Fifths, fourths, inversion, and compound intervals

An interval is the relationship between a pair of pitches. Scientifically speaking, an interval is the **ratio of the vibration frequencies** of two pitches. But musicians usually think of it as the **melodic distance** between pitches, or as the **harmonic sonority** two pitches make when played together.

Intervals are identified by **size** and **quality.** So far we have learned about seconds (major, minor, and augmented) and thirds (major and minor).

More generally, interval **size** is the total number of 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 number of lines and spaces the interval spans on the staff—again, counting both the start and end points.

Interval **quality** modifies the size to specify an interval's 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.

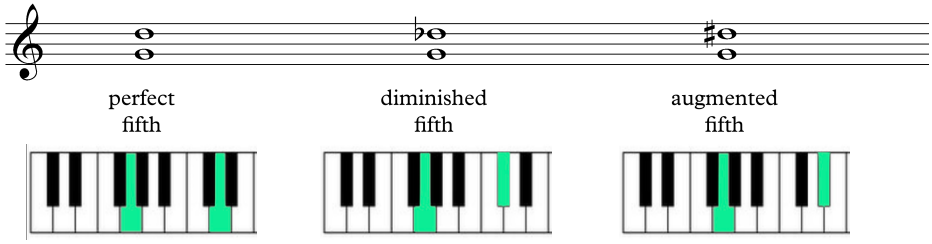
Fifths

A fifth spans 5 letter-names, or 5 lines and spaces on the staff.

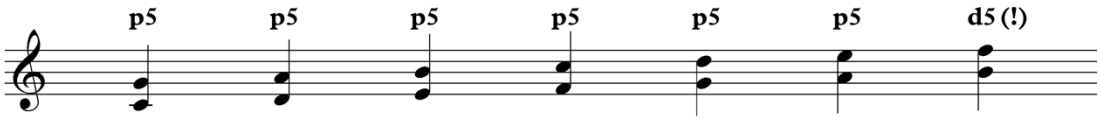
Qualities: perfect, diminished, and augmented

A fifth that spans 7 half steps (3 whole steps and 1 half step) is a **perfect** fifth. It 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 for the final sonority of a phrase.

A fifth that spans only 6 half steps is a **diminished** fifth. It is one of the most dissonant, least stable intervals. A fifth that spans 8 half steps is an **augmented** fifth. It is also dissonant.



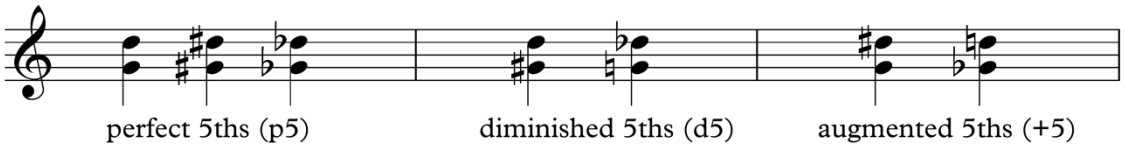
Note that almost all of the natural (white-note) fifths are perfect. The only exception is diminished fifth B-F, which is diminished.



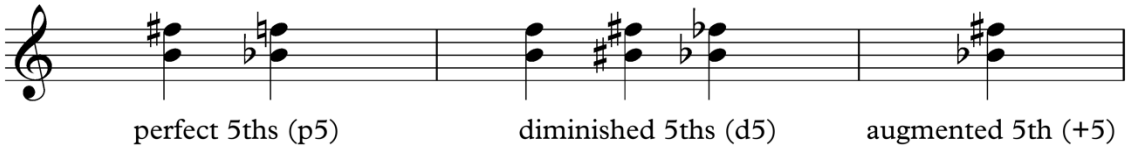
This is not a coincidence. The diatonic (major/minor) scale represents the most even way to divide an octave into 7 distinct pitches while also maximizing the number of perfect fifths. The maximally even distribution is desirable from the standpoint of building coherent stepwise melodies, while the perfect fifths are desirable from the standpoint of creating harmony.

Starting from the fact that white-note fifths (except B-F) are all 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 **lower** note (only) is **sharped**, the interval becomes a half-step smaller; if it was a perfect fifth, it becomes **diminished**. The same is true if only the **upper** note is **flatted**.
- If the **upper** note (only) is **sharped**, the interval becomes a half-step larger; if it was a perfect fifth, it becomes **augmented**. The same is true if only the **lower** note is **flatted**.



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



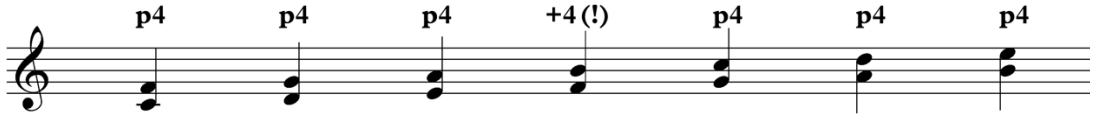
I strongly encourage you to learn to construct and ID fifth qualities this way. Counting half steps for large intervals is time-consuming and error-prone. Because *do* to *sol* forms a perfect fifth, many people are taught to use scales or key signatures to identify quality of fifths. But this becomes complicated when you're tasked with finding the pitch a fifth **below** a given note, or when dealing with a note (like A♯ or C♭) that is not the tonic of a standard scale. The "white-note" method is equally easy going up or down, and for all pitches.

Fourths

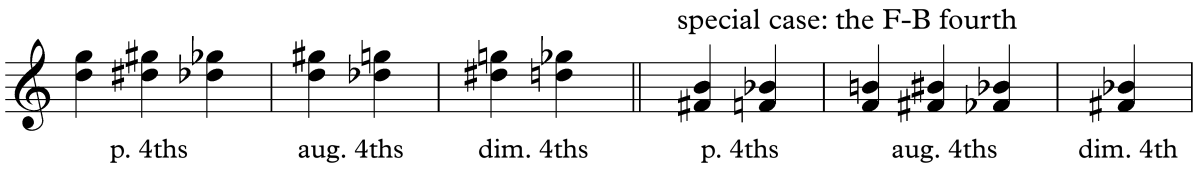
A fourth spans 4 letter-names, or 4 lines and spaces on the staff. With intervals larger than a third, it gets tedious to count lines and spaces. Notice that on a given staff, a fifth always consists of two space notes or two line notes, while a fourth is always one space and one line note. This makes 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 **augmented**.



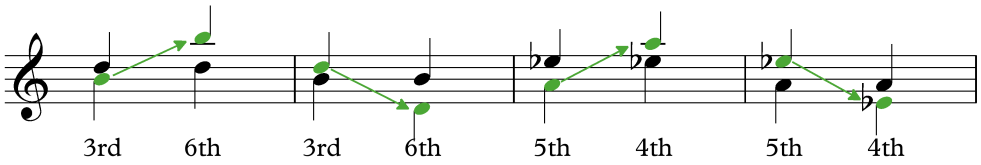
As with fifths, you can use this simple fact to reckon the quality of any fourth: a fourth with two like accidentals is perfect, and so on…but you have to remember the special status of the F-B fourth.



Note: Intervals that have a **perfect** form can never be "major" or "minor". If enlarged from perfect they become augmented; if shrunk from perfect they become diminished. **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 to become the upper note, or the upper note moves down an octave to become the lower note—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. Fifths invert to fourths, 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 hear that an interval and its inversion, while distinct, have a shared or similar quality.

In particular, the augmented fourth and diminished fifth can be difficult to distinguish. 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, 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 intervals**. They are numbered 9, 10, 11 and so on. Intervals of an octave or less can be called **simple** intervals.

You can think of compound intervals as "a simple interval plus an octave". Again 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 bears a strong resemblance to its simple twin, the major 3rd.

MU 1310 (Feurzeig) **More Intervals**

As usual, our funky 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 ninth is a compound second; a tenth is a compound third; an eleventh is a compound fourth, 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 label larger than a 13th (an octave plus a sixth). For wider intervals, people will usually use 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".