

**Music 170 Homework problem set 4 (due Oct. 20)**

1. Two sinusoids have equal amplitudes, equal frequencies, and their phase differs by 90 degrees ( $\pi/2$  radians). By how many dB is their sum louder than either of the original ones?
2. Assume you can hear beating between two sinusoids once the rate of beating falls below 20 Hz. What is the highest pitch at which a half-tone interval beats audibly?
3. What pitch from the standard Western tempered scale is closest to 1000 Hz? Is it higher or lower? By how many cents?
4. A complex tone (not necessarily periodic) has components at 220, 440, 500, 660, 880, 1000, and 1100 Hz. What fundamental frequencies would a listener hear?
5. Two complex, periodic tones, middle C and the G above it, are sounded simultaneously. Which are the lowest harmonics of the two that would beat (at 20 Hz. or less), and how fast? (G is 7 semitones above C).