1. Let x[n] be a finite length signal, N = 7

   (i.e. x[n] = 0 for n < 0 and n ≥ 7)

   Given the first 4 samples of rts DFT X[k] = 12, 0, 1, 4 for k = 0, 1, 2, and 3 respectively

   a) Find X[k] for k = 4, 5, 6

DFT $X[k]$	$k=$	0	1	2	3	4	5	6
DTFT $X(e^{j\omega})$	$\omega=$	0	$2\pi\frac{1}{7}$	$2\pi\frac{2}{7}$	$2\pi\frac{3}{7}$	$2\pi\frac{4}{7}$	$2\pi\frac{5}{7}$	$2\pi\frac{6}{7}$

2π

← Conjugates... i.e. $X[4] = X^*[3]$

So, $X[k] = [12, 0, 1, 4, 4, 1, 0]$

   b) What kind of symmetry does x[n] have?

   Since $X[k]$ is real, $x[n]$ must be periodic Symmetric

2. Given signal x[n] sampled at 5 Hz, you take 5 consecutive readings and call that data $x_1[n]$

   (i.e., $x_1[n]$ is zero outside the interval 0 ≤ n < 5)

   You take its DFT and call it $X_1[k]$, What index k corresponds to signal energy at:

DFT $X[k]$	$K=$	0	1	2	3	4	
DTFT	$\omega = 2\pi\frac{k}{n} =$	0	$2\pi\frac{1}{5}$	$2\pi\frac{2}{5}$	$2\pi\frac{3}{5}$	$2\pi\frac{4}{5}$	rads/sample
	$f = \omega \cdot f_s/2\pi =$ (if $< f_s/2$ otherwise aliased)	0	1	2	2	1	Hz

(k = 3, 4: aliased)

↳ To derive use dimensional analysis

$$\underbrace{\frac{\text{rads}}{\text{Sample}}}_{\omega} \times \underbrace{\frac{\text{Samples}}{\text{second}}}_{f_s} \times \underbrace{\frac{1\text{Hz}}{2\pi\frac{\text{rad}}{\text{sec}}}}_{\text{Conversion between } \omega \text{ and } f} = \text{Hz}$$

   a) 0 Hz? $k = 0$

   b) 1 Hz? $k = 1$

   c) 2 Hz? $k = 2$

   d) 3 Hz? Can't be done; $3\text{ Hz} > f_s/2$.