Australian National University

Research School of Engineering
College of Engineering and Computer Science

ENGN2228 Signal Processing

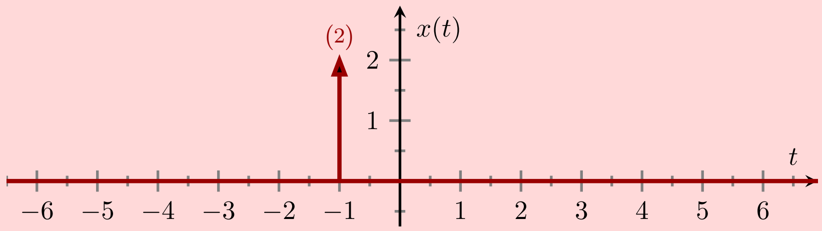
HOMEWORK 4 – SOLUTIONS

Homework 4-1

Draw the following signals

(a) $x(t) = 2\,\delta(t+1)$

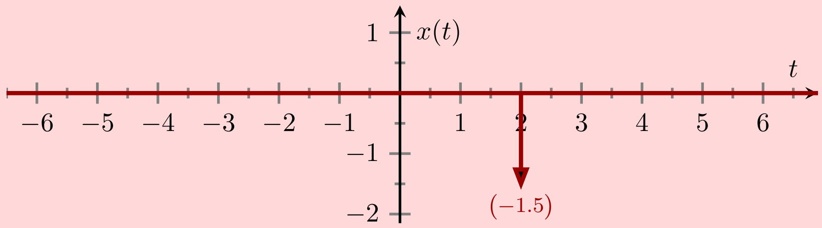
Solution:



Notice that you really should draw in the fact that the functions zero everywhere except at $t = -2$.
$\square$

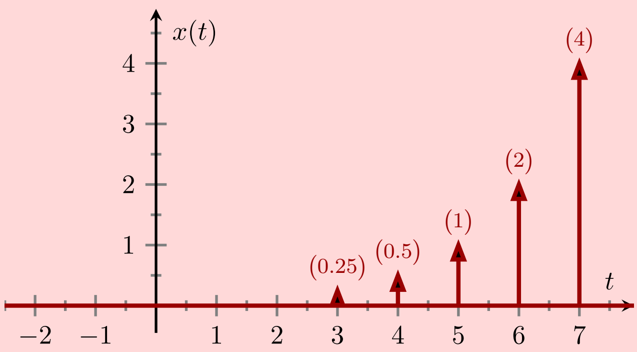
(b) $-1.5\,\delta(t-2)$

Solution:



(c) $x(t) = \displaystyle\sum_{k=3}^{7} 2^{k-5}\delta(t-2k)$

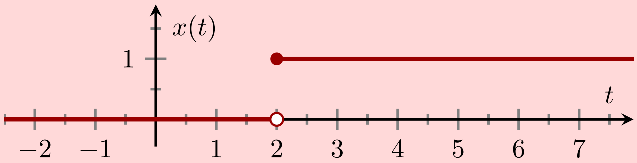
Solution:



(d) $x(t) = \displaystyle\int_{-\infty}^{t} \delta(\tau - 2)\,d\tau$

Solution:

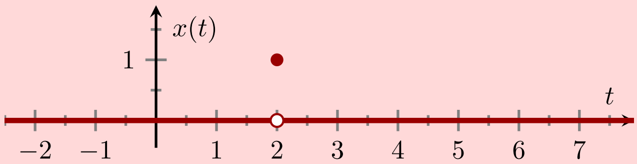
$$\int_{-\infty}^{t} \delta(\tau - 2)\,d\tau = \int_{-\infty}^{t-2} \delta(s)\,ds = u(t-2)$$



Don't worry about what the exact value is a $t = 2$. ☐

(e) $x(t) = \int_{-\infty}^{t} \delta(t-2)\, d\tau$

Solution: Well this is a bit weird. Firstly, the integrand is independent of the integration variable τ. For all values $t \neq 2$ we have $\delta(t-2) = 0$ so $x(t) = 0$ for $t \neq 2$. For $t = 2$ is best to leave the $\delta(t-2)$ inside the integral. At $t = 2$ it has area 1 so $x(2) = 1$.



Not a delta function at $t = 2$ just the value of 2 (zero area). ☐

(f) $\int_{-t}^{t} \delta(t-2)\, d\tau$

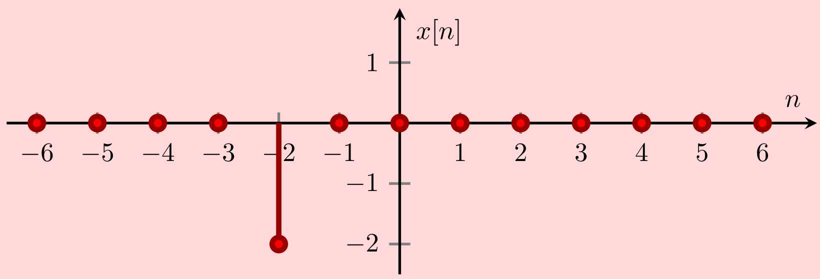
Solution: Messing with your head. Same as previous part. ☐

Homework 4-2

Draw the following signals

(a) $x[n] = -2\,\delta[n+2]$

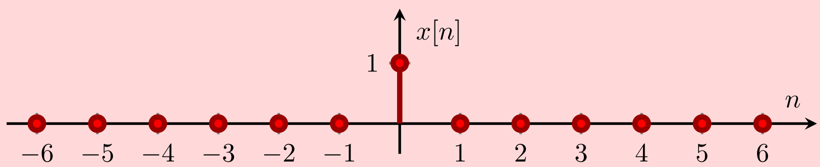
Solution:



Notice that you really should draw in the fact that the functions zero everywhere except at $n = -2$. ☐

(b) $x[n] = u[n] - u[n-1]$

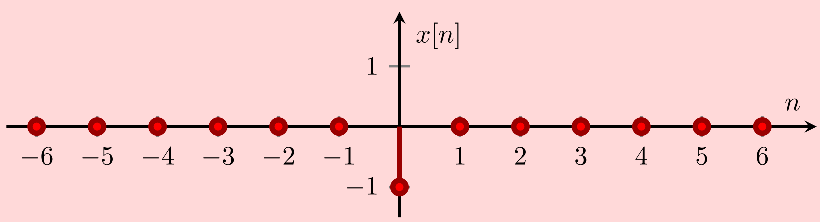
Solution:



Yep, it's the same as $\delta[n]$. ☐

(c) $x[n] = -u[-n] + u[-n-1]$

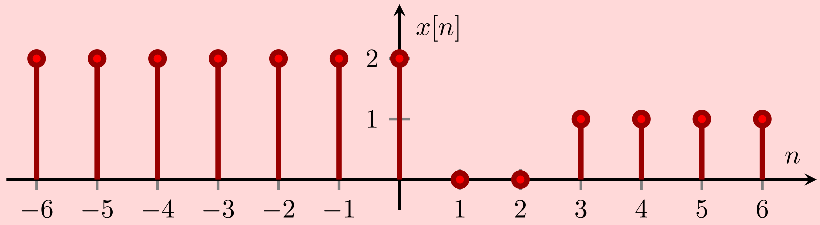
Solution:



Or $-u[-n] + u[-n-1] = -\delta[n]$. □

(d) $x[n] = 2u[-n] - u[n-3]$

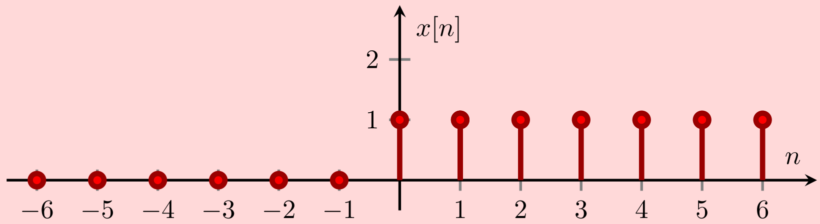
Solution:



□

(e) $x[n] = \sum_{k=-\infty}^{-1} \delta[k] + u[n]$

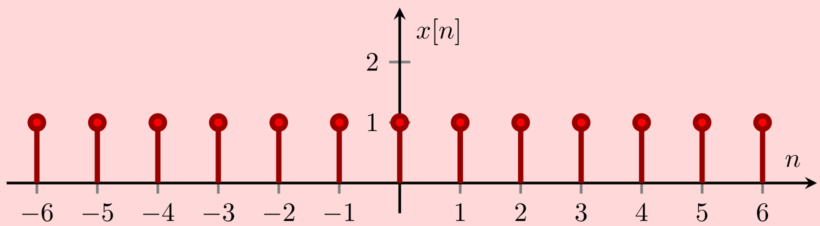
Solution:



That is, $x[n] = u[n]$. □

(f) $x[n] = \sum_{k=-\infty}^{-1} \delta[n-k] + u[n]$

Solution:



That is, $x[n] = 1$ for all n. □