# Assignment X, PHYS 150 (Physics of Sound and Music) Musical Scales and Temperament <br> Due 3/28/14 

Note: In problems 6 and 7 below, when you are asked "how far off" would a hypothetical interval, compare to the just scale.

1. How many different notes are there in:
a) A pentatonic scale?
b) A diatonic scale?
c) A chromatic scale?
2. What is the circle of fifths?
3. What is the biggest disadvantage/problem with the Pythagorean scale?
4. What is the biggest disadvantage/problem with the Just scale?
5. How many cents are there in a perfect (Pythagorean) fourth?
6. A not-very-often-hypothesized system is a 10 note equal-tempered scale. (This is something that seems like a Physicist might support. We like the metric system and all....)
a) Write down the approximate ratio of the frequency of each note to the fundamental in this ten-note scale. Make sure to keep at least 4 or so digits past the decimal. (e.g. if I was doing this for the standard 12 -note equal-tempered scale my ratios would be: $1,1.059463,1.122462,1.189207,1.2599210$, 1.334840,1.414214, 1.498307, 1.587401, 1.6817928, 1.781797, 1.8877486, 2).
b) In this ten-note equal tempered scale, how far off (in cents) would the perfect fifth interval be? Would it be flatter or sharper than a true perfect fifth?
c) In this ten-note equal tempered scale, how far off (in cents) would the perfect fourth interval be? Would it be flatter or sharper than a true perfect fourth?
d) In this ten-note equal tempered scale, how far off (in cents) would the major third interval be? Would it be flatter or sharper than a true major third?
e) In this ten-note equal tempered scale, how far off (in cents) would the minor third interval be? Would it be flatter or shaper than a true minor third?
f) Based on your answers above, why don't we use a ten note scale?
7. In class, we explored in a little bit of detail the 19-note equal tempered scale. We showed hat this generates a fifth that is off by 7 cents from what it should be, a fourth that's off 7 cents, but a minor third that is within 1 cent of the true minor third interval. Let's have you explore the 31 note equal tempered scale in a similar way.
a) In the 31 note equal-tempered scale, what is the frequency ratio between adjacent pitches?
b) Find the interval closest to the perfect fifth (it is a touch flat). How many cents flat would this be?
c) Find the interval closest to the perfect fourth (it is a touch sharp). How many cents sharp would this note be?
d) The worst interval in this 31-note scale appears to be the major sixth. How many cents off is this pitch?
