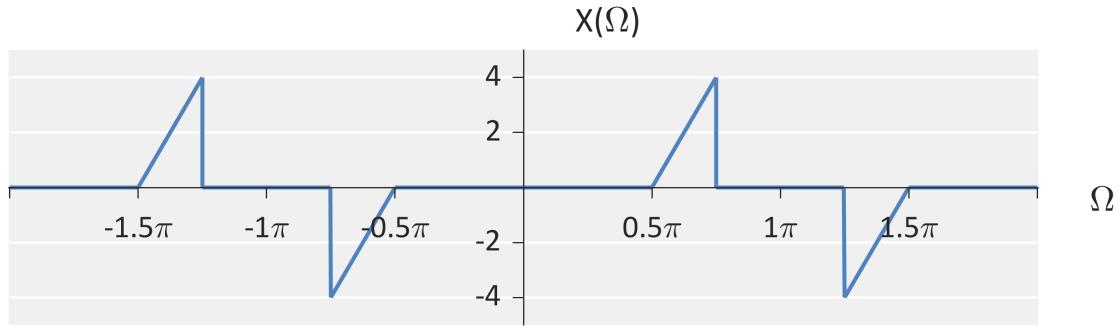


**Question #1:** Consider the DTFT of  $x[n]$ , shown below.



(a) (3 pts) Sketch the DTFT of  $x[n]$  after upsampling by 2 (without an interpolation filter).

(b) (3 pts) Sketch the DTFT of  $x[n]$  after upsampling by 2 (with an interpolation filter).

(c) (3 pts) Sketch the DTFT of  $x[n]$  after upsampling by 3 (without an interpolation filter).

(d) (3 pts) Sketch the DTFT of  $x[n]$  after upsampling by 3 (with an interpolation filter).