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3) The signal $x[n]$ is already given as a sum of sinusoids at frequencies which are 8-point DFT frequencies.

Thus, all we have to is compare the given expression with the 8-point Inverse DFT (IDFT) formula and identify the DFT coefficients $X[k]$:

$$x[n] = \frac{1}{8}\sum_{k=0}^{7} X[k]\, e^{j\omega_k n}, \text{ where } \omega_k = 2\pi k/8$$

Using the trigometric identities (Euler's formula), we write the given signal as

$$x[n] = 1 + 2\sin\left(\frac{\pi n}{2}\right) + 2\cos\left(\frac{3\pi n}{4}\right) + \cos(\pi n) \text{ for } n = 0, 1, \ldots, 7$$

$\sin(\theta) = \frac{1}{2j}\left(e^{j\theta} - e^{-j\theta}\right)$ $\cos(\theta) = \frac{1}{2}\left(e^{j\theta} + e^{-j\theta}\right)$

Shifting frequencies by 2π, observing 8-point DFT frequencies are $\omega_k = 2\pi k/8$