

13.17 Given the following functions $F(s)$, find $f(t)$.

$$(a) \quad F(s) = \frac{s(s+6)}{(s+3)(s^2+6s+18)}$$

$$(b) \quad F(s) = \frac{(s+4)(s+8)}{s(s^2+4s+8)}$$

SOLUTION:

$$a) \quad F(s) = \frac{s(s+6)}{(s+3)(s+3-j3)(s+3+j3)} = \frac{k_1}{s+3} + \frac{k_2}{s+3-j3} + \frac{k_2^*}{s+3+j3}$$

$$k_1 = \frac{-3(-3+6)}{(-j3)(j3)} = -1 \quad k_2 = \frac{(3+j3)(-3+j3+6)}{(3+j3+3)(j6)} = 1 \Rightarrow k_2^* = 1$$

$$F(s) = \frac{-1}{s+3} + \frac{1}{s+3-j3} + \frac{1}{s+3+j3}$$

$$f(t) = [-e^{-3t} + 2e^{-3t} \cos(3t)] u(t)$$

$$b) \quad F(s) = \frac{(s+4)(s+8)}{s(s+2-j2)(s+2+j2)} = \frac{k_1}{s} + \frac{k_2}{s+2-j2} + \frac{k_2^*}{s+2+j2}$$

$$k_1 = \frac{4(8)}{(2-j2)(2+j2)} = 4 \quad k_2 = \frac{(2+j2)(6+j2)}{(-2+j2)(j4)} = 1.58 \angle -162^\circ$$

$$f(t) = [4 + 3.16e^{-2t} \cos(2t - 162^\circ)] u(t)$$