Fifths, Fourths, Inversion, and Compound Intervals

Scientifically, an **interval** is defined as the ratio of the vibrational frequencies of two pitches. You can also think of it as the melodic **distance** between two pitches heard in succession, or the harmonic **sonority** two pitches make when sounded together.

Interval number indicates how many letter names an interval spans, including the two pitches themselves. C to E (ascending) spans three letters, C-D-E, so it is a third. C up to F, C-D-E-F, is a fourth, and so on. This is the same as the total count of lines and spaces the interval spans on the staff—again, including both starting and ending note.

Interval quality modifies an interval's number to specify the exact sound. For example, C-E and C-E♭ are both thirds, but C-E is a major third and C-E♭ is a minor third. Spelling counts too, just as in written language: C-E♭ is a minor third while C-D♯ is an augmented second.

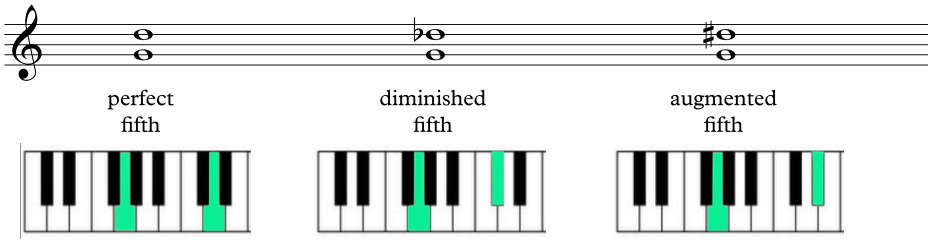
Fifths

A fifth spans 5 letter-names, or 5 lines and spaces on the staff. A fifth's **quality** can be **perfect**, **diminished**, or **augmented** (but **not** major or minor; there is no such thing).

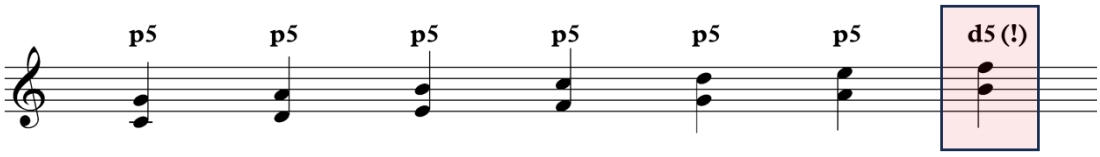
Perfect fifths span 7 half steps (3 whole steps and 1 half step). The perfect fifth is the most stable, consonant interval after the octave. Scientifically, the frequencies of the two pitches of a perfect fifth are in a 3:2 ratio. It is called "perfect" (in the sense of finished, complete) because its stability makes it suitable as a final sonority.

Diminished fifths span only 6 half steps. The diminished fifth is one of the most dissonant intervals.

Augmented fifths span 8 half steps. The augmented fifth is also dissonant.



Note that almost all natural (white-note) fifths are perfect.* The one exception is the fifth B-F, which is diminished. Play the white note fifths on keyboard starting on C-G and going up the scale, and you will hear the contrast when you get to B-F.



* This is not a coincidence. The white notes form a diatonic (major/minor) collection, and the diatonic collection represents the most even way to divide an octave into 7 distinct pitches while maximizing the number of perfect fifths. The relatively even distribution of pitches is useful for building coherent, smooth melodies, while the perfect fifths are desirable for creating stable harmonies.

Starting from the fact that all natural-note fifths (except B-F) are perfect, it is easy to determine the quality of <u>any</u> fifth:

- If **both** notes are **sharped**, the fifth quality is unchanged; likewise if **both** notes are **flatted**.
- If the **<u>upper</u>** note (only) is **<u>flatted</u>**, the interval becomes a half-step smaller. If it started out perfect, it becomes **diminished**. The same is true if the **<u>lower</u>** note (only) is **<u>sharped</u>**.
- If the **<u>upper</u>** note (only) is **<u>sharped</u>**, the interval becomes a half-step larger. If it started out perfect, it becomes **augmented**. The same is true if the **<u>lower</u>** note (only) is **<u>flatted</u>**.



Remember the unique status of the fifth **B-F**! It is **diminished** in its natural (white-note) form. So:



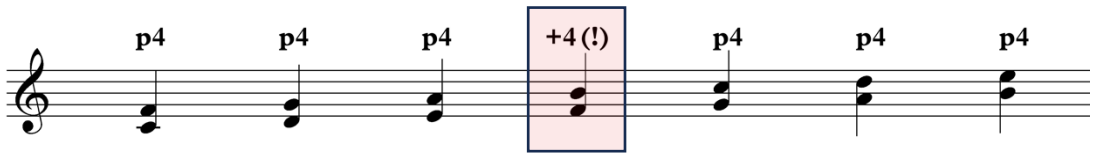
I **strongly** encourage you to learn to construct and ID fifth qualities this way! Counting half steps for fifths is time-consuming and error-prone.*

<u>Fourths</u>

A fourth spans 4 letter-names, or 4 lines and spaces on the staff. But with intervals larger than a third, it gets tedious to count lines and spaces. Observe that on the staff, a fifth always consists of two space notes or two line notes, while a fourth is always one space note and one line note. This makes it easier to distinguish them at a glance.

A fourth spanning 5 half steps is a **perfect** fourth. A fourth spanning 6 half steps is **augmented**, and one spanning 4 half steps is **diminished**.

The situation with natural-note fourths is similar to that with fifths: all white-note fourths are perfect **except for the one fourth F-B**, which is **<u>augmented</u>**.



* Because *do – sol* forms a perfect fifth, some texts recommend using scales or key signatures to identify fifth quality. But this becomes complicated when you need to find the pitch a fifth **below** a given note, or when dealing with a note (like A♯ or C♭) that is not the tonic of any standard scale. The natural-note method is less complicated; and it is equally easy going up or down, and for all pitches.

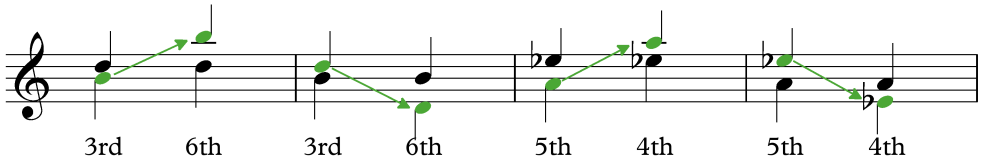
As with fifths, you can use this simple fact to reckon the quality of any fourth: a fourth with two like accidentals is perfect, and so on…but you have to **remember the special status of the F-B augmented fourth**.



Note: Intervals that have a **perfect** form are never "major" or "minor". They can only be perfect, diminished (a half step smaller than perfect), or augmented (a half step larger than perfect). **There is no such thing as a major fourth or major fifth**.

Inversion

When the two pitches of an interval swap places—that is, the lower note moves up an octave, or the upper note moves down an octave—the interval is said to be **inverted**.



Put another way, an interval and its inversion together form the interval of an octave. The numbers of the two intervals add up to 9 (not to 8, because of the funny "interval math" where the starting note is counted as one instead of zero). Fourths invert to fifths, and vice-versa; thirds invert to sixths; seconds invert to sevenths.

The larger an interval, the smaller its inversion. Therefore on inversion, interval **quality** flips symmetrically as follows:

diminished	*inverts to*	augmented
minor	*inverts to*	major
perfect	*inverts to*	perfect
major	*inverts to*	minor
augmented	*inverts to*	diminished

So perfect fifths invert to perfect fourths; diminished fifths invert to augmented fourths; augmented fifths invert to diminished fourths; and vice-versa. (Sixths and sevenths will be covered in a later handout.)

Because of the principle of octave equivalence, you may feel that an interval and its inversion, while distinct, have a shared or similar quality.

In particular, the augmented fourth and diminished fifth are impossible to distinguish out of context. Both span six half steps. They are enharmonic equivalents: one can be respelled to form the other, such as G-C♯ → G-D♭. In the absence of melodic or harmonic context (or notation) it is impossible to tell one from the other. For this reason, there is a term that can signify either one of them: **tritone**. Originally a synonym for the augmented fourth (because an +4 spans three whole steps, or "tones" = tri-tone), *tritone* now refers equally to a an augmented fourth or a diminished fifth.

Compound Intervals

Intervals larger than an octave are called **compound**. They are numbered 9, 10, 11 and so on.

You can think of a compound interval as "a simple interval plus (compounded by) an octave". Because of the principle of octave equivalence, a compound interval sounds very much like its simple counterpart. For example, the compound interval of a major 10th resembles a major 3rd.

Remember that the interval counting system leads to counterintuitive math: to find the compound equivalent of a simple interval, you add 7 (not 8) to the interval number. A compound second is a ninth; a compound third is a tenth; a compound fourth is an eleventh, and so on.

Qualities of compound intervals mirror their simple counterparts. A major 2nd plus an octave is a major 9th; a perfect 5th plus an octave is a perfect 12th, and so on.

Although in theory we could continue numbering larger intervals with ever larger numbers, in practice musicians rarely use any interval label larger than the 13th (an octave plus a sixth). For wider intervals, people will usually substitute a smaller label; for example, the interval from C4 to E6 would typically be called a 10th (not a 17th, its true distance). If it's important to specify the true span, musicians will say something like "two octaves plus a third" or "up a third, two octaves higher". The one common exception is the musical sign 15ma (short for Italian *quindicesima*) which indicates that a note is to be played two octaves higher than written.*

One last thing

The "interval" from a pitch to the same pitch, such as when two people are singing the same note, is called a **unison** (literally "one sound")—not a "first".

* Some musical scores mistakenly uses the symbol 16va to mean "play two octaves higher", showing that even musicians and publishers get confused by interval math.