EX: Find the energy in the function shown in Fig. 1. Note that the function is assumed to zero outside the interval shown.

Imaginary impulses are shown in lighter blue (cyan) and are dashed lines. Impulses are shown as lollipop shapes whose heights indicate the areas of the impulses.

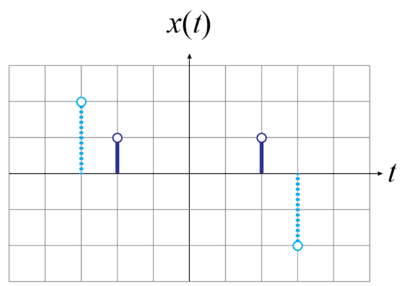

Fig. 1. Signal consisting of impulses.

SOLN: Impulses are different from other continuous-time signals in that we are unable to square them and integrate. We always get $\pm\infty$ or something even stranger if we try to do so. Instead, we must trust a statement that comes from Fourier theory:

> "For a *sampled signal treated as impulse functions* in a continuous-time framework, the average power is the sum of the average powers from the impulses.
>
> $$p_\infty = \sum_{n=\infty}^{\infty} p[n] = \sum_{n=\infty}^{\infty} |x[n]|^2 \text{ for } x(nT) = x[n]\delta(t - nT)\text{"}$$

A single impulse results in infinite energy but a finite average power. Fortunately, the computation of average power for impulses is simple: we need only square the magnitude of impulses and sum.

Note that multiplying an impulse by j leaves the magnitude unchanged, meaning we need only find the size of the sample value multiplying the impulse function. For the purely imaginary impulses in this problem, we may treat them as though they are real.

Sum the magnitudes squared.

$$p_\infty = 2^2 + 1^2 + 1^2 + 2^2 = 10$$