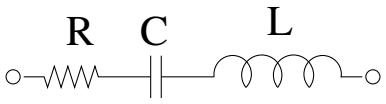
Name: _____

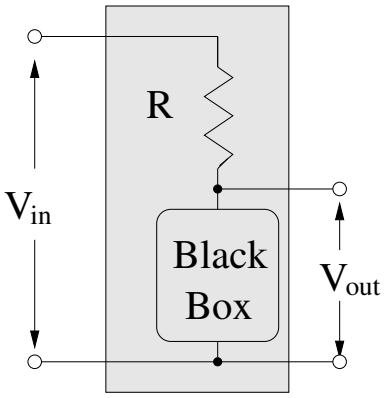
There are **three questions** to complete.

1. Determine the magnitude $|Z|$ of the total impedance Z of the following circuit



What are the limits on your expression for $|Z|$ as the angular frequency ω approaches 0 and ∞? Can you explain these limits intuitively?

2.



Plot qualitatively the expected behavior of V_{out} (or the gain) as a function of the input frequency f [$v_{in} = V_{in}\cos(2\pi ft)$] if the black box contains

(a) a resistor,

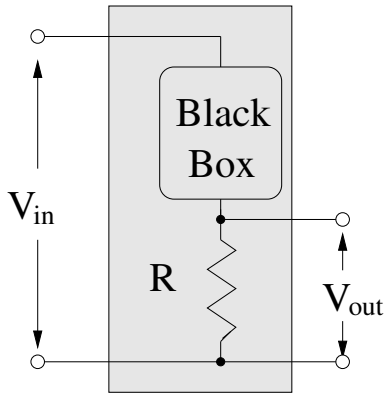
(b) an inductor,

(c) a capacitor,

(d) an inductor and capacitor in parallel,

(e) an inductor and capacitor in series.

3.



For a black box containing a capacitor C and an inductor L that are connected in series, derive the resonance frequency f_0 and the FWHM (full-width-half-maximum) value Δf of the resonance peak that is seen when plotting $|v_{out}|^2/|v_{in}|^2 = V_{out}^2/V_{in}^2$. Give your answer in terms of L, C, and R.