1. **Aliasing** [2 points]
Can a whistle be heard over a telephone? That is, if a whistle rings at 4800 Hz and is sampled at 8000 Hz, then what is the dominant frequency present in the sampled signal?

2. **Lowpass Butterworth Analog Filter Response** [4 points]
Recall that amplitude response of an $n^{th}$ order normalized lowpass Butterworth filter is given by:

$$|H(j\omega)| = \frac{1}{\sqrt{1 + \omega^{2n}}}$$

(a) For $n=8$, please draw the pole-zero diagram for this filter.

(b) What is the DC gain of this filter (as in (a), for $n=8$)?

(c) At what frequency (in terms of $\omega$) will the filter’s output be at half-power (-3 dB)?
3. **Ideal Response (FIR Filters)** [2 points]

Recall that the ideal, desired (zero-phase) low-pass response is given by

\[ h_a(t) = \frac{1}{2T} \text{sinc} \left( \frac{\pi t}{2T} \right) \]

and its discrete form is given by:

\[ h[k] = T h_a(kT) = \frac{1}{2} \text{sinc} \left( \frac{\pi k}{2} \right) \]

Briefly explain why this ideal low-pass filter is not physically realisable.

4. **Filter Type Comparison** [2 points]

(a) What is one advantage of FIR filters have over IIR filters?
(b) What is one advantage of IIR filters have over FIR filters?