1.2 Consider the following *signum* function which returns the sign of its argument.

$$\text{sgn}(t) \triangleq \begin{cases} 1 & , \quad t > 0 \\ 0 & , \quad t = 0 \\ -1 & , \quad t < 0 \end{cases}$$

(a) Find the magnitude spectrum

(b) Find the phase spectrum

Solution

(a) From Appendix 3, Table 3.2

$$X_a(f) = \frac{1}{j2\pi f}$$

Thus the magnitude spectrum is

$$\begin{aligned} A_a(f) &= |X_a(f)| \\ &= \frac{|1|}{|j2\pi f|} \\ &= \frac{1}{2\pi f} \end{aligned}$$

(b) The phase spectrum is

$$\begin{aligned} \phi_a(f) &= \angle X_a(f) \\ &= \angle 1 - \angle j2\pi f \\ &= -\frac{\pi}{2} \end{aligned}$$