

The Diatonic Scale

Sound, Pitch, and Frequency

Sound consists, in reality, of vibrations in a fluid medium – normally, air. The **frequency** of the vibrations causes a sense of “highness” or “lowness” of the sound, and is measured in cycles per second (cps, also called hertz, Hz). Most sounds are actually composed of several different frequencies at once, so we use the term **pitch** to mean our experience of how high or low a sound is.

Octaves and intervals

When one sound has a frequency precisely twice that of another sound – that is, when the two frequencies are in the ratio of 2:1 – they “sound” like the same pitch to most listeners. We call the pitch difference between two such notes an **octave**. That is why, for example, a man, a woman, and a small child can all sing the same melody together – they are singing at intervals of an octave.

Creating pairs of pitches at other ratios – for example, at a ratio of 3:2, meaning that the higher frequency is 1.5 times that of the lower – we find the basic intervals common to most human music. Below each ratio is the name commonly given to the interval in Western music.

2:1	3:2	4:3	5:3	5:4	9:8	15:8
perfect octave	perfect fifth	perfect fourth	major sixth	major third	major second	major seventh

Listen to the instructor demonstrate these intervals, and try singing them yourself. The “perfect” intervals are the ones that sound most “stable.” (The term “major” will be explained later.)

If we sing the beginning pitch (the one that the others are multiples of), then these seven intervals *in order* from lowest to highest, we have a series of notes which you will probably recognize, ending on the “same note”, an octave up. During the Middle Ages, names were assigned to these pitches to help singers learn them:

starting pitch: do	major second: re	major third: mi	perfect fourth: fa	perfect fifth: so	major sixth: la	major seventh: ti	octave: do
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The pitch names repeat from the new “do”. Practice this a few times.

Other musicians during the Middle Ages assigned the letters A through G to the seven pitches – but for various reasons, they started with C:

C	D	E	F	G	A	B	C
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This is called the “C major scale.”

Whole steps and half steps

Now, the pitch interval between consecutive pitches is the same – a major second – except between mi and fa, and ti and do, where the interval is smaller. The interval between mi and fi, or ti and do, we call a “minor second” or a “half step”. The intervals between the remaining pitches of the scale (e.g. between do and re) we call a “major second” or a “whole step”. So:

do	-w-	re	-w-	mi	-h-	fa	-w-	so	-w-	la	-w-	ti	-h-	do
C	-w-	D	-w-	E	-h-	F	-w-	G	-w-	A	-w-	B	-h-	C

Sometimes we need to sing the pitches “in between” two notes separated by a whole step.

To represent the pitch a half step above a particular note, we add a small crosshatch after the name of the note; this symbol is called a **sharp sign**. So C# (“C sharp”) is a half step above C.

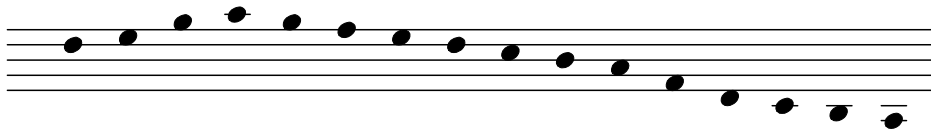
To represent the pitch a half below a particular note, we add a mark like a small italic b after the name of the note; this symbol is called a **flat sign**. So E_b (“E flat”) is a half step below E.

The Staff

In the Middle Ages, when musical notation came into use, some musical manuscripts simply placed the note letters (C, D, and so on) above the words of the text, to show the pitches to be sung. Eventually, musicians began placing pitch marks (notes) on three, four, or five parallel lines, to form a **staff**:

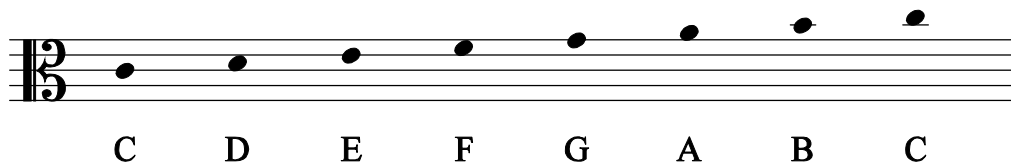


The lines and spaces between lines correspond to degrees of the major scale. If pitches above or below the scale need to be marked, we can add **ledger lines** to continue the staff up or down:

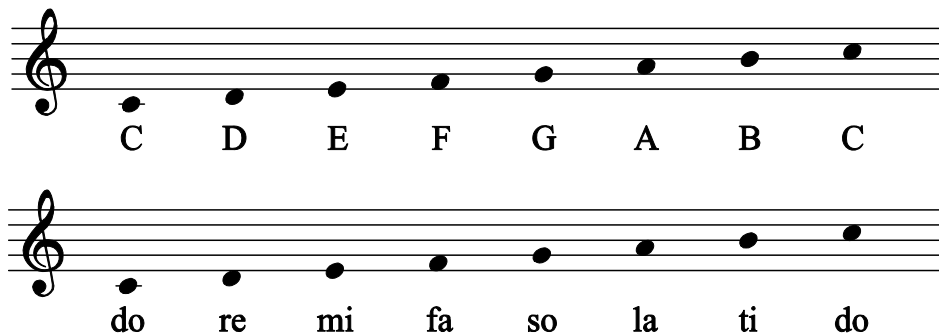


The notes on the staff are sung from left to right. Unfortunately, it is still not clear how the pitches match up with the lines and spaces – in other words, we need to decide or indicate where the major scale starts on the staff.

One early solution assigned the C of the C major scale to the middle line of a five-line staff, and put a mark called a **clef** (from the Latin work for key, *clevis*) on this line as a “key” to reading the music. This clef (the “C clef” or “alto clef”) consists of two backwards letter C’s, and shows that the line between the C’s is... the note C.



Eventually, however, musicians decided that they wanted the C major scale to cover the lower part of the five-line staff, and they began writing C on the first ledger lines under the staff. The new clef consisted of a stylized letter G, with a curlicue in the middle surrounding the line that the pitch G (two lines above C) ends up on.



This is the staff used in modern notation for *prostopinije*.

What if our starting pitch (do) is not C?

One drawback of the staff so far is that C is in an inconvenient place for chant melodies, which often go up and down from the starting pitch. Using the staff shown above, with C as our starting pitch, the notes of the melody could easily go “off the chart” and be hard to follow. Changing the clef for each chant would be confusing; it would be easier to keep the same clef, and just start our major scale on another note. In other words, we start with another pitch as *do* – something other than C.

Suppose our starting pitch is G:

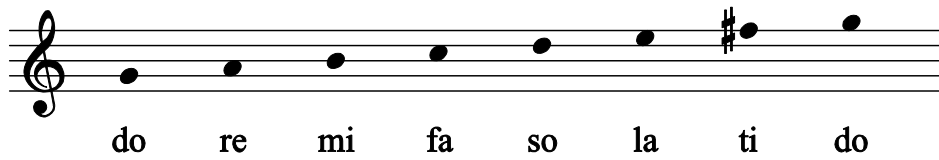
do	re	mi	fa	so	la	ti	do
G	A	B	C	D	E	??	G

Everything works nicely up to *ti*. Whole step, whole step, half step (B to C); whole step, whole step... and we come to the problem. E to F is a half-step, and F to G is a whole step – the exact opposite of what we want, which is from *la* to *ti* to be a *whole step*, and *ti* to *do* to be a half step.

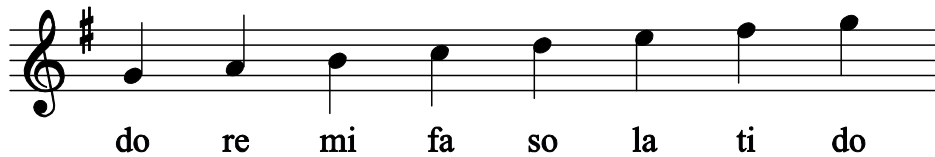
Our problem would be solved if *ti* were just a little higher – in fact, a half step higher. So the seventh pitch of the scale should be an F sharp instead of an F:

do	re	mi	fa	so	la	ti	do
G	A	B	C	D	E	F#	G

On the staff, we can put the sharp sign in front of the F, and we have our major scale, beginning on G:



In fact, we could put the sharp sign in front of every F that occurs in our chant, but it would be simpler and easier to just put the sharp once at the start of the staff, on the line for F, and agree that it applies to every F on that staff.

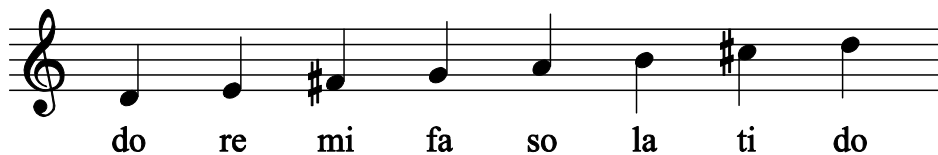


The sharp sign is called an **accidental** mark, and putting it at the start of the staff, just after the clef, gives us our **key signature** – it shows us where the starting pitch of our scale is.

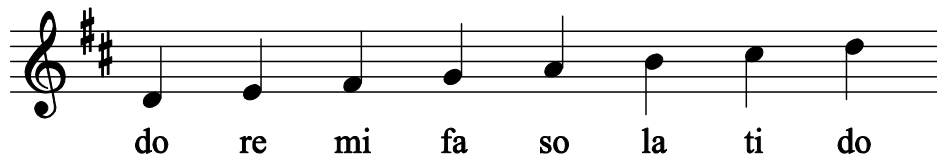
We could start on D:

do	re	mi	fa	so	la	ti	do
D	E	F#	G	A	B	C#	D

For this scale, we have to raise both F to F#, and the C to C#, to make the notes of the scale come out right. So the key signature for the D major scale has two sharps, F and C:



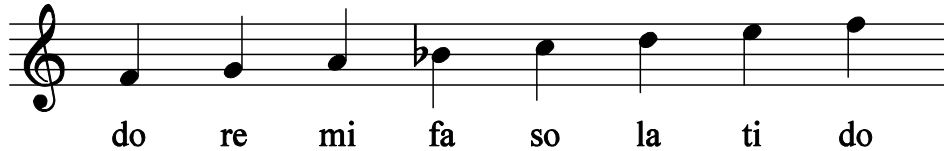
With a key signature:



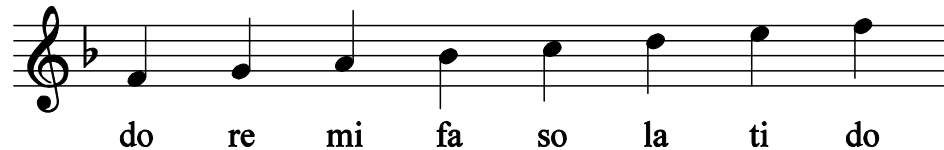
If we start on F, we find that we have to *lower* the fourth pitch (B) to make the interval from mi to fa a half step. Making the fourth degree of the scale a B flat gives us the correct pattern of whole and half steps:

do	re	mi	fa	so	la	ti	do
F	G	A	Bb	C	D	E	F

Here is the F major scale:



And here is the same scale, with its proper key signature:



Minor scales

So far we have not really defined what makes a major scale. Simply, a major scale is a seven tone scale with half tones between the 3rd and 4th degrees (mi to fa) and the 7th and 8th degrees (ti to do).

A minor scale, by comparison, is a seven tone scale with half-notes between the 2nd and 3rd degrees, and the 5th and 6th degrees. (This is called the “natural minor” scale, but the details of the harmonic and melodic minor scales are not vital to know at this point.) The third, sixth, and seventh of this scale are a half-step smaller than the same intervals of the major scale. So we say these intervals in the minor scale are a **minor third**, a **minor sixth**, and a **minor seventh**.

The easiest way to sing a minor scale is to sing the progression of pitches we already have, but starting on la instead of do:

minor scale:

do ti la la ti do re mi fa so la

la ti do re mi re do ti la

And back to major without changing our key pitch:



By doing it this way, we can avoid talking about major and minor scales entirely – which is all to the good, because *prostopinije*, like some other Eastern forms of chant, is not tied nearly so closely to Western major / minor tonalities.

Putting it all together

When singing *prostopinije*, we are primarily working with relative pitch. Sometimes our starting note will be taken from the priest's or deacon's pitch; sometimes it will be chosen so that the entire chant is in the vocal range of the congregation. Either way, the cantor uses notation to sing the chant as intended.

To do this:

1. Identify the key signature; use the key signature to find the starting pitch (do) of the appropriate major scale on the staff.



2. Choose a reasonable pitch for do, based on your knowledge of the chant you are going to sing. (For example, if the chant will go very far above this pitch, it is best to begin a little low.)
3. Sing, as quietly as possible to yourself, the following pattern: do – mi – so – mi – do. You may want to sing *down* to so and back to the starting pitch of the scale: do – mi – so – mi – do – so – do.
4. If the chant does not start on do, go up or down the scale to find the starting pitch of the chant.
5. Now you know both the key you are in, and the beginning pitch of the chant. Start singing!

This is the process we will practice and use throughout the Metropolitan Cantor Institute courses. Eventually, you will be able to do this “in your head”, and very quickly. But it is an invaluable way to being singing chant.