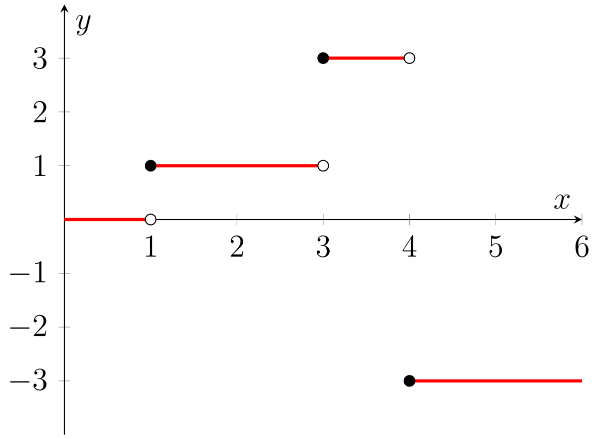
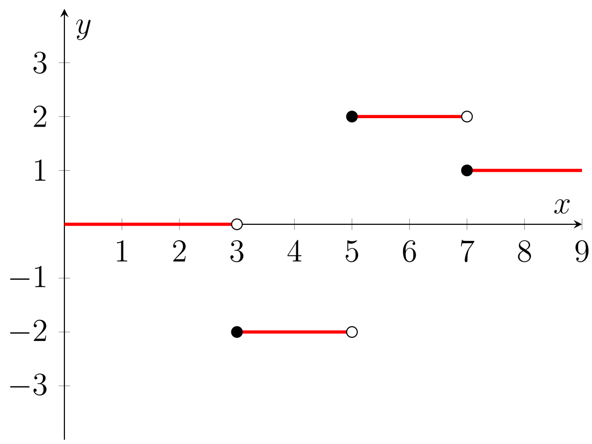
1.) $g(t) = u_1(t) + 2u_3(t) - 6u_4(t)$

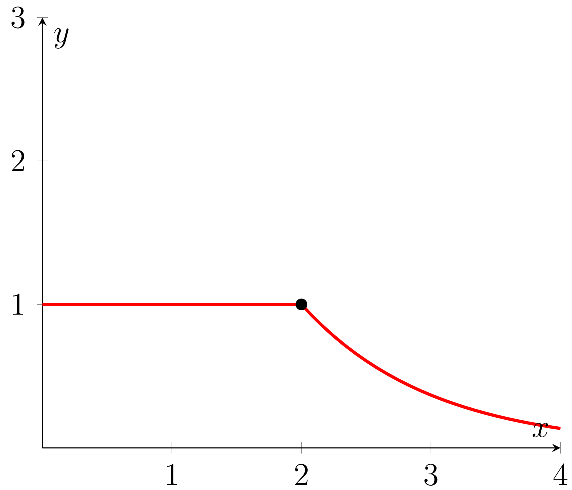


5.) $f(t) = \begin{cases} 0, & 0 \le t < 3 \\ -2, & 3 \le t < 5 \\ 2, & 5 \le t < 7 \\ 1, & t \ge 7 \end{cases}$



$f(t) = -2u_3(t) + 4u_5(t) - u_7(t)$

7.) $f(t) = \begin{cases} 1, & 0 \le t < 2 \\ e^{-(t-2)}, & t \ge 2 \end{cases}$



$f(t) = 1 + (e^{-(t-2)} - 1)u_2(t)$

9.)

$$\mathcal{L}\left[(t-2)^2 u_2(t)\right] = e^{-2s}\mathcal{L}\left[t^2\right] = \frac{2e^{-2s}}{s^3}$$

12.)

$$\mathcal{L}\left[(t-3)u_2(t) - (t-2)u_3(t)\right] = e^{-2s}\mathcal{L}\left[t-1\right] - e^{-3s}\mathcal{L}\left[t+1\right]$$
$$= e^{-2s}\left(\frac{1}{s^2} - \frac{1}{s}\right) - e^{-3s}\left(\frac{1}{s^2} + \frac{1}{s}\right) = \frac{(1-s)e^{-2s} - (1+s)e^{-3s}}{s^2}$$

14.)

$$\mathcal{L}^{-1}\left[\frac{1}{s^2+s-2}\right] = \mathcal{L}^{-1}\left[\frac{1}{(s-1)(s+2)}\right] = \frac{1}{3}\mathcal{L}^{-1}\left[\frac{1}{s-1} - \frac{1}{s+2}\right] = \frac{1}{3}\left(e^t - e^{-2t}\right)$$
$$\therefore\ \mathcal{L}^{-1}\left[\frac{e^{-2s}}{s^2+s-2}\right] = \frac{1}{3}u_2(t)\left(e^{t-2} - e^{-2(t-2)}\right)$$

15.)

$$\mathcal{L}^{-1}\left[\frac{2(s-1)}{s^2-2s+2}\right] = 2\mathcal{L}^{-1}\left[\frac{s-1}{(s-1)^2+1}\right] = 2e^t\cos t$$
$$\therefore\ \mathcal{L}^{-1}\left[\frac{2(s-1)e^{-2s}}{s^2-2s+2}\right] = 2u_2(t)e^{t-2}\cos(t-2)$$

16.)

$$\mathcal{L}^{-1}\left[\frac{e^{-s} + e^{-2s} - e^{-3s} - e^{-4s}}{s}\right] = u_1(t) + u_2(t) - u_3(t) - u_4(t)$$