} + c_2 e^{-2t}$$

(4)



Nyquist stability criteria

Stable system

Problem 2

$$(1) \quad Y(s) = H(s) X(s)$$

$$s^2 Y(s) - s Y(s) - 2 Y(s) = 2s X(s) - X(s)$$

$$y''(t) - y'(t) - 2y(t) = 2x'(t) - x(t)$$

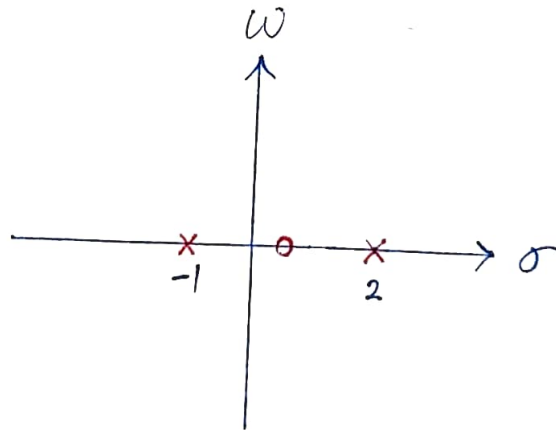
$$(2) \text{ pole: } s^2 - s - 2 = 0$$

$$(s - 2)(s + 1) = 0$$

$$s = 2, -1$$

$$\text{zero: } 2s - 1 = 0$$

$$s = \frac{1}{2}$$



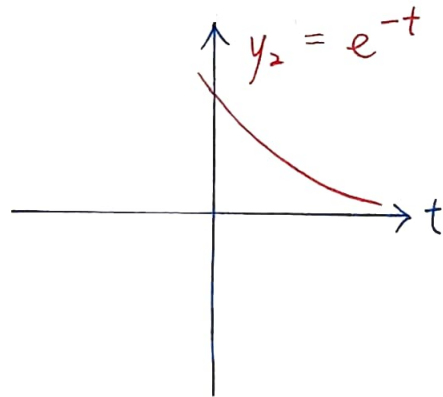
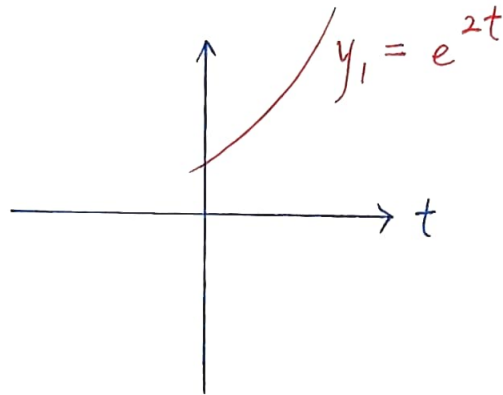
s - plane

Problem 2 (continued)

(3) pole : 2, -1

$$y_h = c_1 e^{2t} + c_2 e^{-1t}$$

(4)



Nyquist stability criteria

Unstable system

Problem 3

$$(1) \quad Y(s) = H(s) X(s)$$

$$s^2 Y(s) - 3s Y(s) + 2 Y(s) = 2s X(s) - 3 X(s)$$

$$y''(t) - 3y'(t) + 2y(t) = 2x'(t) - 3x(t)$$

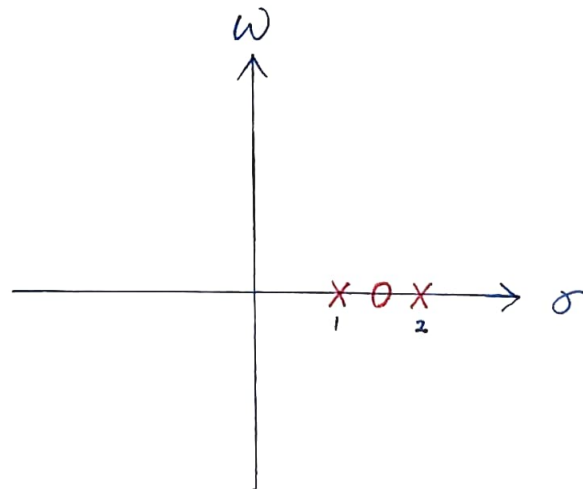
$$(2) \text{ pole: } s^2 - 3s + 2 = 0$$

$$(s - 2)(s - 1) = 0$$

$$s = 2, 1$$

$$\text{zero: } 2s - 3 = 0$$

$$s = \frac{3}{2}$$



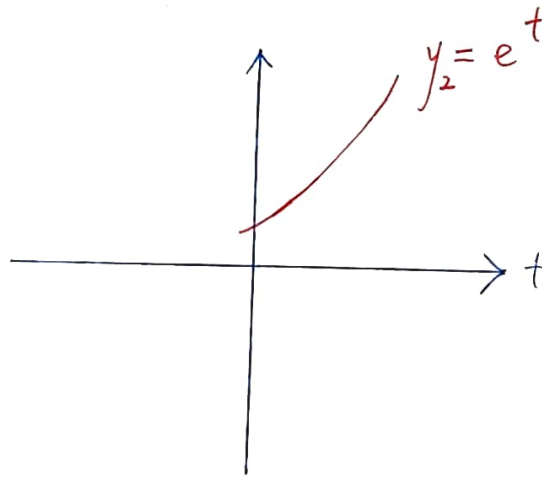
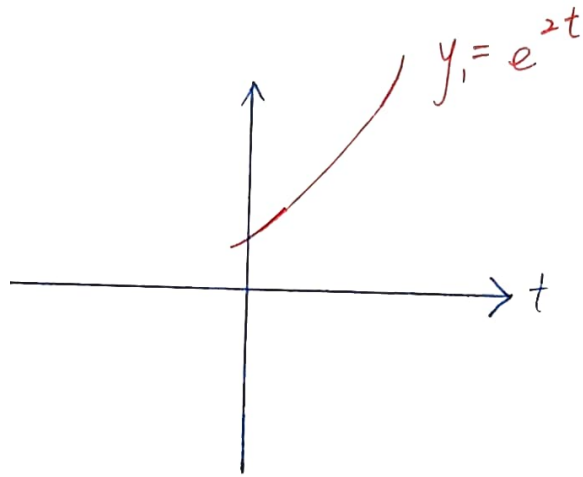
s-plane

Problem 3 (continued)

(3) pole : 2, 1

$$y_h = c_1 e^{2t} + c_2 e^{1t}$$

(4)



Nyquist stability criteria

Unstable system