Scales: major, minor and other "modes"

Here "mode" (or "key") refers to a specific arrangement of whole and half-tone intervals used in a given tune

most common modes:

major: $1 \quad \frac{1}{2} \;|\; 1 \quad 1 \quad \frac{1}{2} \quad 1 \quad 1 \quad 1 \quad \frac{1}{2} \;|\; 1 \quad 1 \quad \frac{1}{2} \quad 1 \quad 1$

minor: $|\; 1 \quad \frac{1}{2} \quad 1 \quad 1 \quad \frac{1}{2} \quad 1 \quad 1 \;|\; 1 \quad \frac{1}{2} \quad 1 \quad 1 \quad \frac{1}{2} \quad 1 \quad 1$

note same sequence of 1 and $\frac{1}{2}$ tones, but different start position

ancient modes: Greek modes, Gregorian modes

white keys on keyboard play C-major and A-minor <u>only</u>

need black keys for other modes, e.g. C-major -> D-major

names: F# (F-sharp) is half-tone above F, etc.

Eb (E-flat) is half-tone below E, etc

examples on blackboard:

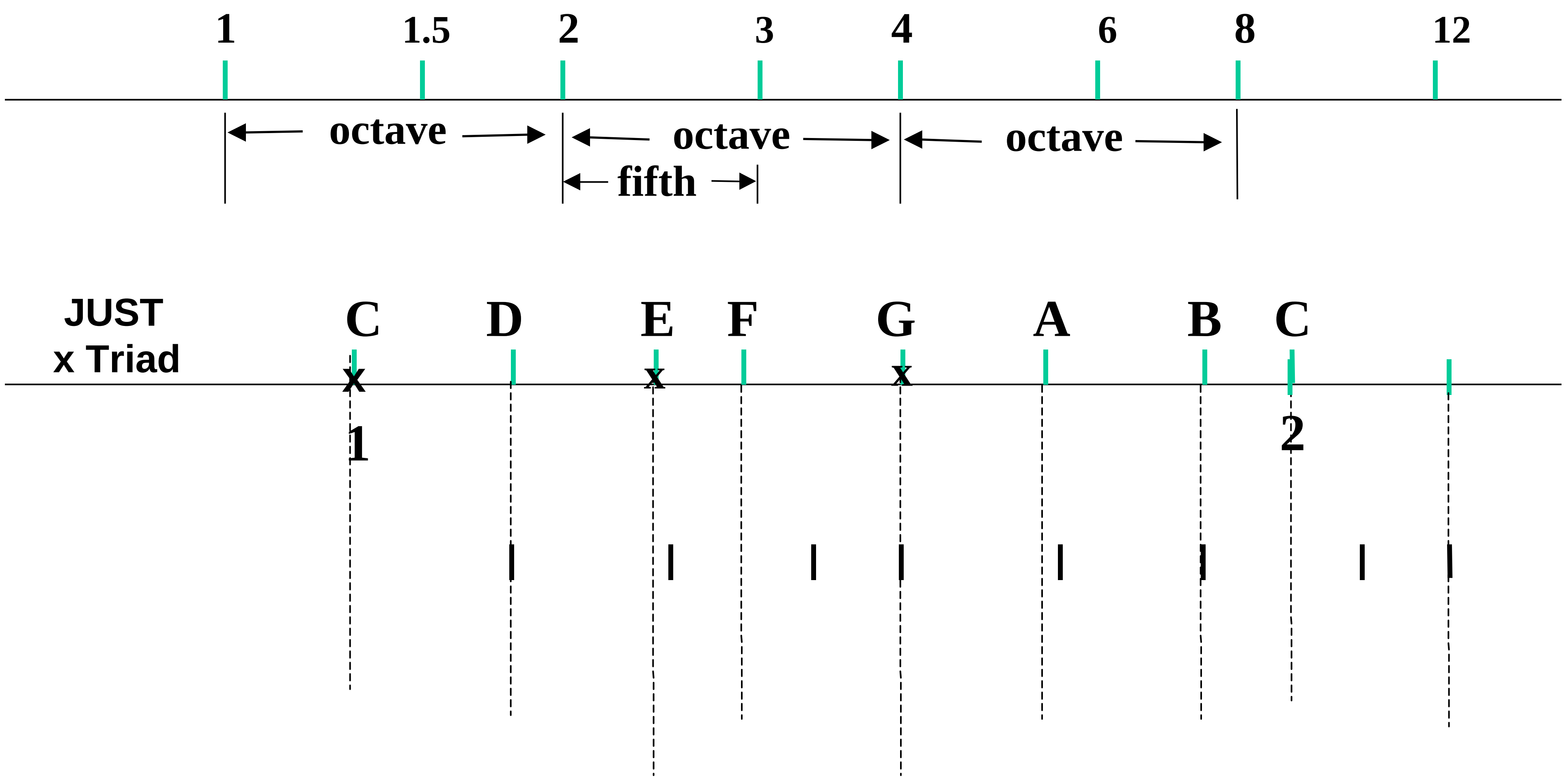
what tones used for D-major?

what tones used for C-minor?

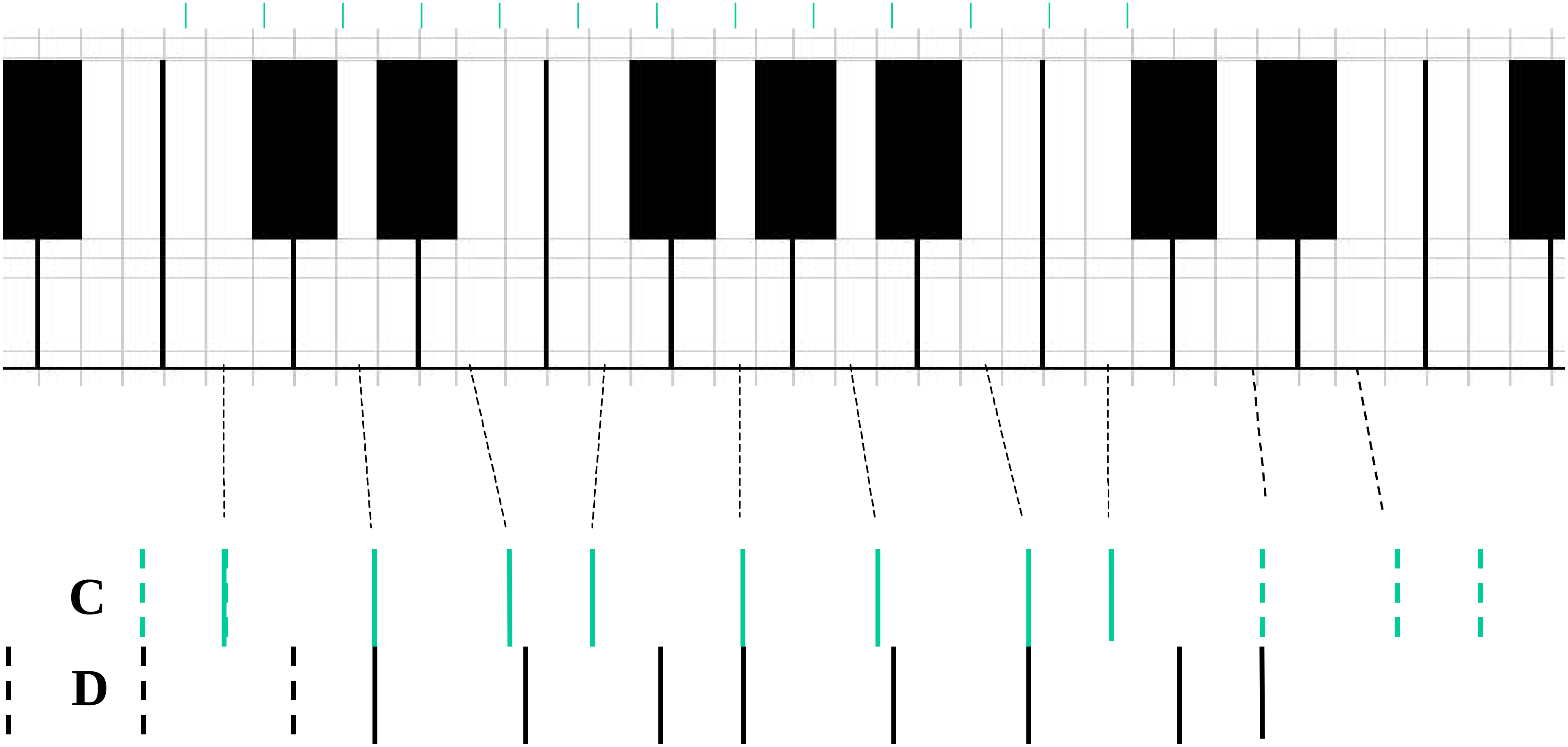
demo: row-your-boat in minor key

Help in visualizing scales:

- equal musical intervals - equal frequency ratio
- on a "multiplicative" number line (=log scale) equal ratios are equidistant
- advantage: in graphs below equal intervals have same length



Disadvantage of Just tuning:



compare just **C-major** and **D-major**

problem of just tuning: need to retune keyboard

Tempered Tuning - a Compromise

Tempered tuning:
all half-tone intervals are identical

advantage: transposition maintains same intervals

but: how calculate the frequencies?
how close to JUST are the resulting intervals?

Calculate Tempered Frequency Ratios

Octave = 12 semitones

$$2 = x \cdot x \cdot x \cdot \ldots\ldots = x^{12}$$

semitone ratio: $x = 1.05946...$

whole tone ratio: 2 semi = x^2 =1.1225

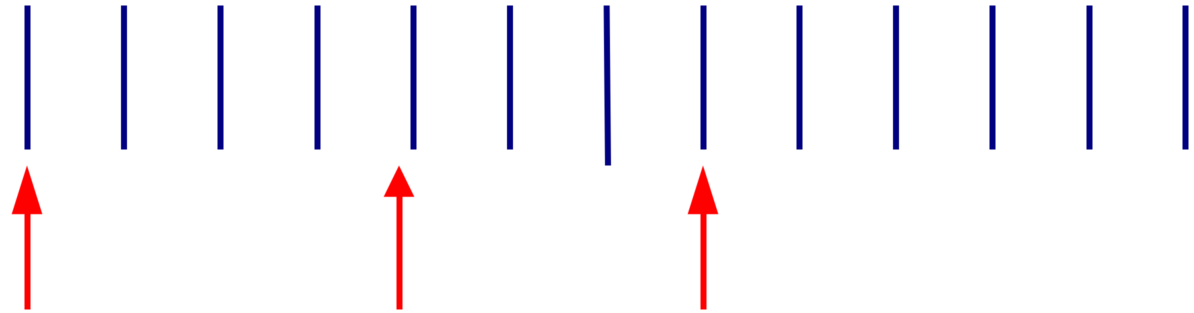
minor third ratio: 3 semi = x^3 = 1.189 not very good

major third ratio: 4 semi = x^4 = 1.260 not very good

fifth ratio: 7 semi = x^7 = 1.498 very good "perfect fifth"

disadvantage of tempered tuning

tempered:



major triad

the major third is sharp
the minor third is flat

how much is it out of tune?

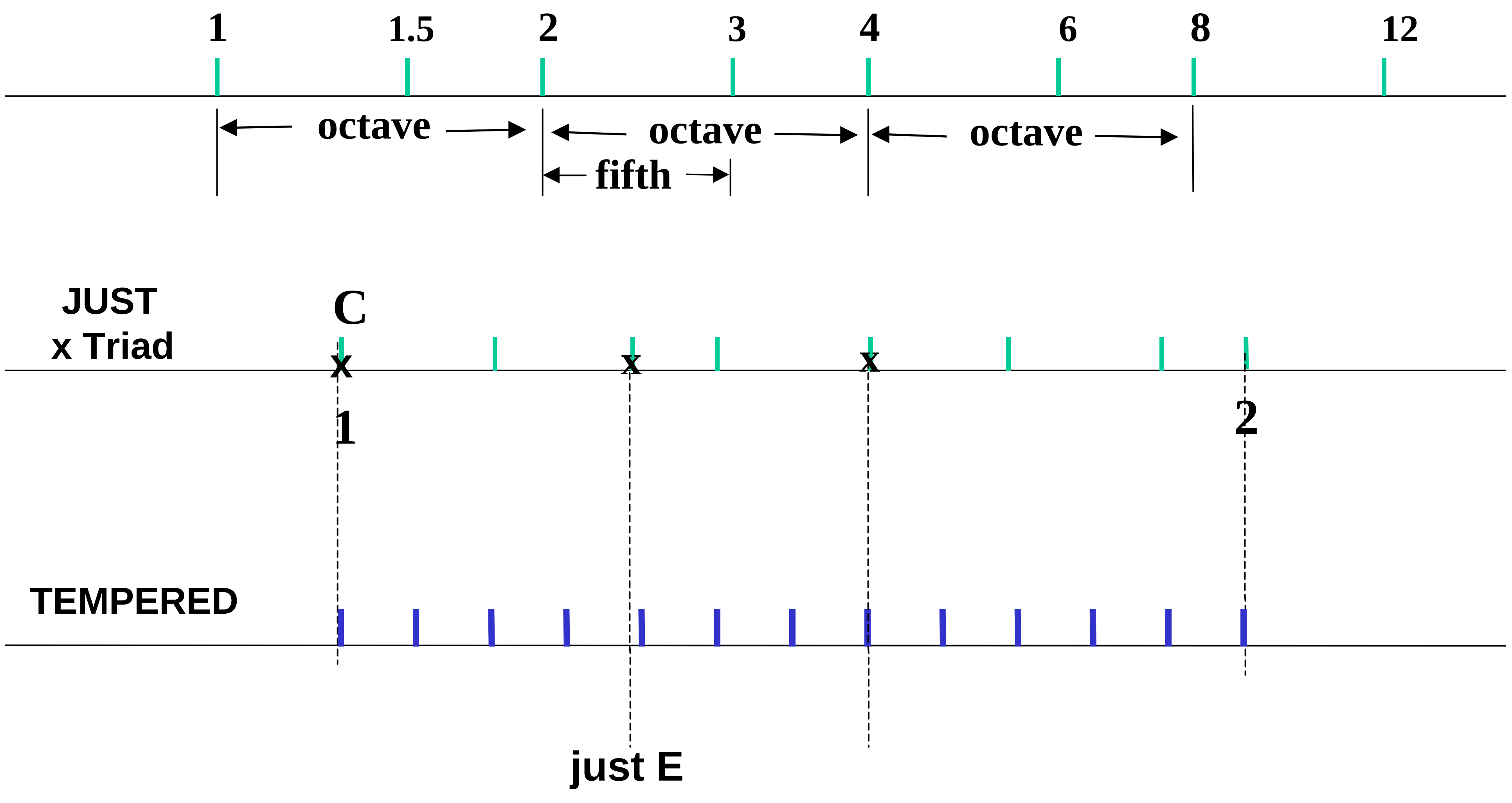
just major third: ratio 5/4 = 1.25

tempered major third: ratio $(1.05946\ldots)^4 = 1.260$

e.g 200 Hz+ 250 Hz :4th and 5th partials = 1000 +1000Hz
vs 200 Hz +252 Hz: 1000 +10**<u>10</u>**Hz

Handout on SCALES .

- equal musical intervals - equal frequency <u>ratio</u>
- on a “multiplicative” number line (=log scale) equal <u>ratio</u>s are <u>equidistant</u>
- advantage: in graphs below equal intervals have same length



Handout on SCALES (page 2) .

purpose of this page: to transpose or to compare just and tempered tuning, either cut the page into strips so you can shift one scale with respect to the other, or copy to scale at the edge of another piece of paper and then shift the other paper (examples were done on blackboard)