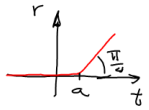
# Sectional continous functions

slope function

$$r(t-a) = \begin{cases} 0 ; & t < a \\ (t-a) ; & t > a \end{cases} = (t-a)\cdot u(t-a)$$

$$\mathcal{L}\{r(t-a)\} = \frac{e^{-as}}{s^2} \qquad r(t-a)\Big|_{t=0} = 0.$$




---

$$\mathcal{L}\{r'(t-a)\} = s\mathcal{L}\{r(t-a)\} - r(t-a)\Big|_{t=0}$$

$$\mathcal{L}\{r'(t-a)\} = s\left[\frac{e^{-as}}{s^2}\right] - (0)$$

$$\mathcal{L}\{r'(t-a)\} = \frac{e^{-as}}{s}$$

---

$$\mathcal{L}\{u(t-a)\} = \frac{e^{-as}}{s}$$

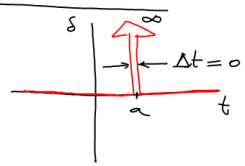
step function


$$\mathcal{L}\{r'(t-a)\} = \mathcal{L}\{u(t-a)\} \qquad u(t-a)\Big|_{t=0} = 0$$

$$r'(t-a) = u(t-a)$$

---

$$\delta(t-a) = \begin{cases} \infty ; & t = a \\ \int_{-\infty}^{\infty} \delta\, dt = 1 \end{cases}$$




$$\mathcal{L}\{\delta(t-a)\} = e^{-as}$$

---

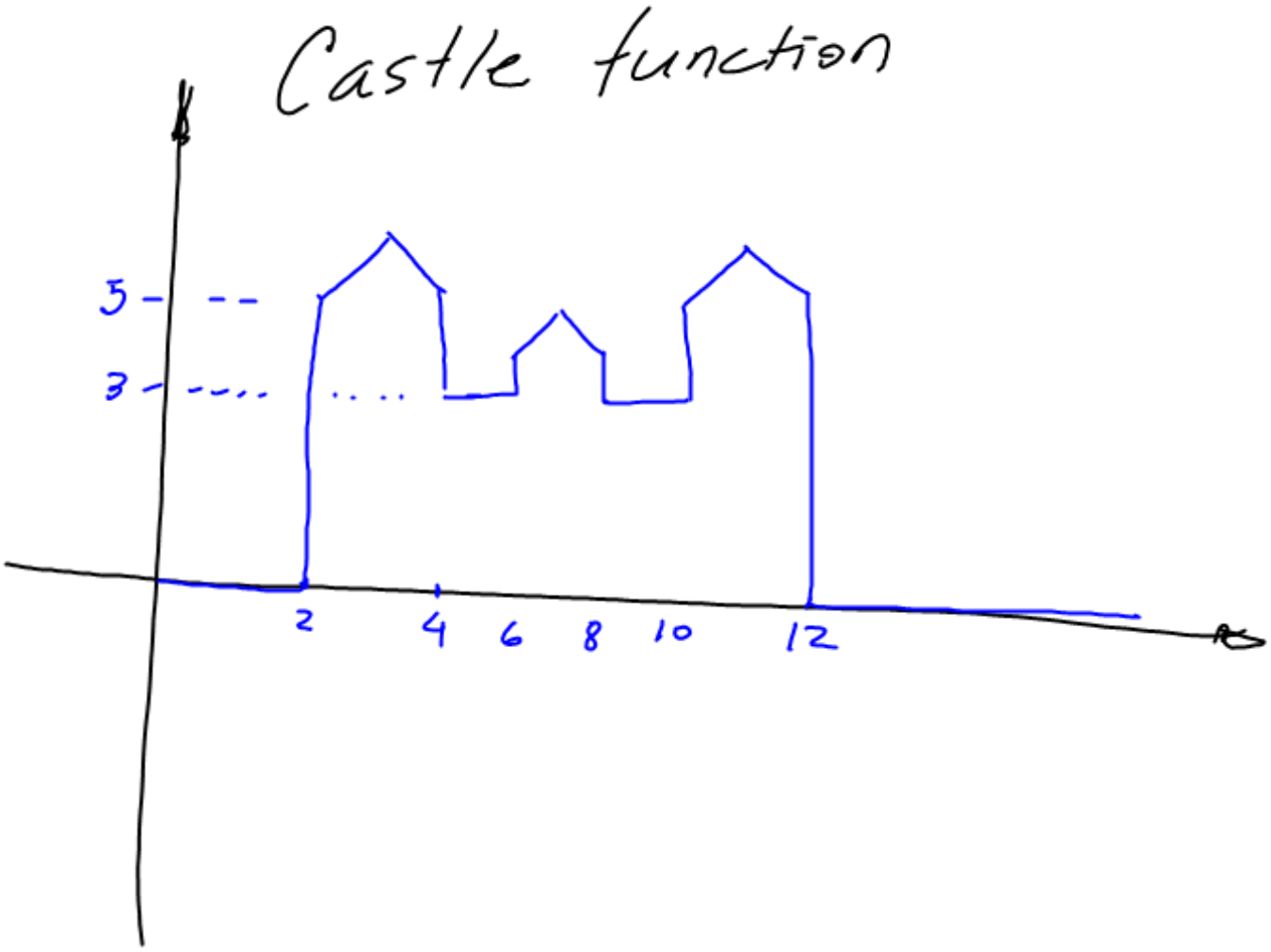
$$\mathcal{L}\{u'(t-a)\} = s\mathcal{L}\{u(t-a)\} - u(t-a)\Big|_{t=0}$$

$$\mathcal{L}\{u'(t-a)\} = s\left[\frac{e^{-as}}{s}\right] - (0)$$

$$\mathcal{L}\{u'(t-a)\} = e^{-as}$$

$$\mathcal{L}\{u'(t-a)\} = \mathcal{L}\{\delta(t-a)\}$$

$$u'(t-a) = \delta(t-a)$$


Castle function
5
3
2
4
6
8
10
12

$$\frac{d^2y}{dt^2} + \frac{dy}{dt} + y = 40 \cdot u(t-3) \cdot e^{2t-6} \cos(4t-12)$$

$$y(0) = 7 \qquad y'(0) = -4$$

---

$$\mathcal{L}\left\{e^{2t-6} \cdot \cos(4t-12) \cdot u(t-3)\right\} = \frac{e^{-3s}(s-2)}{(s-2)^2 + 16}$$

$$\mathcal{L}\left\{e^{2t}\cos(4t)\right\} = \frac{(s-2)}{(s-2)^2+16}$$

$$\mathcal{L}\left\{\cos(4t)\right\} = \frac{s}{s^2+16}$$

---

$$\mathcal{L}\left\{\frac{d^2y}{dt^2} + \frac{dy}{dt} + y\right\} = \mathcal{L}\left\{40 e^{2t-6} \cos(4t-12) \cdot u(t-3)\right\}$$

$$\mathcal{L}\left\{\frac{d^2y}{dt^2}\right\} + \mathcal{L}\left\{\frac{dy}{dt}\right\} + \mathcal{L}\{y\} = 40\left[\frac{e^{-3s}(s-2)}{(s-2)^2+16}\right]$$

$$s^2\mathcal{L}\{y\} - s(7) - (-4) + s\mathcal{L}\{y\} - (7) + \mathcal{L}\{y\} = \frac{40e^{-3s}(s-2)}{s^2-4s+20}$$

$$(s^2+s+1)\mathcal{L}\{y\} - 7s - 3 = \frac{40e^{-3s}(s-2)}{(s^2-4s+20)}$$

$$(s^2+s+1)\mathcal{L}\{y\} = \frac{40e^{-3s}(s-2)}{(s^2-4s+20)} + 7s + 3$$

$$\mathcal{L}\{y\} = \frac{40e^{-3s}(s-2) + (7s+3)(s^2-4s+20)}{(s^2+s+1)(s^2-4s+20)}$$

$$\mathcal{L}\{y\} = \frac{As+B}{(s^2+s+1)} + \frac{Cs+D}{s^2-4s+20}$$