

**Homework 22.** *Chapter 15.*

- 2.2  $(e^{-at} - e^{-bt})/(b - a) \mapsto (1/(p + a) - 1/(p + b))/(b - a) = 1/(p + a)(p + b)$ .  $(ae^{-at} - be^{-bt})/(a - b) \mapsto (a/(p + a) - b/(p + b))/(a - b) = p/(p + a)(p + b)$ .
- 2.3  $\sinh(at) = i \sin(ta/i)$ , so by L3 its Laplace transform is  $i(a/i)/(p^2 + (a/i)^2) = a/(p^2 - a^2)$ .  $\cosh(at) = (e^{at} + e^{-at})/2$ , so by L2 its Laplace transform is  $(1/(p - a) + 1/(p + a))/2 = p/(p^2 - a^2)$ .
- 2.4 The Laplace transform of  $\cos(at)$  is  $p/(a^2 + p^2)$ . Differentiating with respect to  $a$  gives formula L12.
- 2.5 The Laplace transform of  $\sin(at)$  is  $a/(a^2 + p^2)$ . Integrating with respect to  $a$  gives formula L19.
- 2.8  $e^{-2t}(1 - t)$
- 2.9  $(5 - 2p)/(p^2 + p - 2) = -3/(p + 2) + 1/(p - 1)$ , so its inverse Laplace transform is  $-3e^{-2t} + e^t$
- 2.10  $e^t \sin(3t)/3 + 2e^t \cos(3t)$
- 2.15 See hint.
- 2.16 Applying L32 to L3 gives L11 immediately.
- 2.21  $2b(p + a)/((p + a)^2 + b^2)^2$
- 2.22  $((p + a)^2 - b^2)/((p + a)^2 + b^2)^2$
- 2.23  $y = te^{-2t}(\cos(t) - \sin(t))$ .