

Exercise 7.1

16. Solution: $\mathcal{L}\{e^t \cos t\} = \frac{s-1}{s^2-2s+2}, s > 1.$

31. Solution: $\mathcal{L}\{4t^2 - 5 \sin 3t\} = 4\frac{2}{s^3} - 5\frac{3}{s^2+9}.$

40. Hint: $\cos(t - \frac{\pi}{6}) = \frac{\sqrt{3}}{2} \cos t + \frac{1}{2} \sin t$. Solution: $5 \times \frac{\sqrt{3}s+1}{s^2+1}.$

50. Hint: use the superposition principle.

Exercise 7.2

24. Solution: $\frac{1}{2} - e^t - \frac{1}{3}e^{-t} + \frac{5}{6}e^{2t}.$

38. Solution: $y = \frac{1}{13}e^t - \frac{1}{13}\cos 5t + \frac{5}{13}\sin 5t.$

51. Solution: zero-input response is $\frac{5}{4} - \frac{1}{4}e^{4t}$, zero-state response is $\frac{27}{20}e^{4t} - 2e^{3t} + \frac{5}{4} - \frac{3}{5}e^{-t}.$

Exercise 7.3

16. Solution: $y = 2e^{-3t} \cos 5t - \frac{1}{5}e^{-3t} \sin 5t.$

29. Solution: $y = \frac{1}{2} - \frac{1}{2}e^t \cos t + \frac{1}{2}e^t \sin t.$

48. Solution: $y = -\mathcal{U}(t-2) - (t-2)\mathcal{U}(t-2) + e^{t-2}\mathcal{U}(t-2).$

56. Solution: $\mathcal{L}\{f(t)\} = \frac{1}{s} - \frac{e^{-4s}}{s} + \frac{e^{-5s}}{s}.$

82. Solutions: (a) $e^{-s}\left(\frac{2}{s^2} + \frac{3}{s}\right)$ (b) $\frac{e^{-5(s-1)}}{s-1}$ (c) $-\frac{se^{-\pi}}{s^2+1}$ (d) $e^{-2s}\left(\frac{2}{s^3} + \frac{1}{s^2} + \frac{2}{s}\right).$