

**Problem 13 in Section 7.3.** Find the inverse Laplace transform of  $F(s) = \frac{5-2s}{s^2+7s+10}$ .

**Solution.** We notice that  $s^2 + 7s + 10 = (s+2)(s+5)$ . We apply the technique of partial fractions to see

$$\frac{5-2s}{s^2+7s+10} = \frac{A}{s+2} + \frac{B}{s+5}.$$

Multiply both sides by  $(s+2)(s+5)$

$$5-2s = A(s+5) + B(s+2).$$

Plug in  $s = -2$  to learn that  $A = 3$ . Plug in  $s = -5$  to learn  $B = -5$ . Observe that

$$\frac{5-2s}{s^2+7s+10} = \frac{3}{s+2} + \frac{-5}{s+5}.$$

We compute

$$\mathcal{L}^{-1}\left(\frac{5-2s}{s^2+7s+10}\right) = \mathcal{L}^{-1}\left(\frac{3}{s+2} + \frac{-5}{s+5}\right) = \boxed{3e^{-2t} - 5e^{-5t}}.$$