PhD Exam – Electronic Circuits

1. The following two circuits 1A and 1B use ideal op amps with output saturation voltage L+/L- of ±10V. Given an input of \( v_i = 0.2 \times \sin(2\pi \times 1000 \times t) \) V, a sinusoidal waveform of ±0.2V peak and frequency of 1000Hz, find the outputs of the following two circuits with \( R_1 = 1k\Omega \), \( R_2 = 10k\Omega \). Plot their output voltages \( v_{OA} \) and \( v_{OB} \) versus time. Note: the output of Circuit 1A goes to the input of Circuit 1B.

![Circuit 1A and 1B](image)

2. The following circuit consists of two resistors of the same value \( R \) and two capacitors of the same value \( C \). Input signal is \( v_i \) and there are two outputs \( v_{o1} \) and \( v_{o2} \). If \( v_i \) is a single-tone small-signal sinusoidal waveform of frequency \( f \), calculate the two outputs \( v_{o1} \) and \( v_{o2} \). What is the phase difference between \( v_{o1} \) and \( v_{o2} \)? At what frequency \( f \) will the two outputs \( v_{o1} \) and \( v_{o2} \) have equal amplitude?

![Circuit with R and C](image)