

BASIC MUSIC THEORY TUTORIAL

Physics 204 / Music 204

This tutorial contains just enough music theory to survive Physics 204 / Music 204. It will be most useful to students who don't play any instrument, or play entirely by ear.

The tutorial is designed to be done while sitting at a piano keyboard with a friend who is also learning this material. There are pianos available in the practice rooms in the basement of Lincoln Hall.

Caveat: This way of looking at music theory is from the Western European classical tradition, it does not translate well to all musical traditions!

Note Names

There are twelve musical note names. They have approximately equal pitch intervals (or frequency RATIOS) between them:

C C# D D# E F F# G G# A A# B C

C# is pronounced “C sharp”.

The pitch interval between neighboring notes is called a half-step (about a 6% increase in frequency).

Two half-steps make a whole-step (~12% increase in frequency).

Sharps and Flats

Some of the notes actually have two (weird) names:

C C#/D^b D D#/E^b E F F#/G^b G G#/A^b A A#/B^b B C

C[#] is pronounced “C-sharp”. That means, “the note that is a half-step higher than C”.

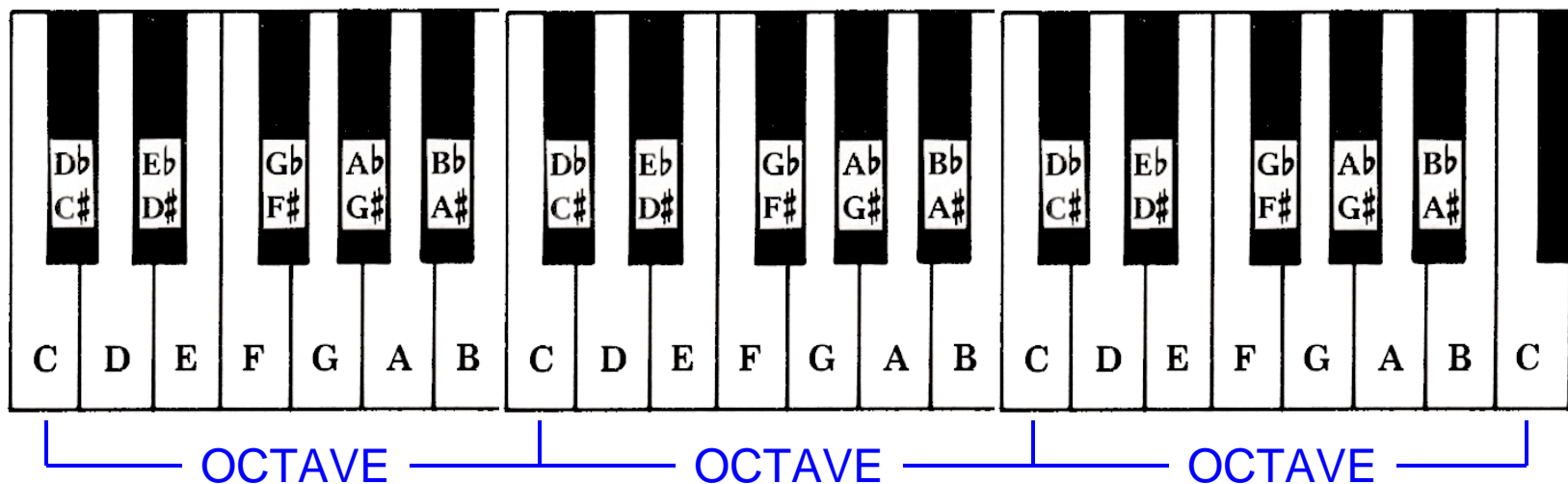
D^b is pronounced “D-flat”, or “the note that is a half-step lower than D”.

Piano keyboard

A piano keyboard is arranged in a repeating pattern of white and black keys. Each repeat of the pattern is called an OCTAVE.

Each octave has one key corresponding to each of the 12 note names.

The “normal” alphabet letters are white keys, the “sharps/flats” are the black keys.



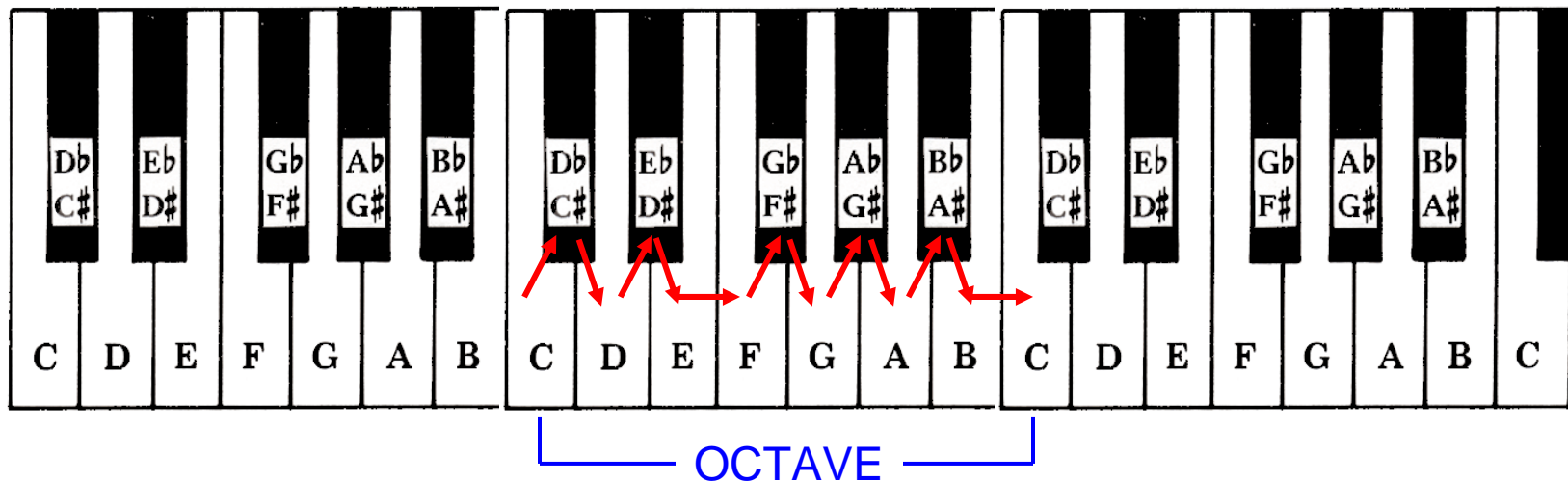
Half-steps

To go up one half-step in pitch, move one key to the right. Usually it's a key of the "other" color, (black→white, or white → black), but sometimes you need to play white →white).

TRY IT (see pic below).

You are playing a CHROMATIC scale, a series of half-step intervals.

Do you think a half-step interval is easy to hear? Do you think you could distinguish a quarter-step? an eighth-step?



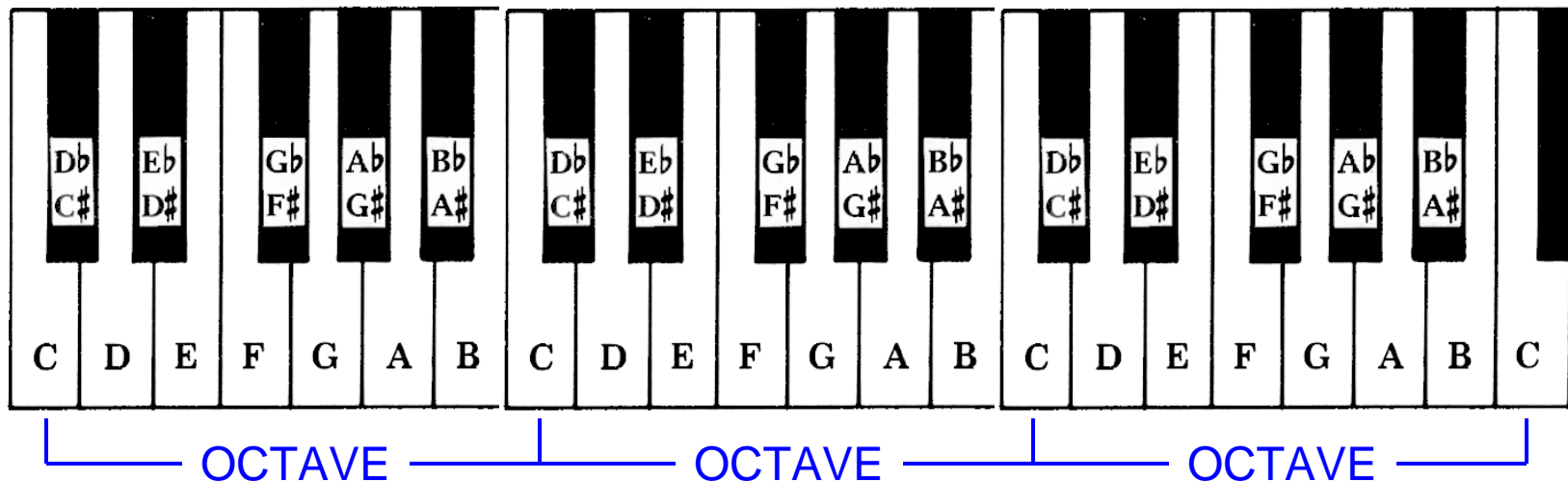
Octaves

The pattern of black and white keys (and note names) repeats itself, over and over.

When you jump from a note to the next one with the same name (going to the right), you have gone up ONE OCTAVE.

TRY IT

The fundamental frequency of the note is multiplied by 2, the pitch has gone up by 12 half-steps.



Octaves

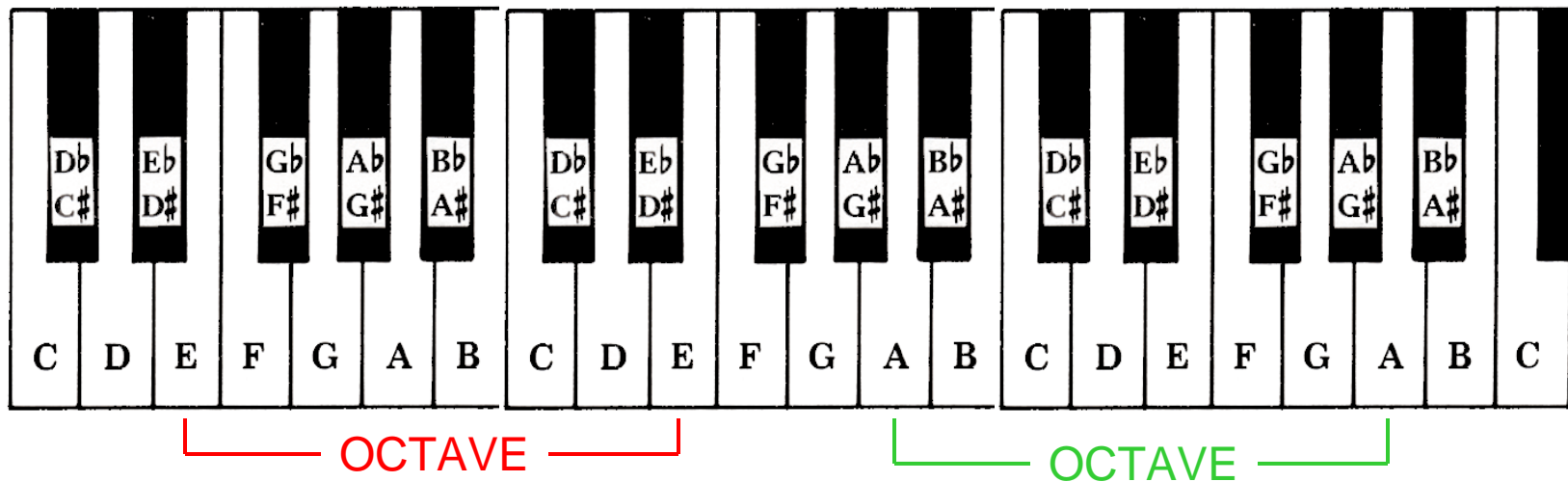
An octave is the pitch interval between any note name and the closest one with the same name.

It doesn't matter which note name you start with. If you then go to the next note with the same note name, that's still an octave.

Moving to the right is going "up one octave".

Moving to the left is going "down one octave".

PLAY SOME OCTAVES, starting from a different note name each time.

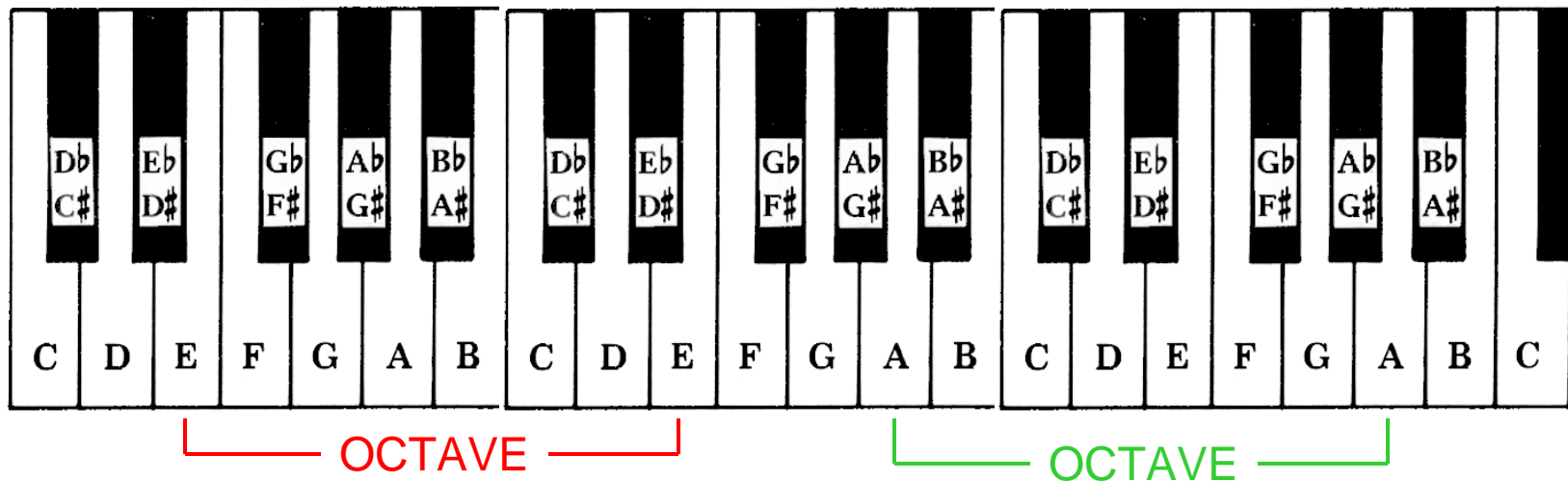


Octaves

Two notes an octave apart blend together very well, and sound almost like one note when played together.

TRY IT and listen

The octave is the most important musical interval.

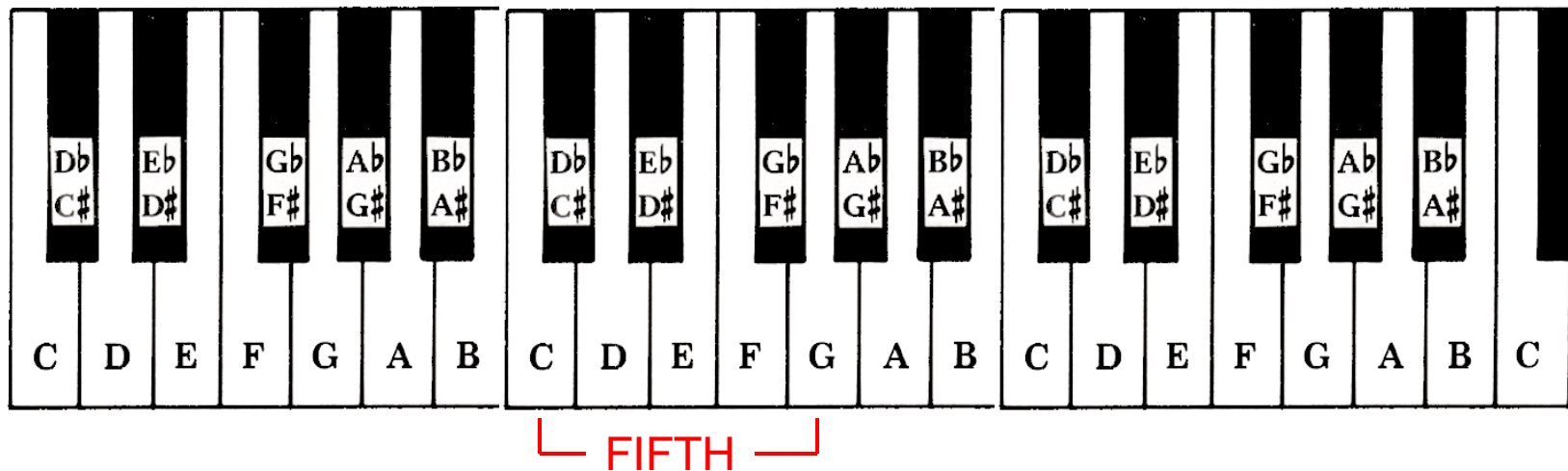


Perfect Fifth

The next most important interval is called the “perfect fifth”. Two notes which are a fifth apart also sound very good together, and blend well.

TRY IT: Play a C note, then play the next G note to the right. Now try playing both of the notes together. Does it sound pretty?

Play CCGG... that’s the beginning of “Twinkle Twinkle Little Star”.



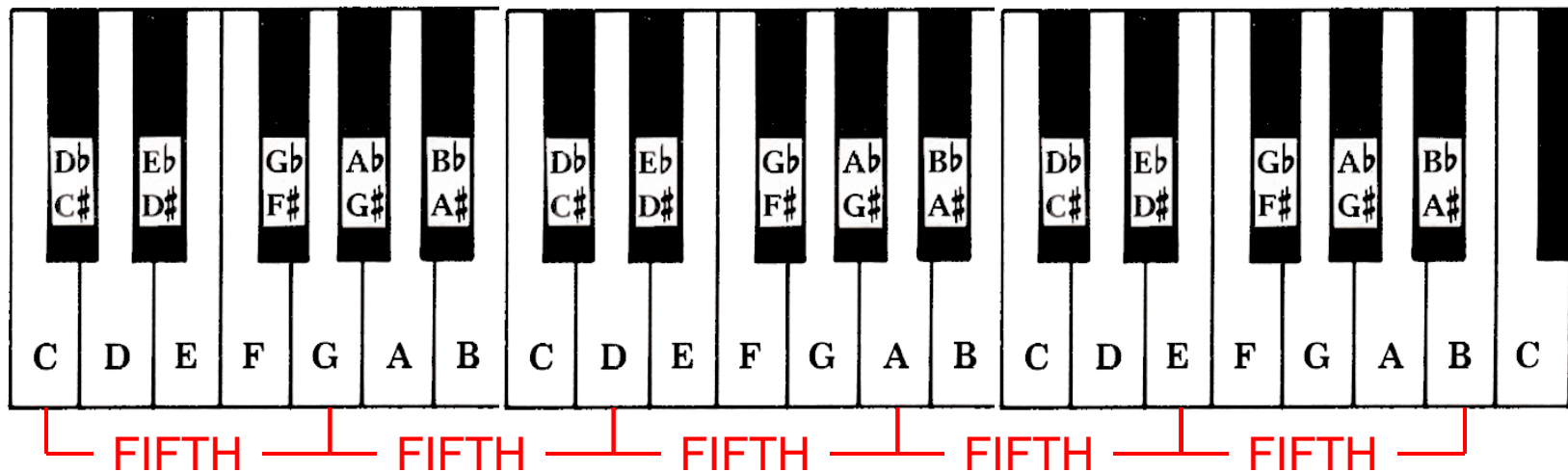
Circle of Fifths

You can start your perfect fifth on ANY note name. The other note name is **seven half-steps** to the right. (Count them!)

TRY THEM ALL:

C – G, G – D, D – A, A – E, E – B, B – F#, F# – C#,
C# – G#, G# – D#, D# – A#/B♭, B♭ – F, F – C.

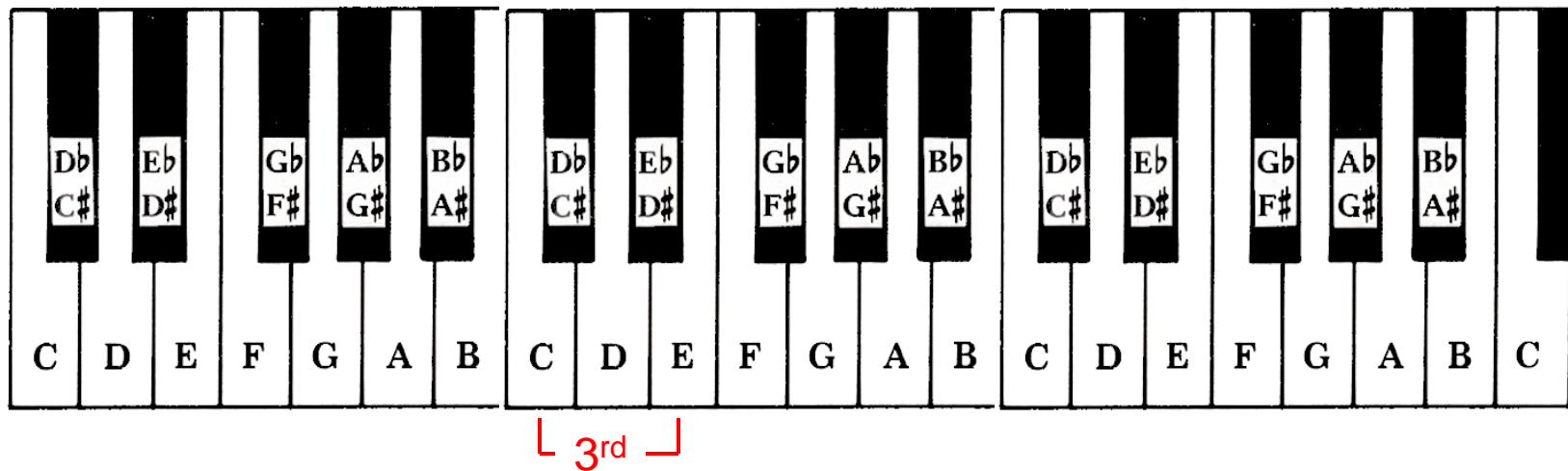
There are twelve of them, and you end up back on a C note. (That's called “the circle of fifths”, because the note names come back round in a circle).



Major Third

This another very important interval. Two notes which are a third apart also sound pretty together, and blend well.

TRY IT: Play a C note, then play the next E note to the right. Now try playing both of the notes together. Does it sound pretty?

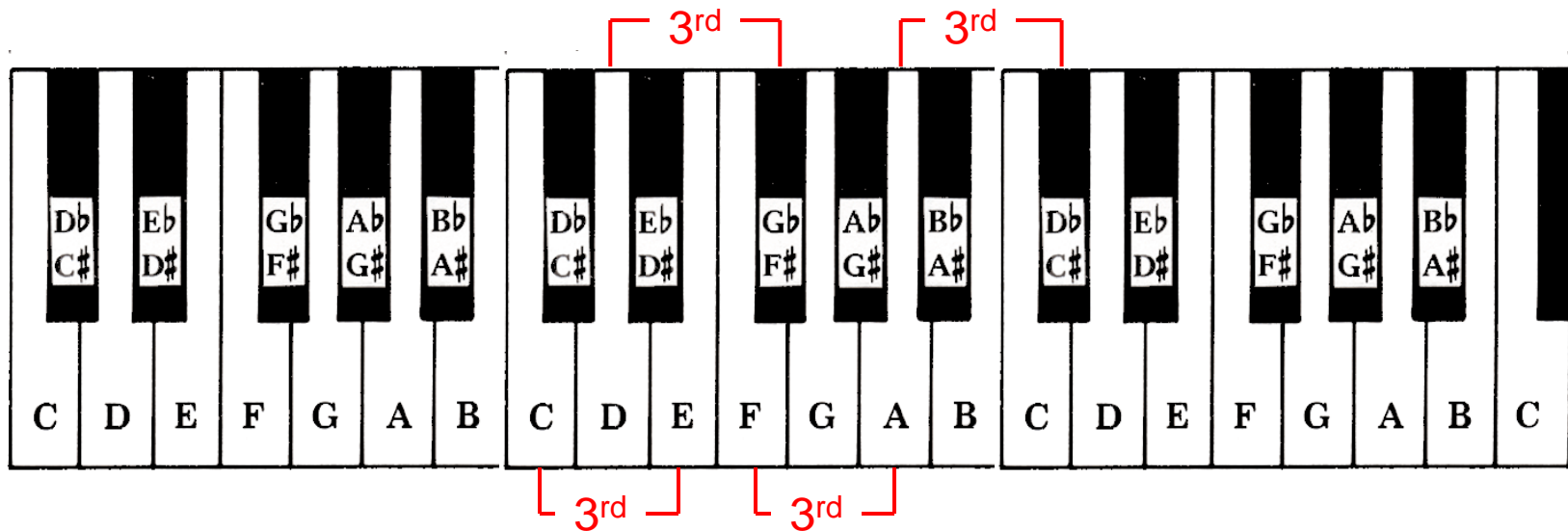


More Major Thirds

You can start your major third on ANY note name. The other note name is **FOUR half-steps** to the right. (Count them!)

TRY THESE:

C – E, D – F#, E – G#, F – A, G – B, A – C#, B – D#.

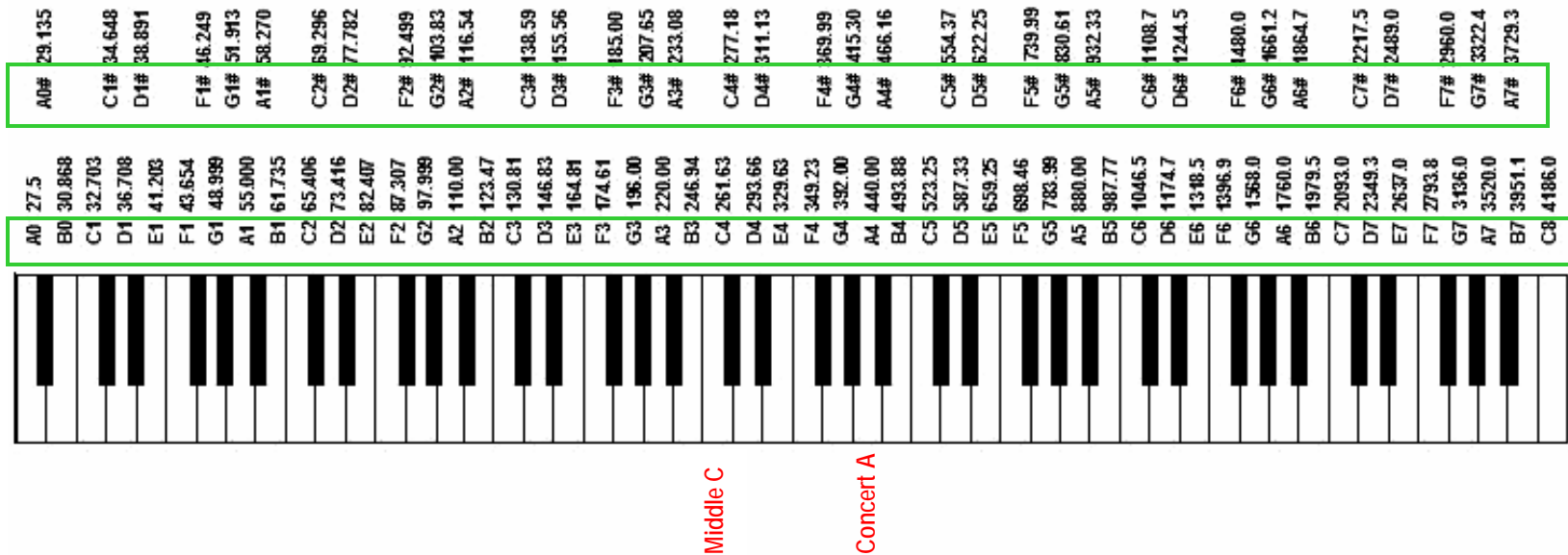


Octave labeling of notes

The complete piano keyboard has more than seven octaves.

We can label the **note names** with a **number** which tells us which octave they are in. **See diagram.**

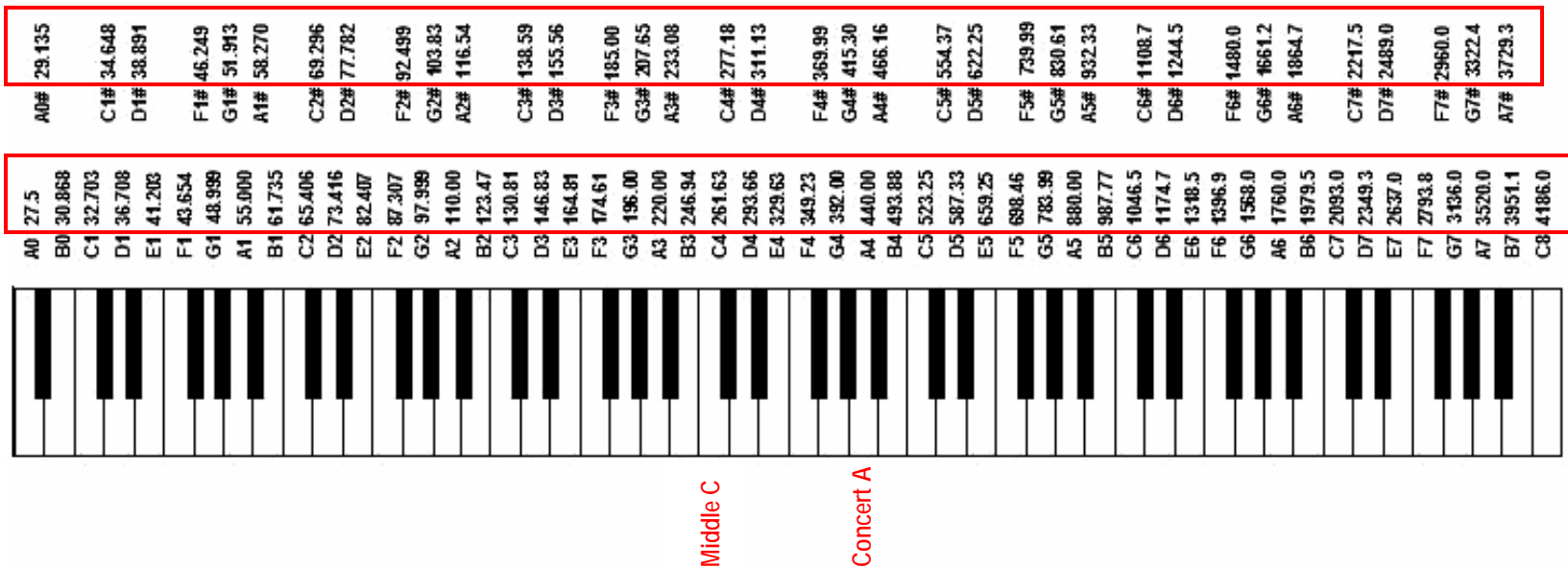
The C note in the middle of the keyboard (C_4) is called “**middle C**”. The A note to the right of that (A_4) is often called “**concert A**”, or “A-440”).



Note Names and Frequencies

The other numbers on this keyboard chart give the fundamental (lowest) **frequency** in Hz of the sound played by each of the piano keys.

Each note name (with its octave label) corresponds to a particular frequency.



Note Names and Frequencies

The table on Rossing p. 183 also lists these note names and their frequencies. (See next slide.)

The frequencies shown here and in Rossing are presented as they would be tuned on a keyboard instrument in “equal temperament”. The note frequencies on a real piano are not exactly these, but they are close.

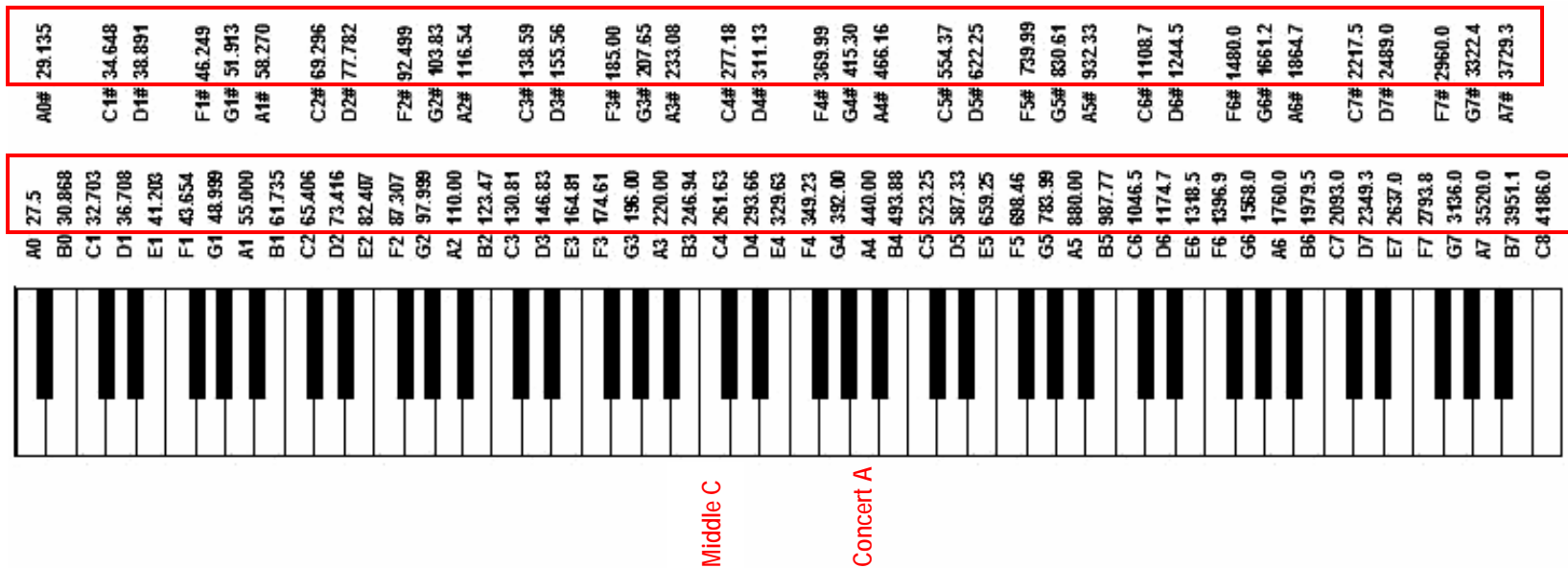


Table of note frequencies, Rossing p. 183.

The frequencies shown offset to the right are the black notes on the piano.

TABLE 9.2 Frequencies of notes in tempered scale

| | | | | | | | |
|----------------|--------|--|----------------|--------|--|----------------|--------|
| C ₀ | 16.352 | | C ₃ | 130.81 | | C ₆ | 1046.5 |
| | 17.324 | C [#] ₀ /D ^b ₀ | | 138.59 | | | 1108.7 |
| D ₀ | 18.354 | | D ₃ | 146.83 | | D ₆ | 1174.7 |
| | 19.445 | D [#] ₀ /E ^b ₀ | | 155.56 | | | 1244.5 |
| E ₀ | 20.602 | | E ₃ | 164.81 | | E ₆ | 1318.5 |
| F ₀ | 21.827 | | F ₃ | 174.61 | | F ₆ | 1396.9 |
| | 23.125 | F [#] ₀ /G ^b ₀ | | 185.00 | | | 1480.0 |
| G ₀ | 24.500 | | G ₃ | 196.00 | | G ₆ | 1568.0 |
| | 25.957 | G [#] ₀ /A ^b ₀ | | 207.65 | | | 1661.2 |
| A ₀ | 27.500 | | A ₃ | 220.00 | | A ₆ | 1760.0 |
| | 29.135 | A [#] ₀ /B ^b ₀ | | 233.08 | | | 1864.7 |
| B ₀ | 30.868 | | B ₃ | 246.94 | | B ₆ | 1975.5 |
| <hr/> | | | <hr/> | | | <hr/> | |
| C ₁ | 32.703 | | C ₄ | 261.63 | | C ₇ | 2093.0 |
| | 34.648 | ...etc... | | 277.18 | | | 2217.5 |
| D ₁ | 36.708 | | D ₄ | 293.66 | | D ₇ | 2349.3 |
| | 38.891 | | | 311.13 | | | 2489.0 |
| E ₁ | 41.203 | | E ₄ | 329.63 | | E ₇ | 2637.0 |
| F ₁ | 43.654 | | F ₄ | 349.23 | | F ₇ | 2793.8 |
| | 46.249 | | | 369.99 | | | 2960.0 |
| G ₁ | 48.999 | | G ₄ | 392.00 | | G ₇ | 3136.0 |
| | 51.913 | | | 415.30 | | | 3322.4 |
| A ₁ | 55.000 | | A ₄ | 440.00 | | A ₇ | 3520.0 |
| | 58.270 | | | 466.16 | | | 3729.3 |
| B ₁ | 61.735 | | B ₄ | 493.88 | | B ₇ | 3951.1 |
| <hr/> | | | <hr/> | | | <hr/> | |
| C ₂ | 65.406 | | C ₅ | 523.25 | | C ₈ | 4186.0 |
| | 69.296 | | | 554.37 | | | 4434.9 |
| D ₂ | 73.416 | | D ₅ | 587.33 | | D ₈ | 4698.6 |
| | 77.782 | | | 622.25 | | | 4978.0 |
| E ₂ | 82.407 | | E ₅ | 659.26 | | E ₈ | 5274.0 |
| F ₂ | 87.307 | | F ₅ | 698.46 | | F ₈ | 5587.7 |
| | 92.499 | | | 739.99 | | | 5919.9 |
| G ₂ | 97.999 | | G ₅ | 783.99 | | G ₈ | 6271.9 |
| | 103.83 | | | 830.61 | | | 6644.9 |
| A ₂ | 110.00 | | A ₅ | 880.00 | | A ₈ | 7040.0 |
| | 116.54 | | | 932.33 | | | 7458.6 |
| B ₂ | 123.47 | | B ₅ | 987.77 | | B ₈ | 7902.1 |

Scales

A scale is a pattern of notes that is the same in every octave.

Most Western music is played by choosing eight notes out of each octave to use.

Major Scale

The most common scale type (“mode”) is called the major scale.

To build a major scale you must select eight of the possible twelve notes in an octave so that they form this pattern of whole and half step intervals:

W W H W W W H (W = whole-step, H = half-step)

We can start a major scale on any note, but it must follow this pattern of whole and half steps.

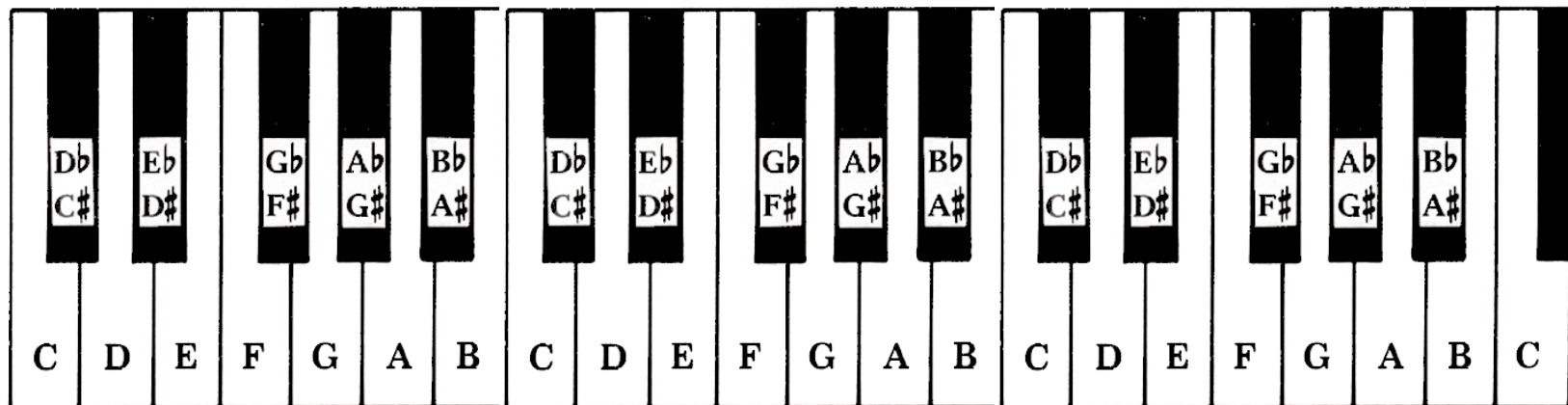
The next slides will show you how to play major scales on the piano. We’ll try three: C major, G major, and D major.

(The song “Doe, a deer” from The Sound of Music, illustrates the major scale.)

C Major Scale

The piano keyboard was designed to make it very easy to play the C major scale.

Play all the white keys, going from left to right, from any C note to the next C. This is a “C major” scale. TRY IT

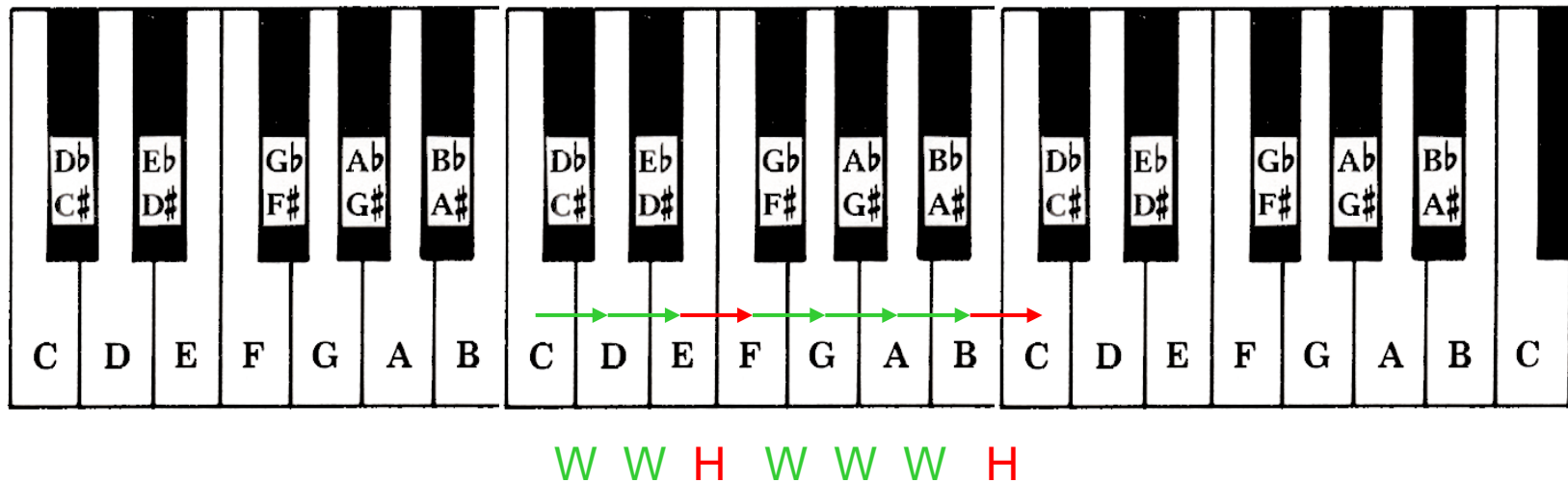


Start on any C note and play all the white keys, going left to right, until you get to the next C.

C Major Scale

The notes you just played had the correct pattern of W and H steps to make that a “major” scale:

W W H W W W H (W = whole-step, H = half-step)

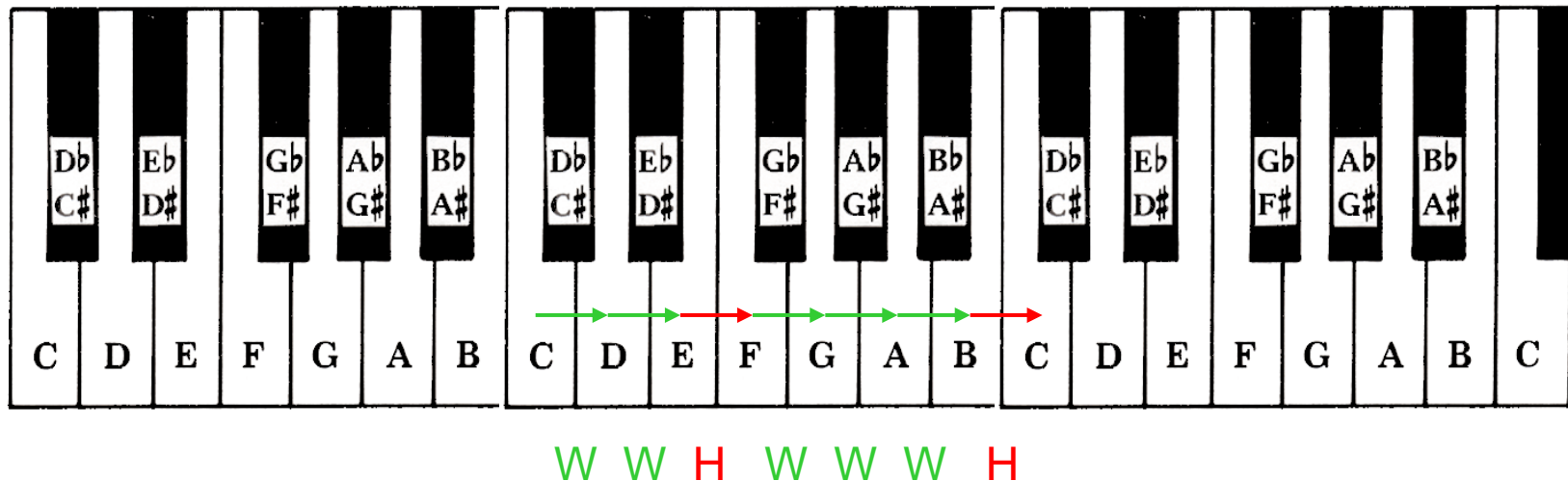


C Major Scale

The notes you just played had the correct pattern of W and H steps to make that a “major” scale:

W W H W W W H (W = whole-step, H = half-step)

Notice that there is only a half-step between the white notes C D and E F (“Be Careful, Electric Fire!”)
There is a whole-step between all other neighboring white notes.



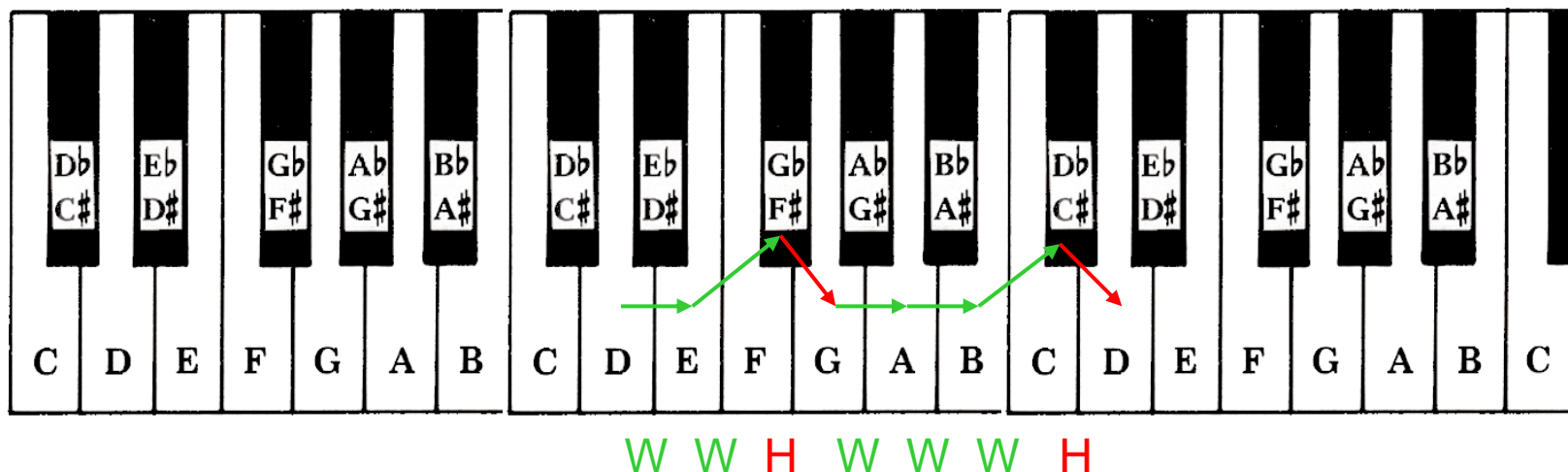
D Major Scale

If we start our major scale on a D note, we'll need to replace TWO of the white notes with black notes, to preserve the correct pattern of whole and half steps:

W W H W W W H (W = whole-step, H = half-step)

We'll need F# and C# (black) instead of F and C (white), so the notes are:

D E F# G A B C# D



TRY PLAYING THE D MAJOR SCALE

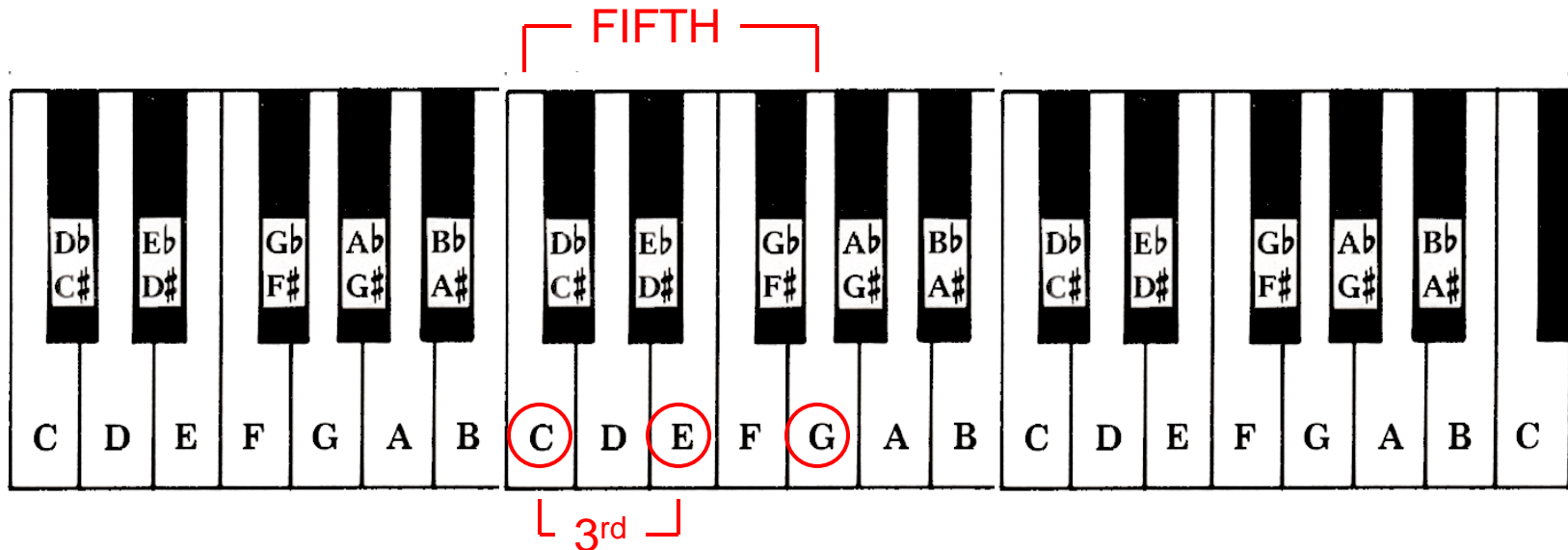
It should sound "like" your C and G scales, just starting on a different note.

Major Chords

The major chord is a very important structure in Western classical music. It is built from the intervals of a major third and a perfect fifth.

To play a major triad, play any note, then the note a **major third** above it, then the note a **perfect fifth** above the first note.

TRY IT: Play C - E - G. Now try playing all three notes together. Does it sound nice? You just played a **C MAJOR CHORD**, aka C major TRIAD.



More Major Chords

Let's try playing more major triads, starting on some different notes.

Remember - play any note, then the note a **major third** above it, then the note a **perfect fifth** above the first note.

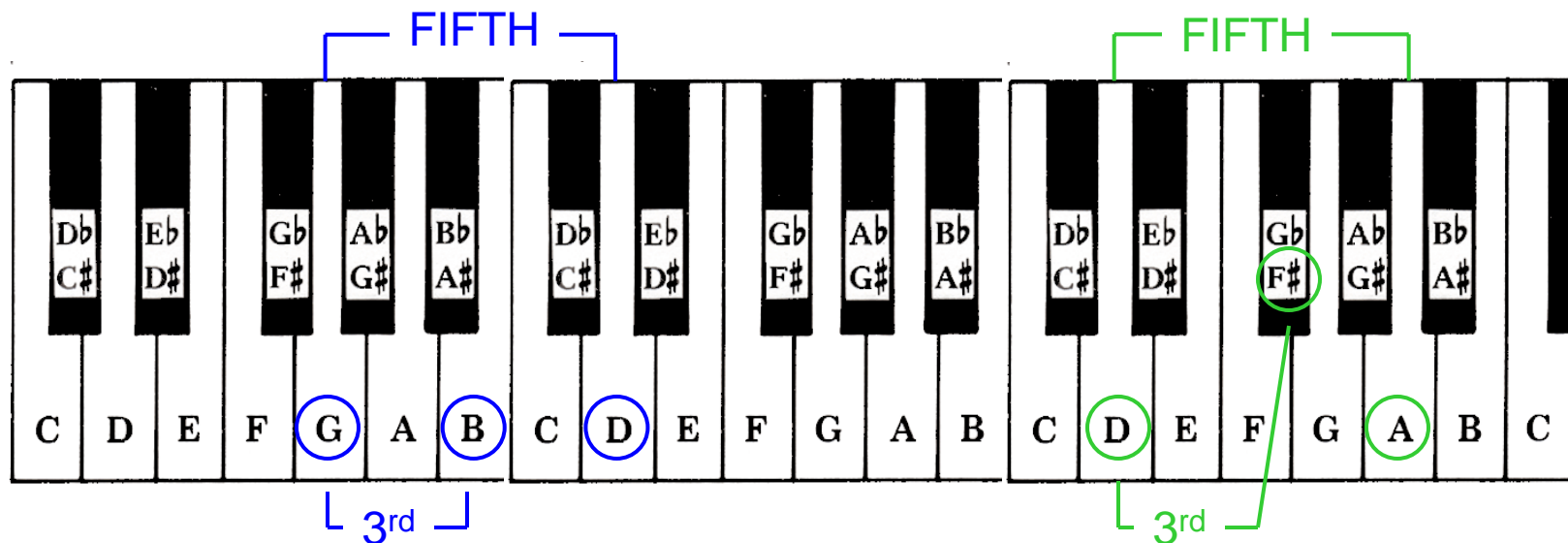
TRY THESE:

C major chord: C – E – G

G major chord: G – B – D

D major chord: D – F# - A

A major chord: A – C# - E



Music notation

We're going to learn just enough to show you how to read/write the pitch of each piano key on a musical staff.

This tutorial will not cover notation of rhythm.

The note played by each piano key has a special place on the musical staff, so that (with practice) you can read the music notation, and know which piano key to play.

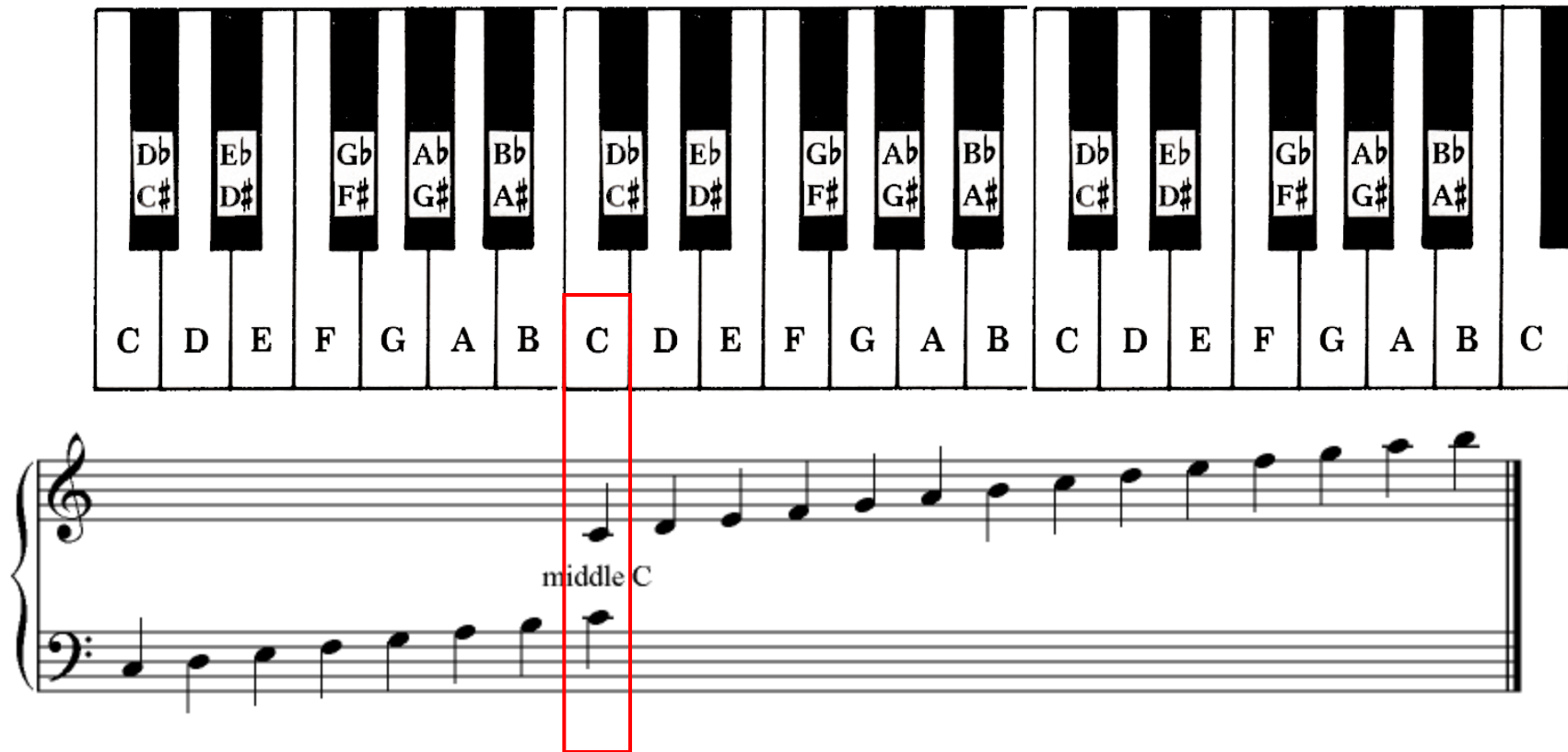
Western music notation has become of the most "international" languages.

However, it doesn't work very well for musical genres that are not based on the Western system of musical pitches. (eg Indian ragas.)

Music notation – white keys

The **note-head** (the black blob) goes in a line, or on a space, on the **staff**.

The top set of five lines is for notes played with the right hand (typically middle C and above). The bottom set is for notes played with the left hand (typically middle C and below).



Music notation – black keys

The **note-heads** for each black key go in the same line or space as for the white key with the same alphabet letter. We write “#” or “b” before the note.

So each black note can be recorded on the staff in two different ways:

The diagram illustrates the notation of black keys on a piano keyboard and a musical staff. It shows three segments of a piano keyboard. The first segment shows the white keys C, D, E, F, G, A, B. The second segment shows the black keys Db, Eb, F#, G#, Ab, Bb. The third segment shows the white keys C, D, E, F, G, A, B, C. Red arrows point from the black keys Db and Eb to the first two notes on the staff, and from the black keys Ab and Bb to the fifth and sixth notes on the staff. The staff shows a sequence of notes: middle C (C), D, E, F, G, A#, Bb, C, D, E, F, G, A, B, C. The notes A# and Bb are shown with a sharp sign and a flat sign respectively. The notes C# and Db are also shown in red text below the staff.

That's all

If you need help with this, please ask Dr. Selby or Andrew, we're here to help.

Please let us know if you can think of a way to improve this tutorial.