The Science of Music

ALL IN ONE PLACE COMPLETE

by Joseph Pingel

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Please direct all inquiries regarding this book, distribution, affiliation, improvements, suggestions and anything of interest to Joseph Pingel.

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I wanted to be a rock star when I was a kid. I was good on the guitar at an early age and used guitar-chord knowledge to teach myself piano (after a couple years of lessons).

That changeover from one instrument to another drove home some music theory concepts that rocked my musical world. I made an unobvious discovery; a discovery missed by most musicians out there. That’s what this book is about.

No matter your musical skills, you will either acknowledge and recognize the rare insights I share here or aspire to understand them better.

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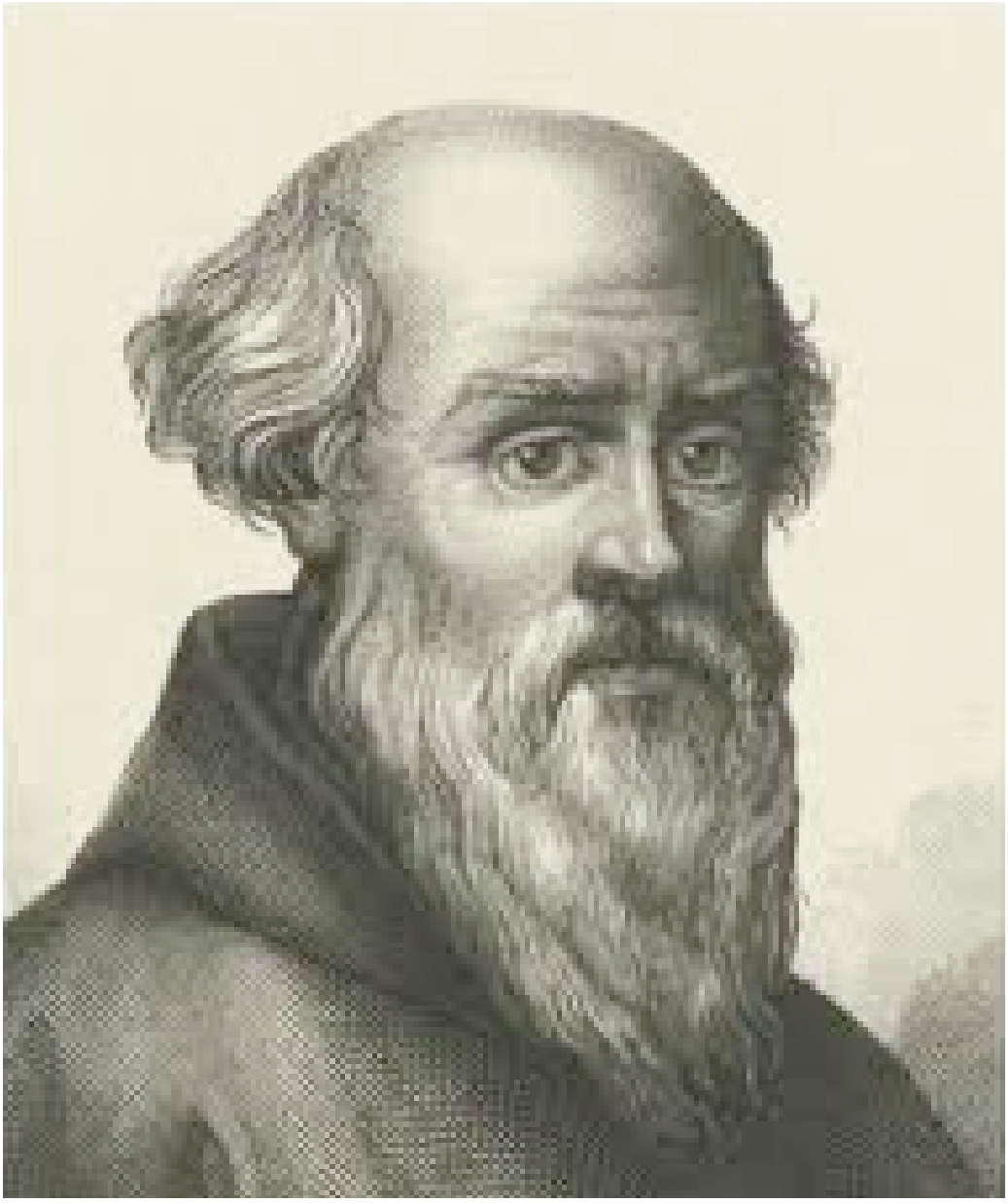

Guido of Arezzo (991 – after 1033) was a monk of the Benedictine order. He is regarded as the inventor of the piano keyboard (as it looks today) as well as modern musical notation on the staff.

Introduction

The Music Theory Discovery

Guido of Arezzo was on to something when he invented music notation back in the 11th century. Ever since then, we've been trying to explain his invention and discovery.

Over the hundreds of years, music theory has refined and distilled itself down to what it is today. It doesn't seem there's any more to be learned.

Some learn theory in music school but most musicians don't. They find this information from various sources and start to put things together. Trouble is, the information you need is hard to find in one place.

My Search

For five years I studied many college texts and courses looking for answers. Everything I read was the same; some, duller than dull; some well-explained but "the same" nonetheless.

Rarely did I find explanations that included insightful context. With a little luck, just a paragraph or two might turn up here or there but overall, it was all the same.

I Didn't Know Know What I Needed to Know.

- I wanted to know theory to become a better musician;
- I wanted to find the information in one place; and
- I wanted some good direction.

Even though I knew theory, I felt like I was still missing something. Most people don't have this premonition so they don't go looking very deep. But there is something much deeper below the surface that puts things in context.

Discover Movement

Music is not any **one** thing. It is a combination of interactive, **multiple conditions** that create motion that occur at the same time. When you recognize "motion," it changes your perspective of interpretation (sight reading). This is the kind of context you need to comprehend theory quickly.

The 7 Principles Are The Moving Parts of Music

- they show music theory as a simple, limited science.
- they show the "numbers" side of music that controls.
- they show the machine that joins numbers and letters.
- they define the borders of music structure.

Defining The Borders of Music

The defining borders of music are the 7 Principles that reduce music to numbers and letters. It's a very limited understanding. The Principles are "complete knowledge" of the science that lets you manage music. Everything you need is in right here.

Your Greatest Insights

This book defines music theory and is complete start to finish. The concept of "completeness" changes things in your mind and makes learning music more goal oriented. There are always infinite ways to apply theory but the science is quite limited.

Your greatest insights comes as a result of learning chords. Chords *force* you to apply numbers routinely and give you a reason to practice numerical thinking. With practice it becomes a second nature.

I'm humble and appreciative to all that I might help focus a keener vision.

All the best,

Joseph Pingel

The 7 Principles of Music At a Glance

Principle 1: Keyboard Layout

This Principle covers the basics. The layout was invented by Guido of Arezzo back in 1013 who is also given credit for inventing music notation. Guido used two black notes followed by three black notes to divide it up his 8-note scale.

Principle 2: Scale Uniformity

This Principle uses the major scale order as a ruler in music. Although it appears somewhat simple on the surface, the scope is infinite and cannot be realized without greater experience.

Principle 3: Building Chords

You don't need a chord book to figure chords out if you know the building formula. Start with a basic major or minor chord and build from there. It's an easy understanding and it doesn't make any difference what key.

Principle 4: Creative Variables of Music

Music is an infinite art form and this is the oldest Principle. Before written theory (like the caveman days) these concepts were all there was. Rhythms, tempos and pitch combine invisibly as reciprocal moving parts of expression. There is great movement that takes place every time a song is played.

Principle 5: Counting Variables of Music

This is the Principle of duration. Notes, rests and time signatures are all static facts of notation. A beat can be divided in half and in fourths and that's all. With only three tiers of notes, you can express any rhythm there is.

Principle 6: Alpha Notation on The Staff

Alpha is the communication vehicle of music that let's us write a song down on paper or sight read it. The five-lined staff is a pallet that defines the tones with the treble and bass clefs. It's a simple layout to expressing the infinity of music.

Principle 7: The Machine

The "Machine" is the technology we use to combine numbers and letters together. It is the process that puts you in command to identify keys, build progressive keys and be able to place the notation properly. Just 3 things, but when you master the machine, you achieve a higher level of understanding.


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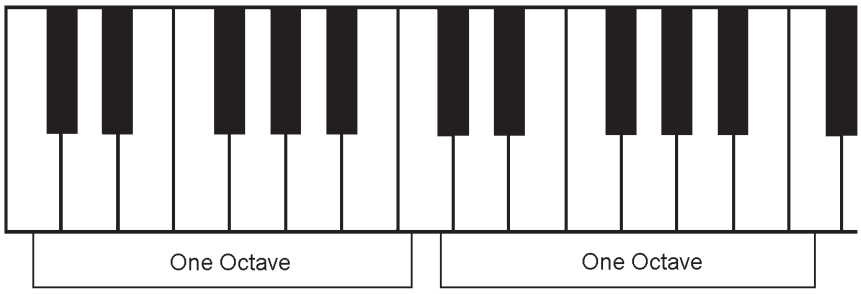
Principle 1: Keyboard Layout

The Keyboard and Octaves

The standard piano keyboard has 88 keys consisting of seven octaves of twelve (12) notes plus four extra notes.

An octave is the distance from one not to the next that has the same name (i.e. C to C or A♭ to A♭). It spans 8 white notes and 5 black notes that repeat in succession up the keyboard.



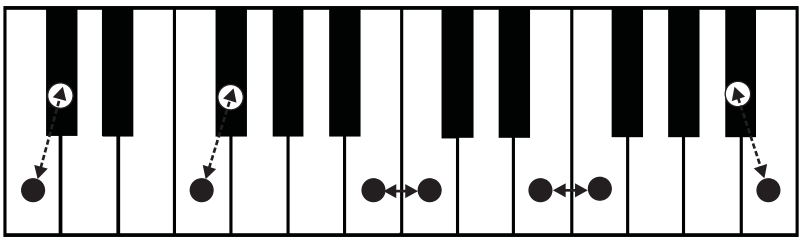
Arezzo is credited with the modern layout of the keyboard as shown above. This invention is early in history when no single keyboard layout had gained dominance or been standardized.

He standardized the keyboard with a layout that displayed black notes in repeating groups of 2 and 3.

Whole Steps and Half Steps

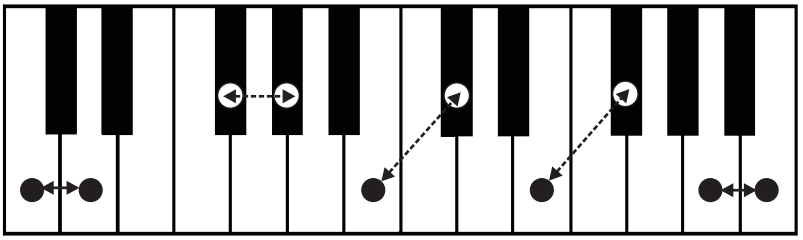
All notes on the keyboard are one half step away from each other. It doesn't matter if an adjoining note is black or white, a half step is the note directly next to any note.

Half Steps

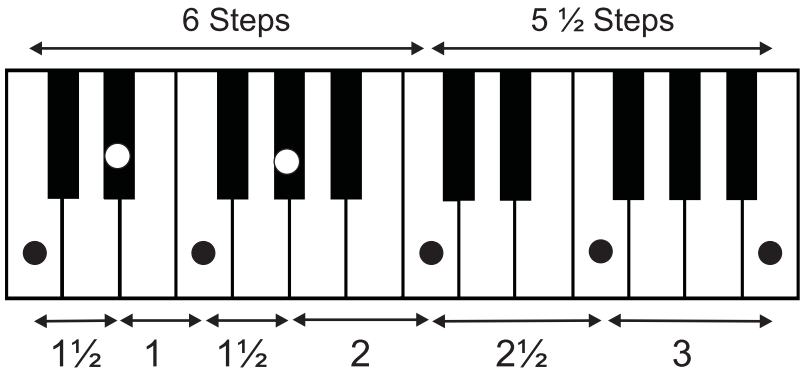


A whole step is twice that of a half step. To figure a whole step you count every other note up or down from any note.

Whole Steps



Study these examples below and learn how to count whole and half steps from one note to another.



Middle C

Middle C is the C note closest to the center of the keyboard within the proximity of the piano's insignia. The Middle C Range is made up of the twelve (12) black and white keys directly above and below middle C where most playing takes place.

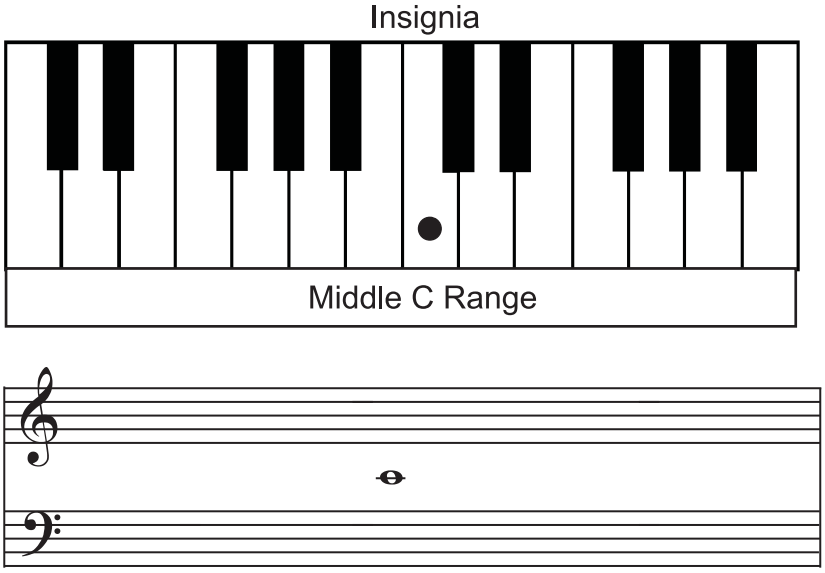
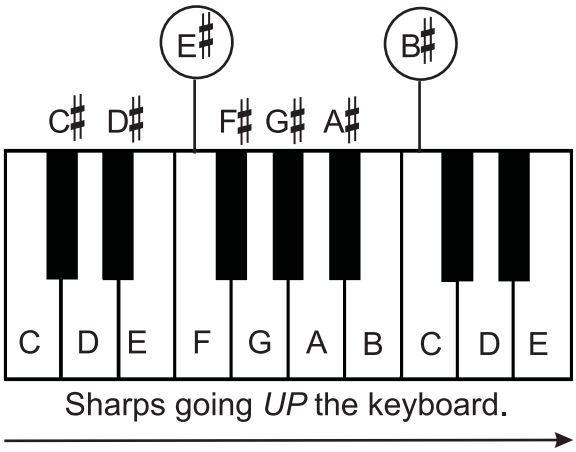


Figure 1.1 Middle C is shown as a single ledger line between the two staffs.

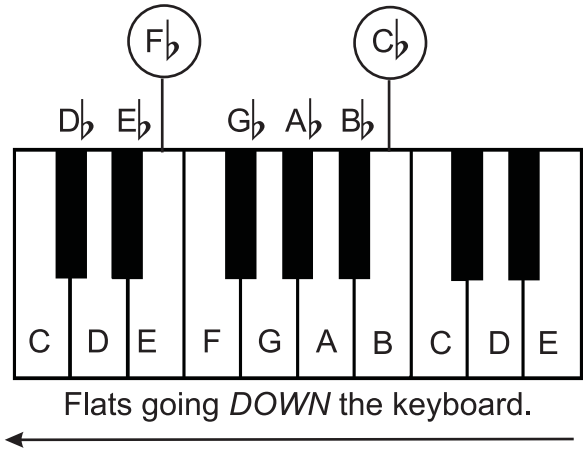
Black Notes

The 5 black notes in each octave are given both sharp and flat names. Designation between sharp and flat is determined by the direction of the half step.

Sharp (♯) means the note one half step <u>up</u> from any white note.



Flat (♭) means the note one half step <u>down</u> from any white note.



White notes can also be sharp or flat (see E♯ and F♭ above). White or black, all notes are sharp or flat relative to their closest, neighboring half step.

For example, B♭ double flat (notated B𝄫) is A and F♯ double sharp (notated F𝄪) is G.

If you don't fully understand this, you will fall into it shortly. For definition purposes however, notes going up the keyboard are sharp and those going down are flat. Though A♯ is the same tone as B♭ flat, they are written differently on the staff.

Principle 2: Scale Uniformity

This understanding is the cornerstone of music because it unifies all 12 keys. You can control them all by applying the same numerical concepts from one key to another. They have different notes but the order stays the same.

- A **SCALE** is a series of eight notes that begins and ends on the same note. Each note is designated a number from 1 through 8.
- A **MAJOR SCALE** consists of half steps between the 3rd and 4th, and the 7th and 8th tones of the scale. All other steps are whole steps.
- The **ROOT NOTE** (or tonic) is the first note of a scale. It names the key and is given the number one.

Using Your Ear

If you play all the white notes progressively up one at a time from C to C, it sounds like "do-re-mi-fa-sol-las-ti-do." This is called a diatonic scale. Now play the white notes from D to D. It doesn't produce the "do-re-mi" scale.

Why not? You'll find out on the next page.

The Major Scale Ruler

The key of C is a musical ruler that shows the mathematical order notes that include half steps at the 3rd / 4th and 7th / 8th intervals.

The Key of C shows the uniform layout of scale tones without using any black notes. The exact same order applies to all other keys as well.

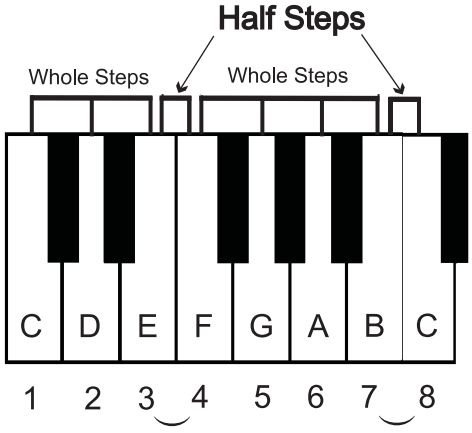


Figure 2.1
The KEY OF C is the model for all other keys numerically because it has no sharps or flats.

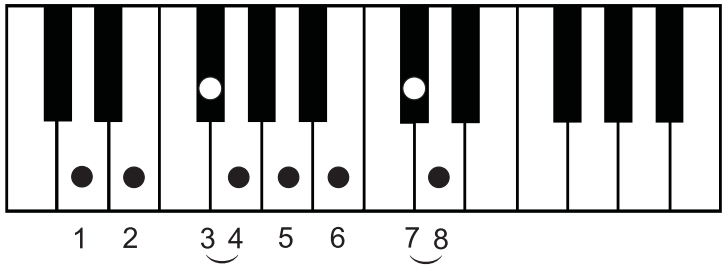
No Two Things Can Occupy The Same Space at the Same Time.

This is a law of physics. Each note on the keyboard has its own unique position *compared to the location of C.* The order stays the same for all keys. The notes shift evenly and uniformly when you change the root not. This is a key concept to transposing, building chords and manipulating music.

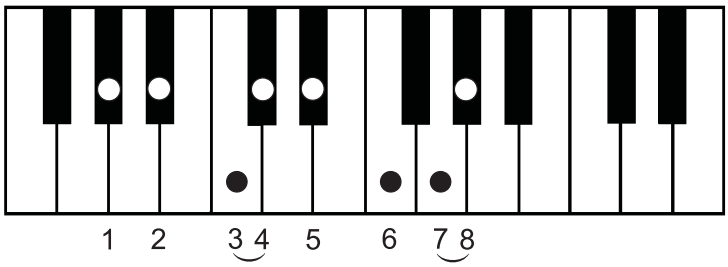
The Key Signature Identifies The FACT Of The Scale; Not the Other Way Around.

An important distinction is that notes are not played sharp or flat *because the key signature says to.* Rather, the key signature merely identifies the fact of the major scale order; not the other way around.

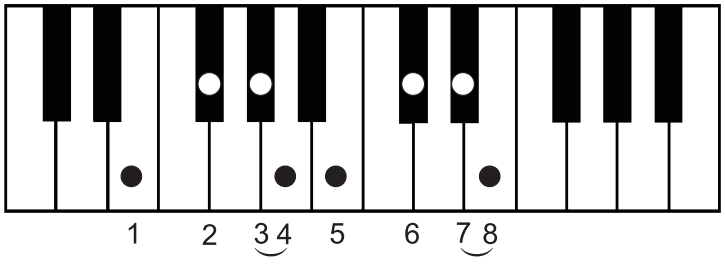
Key of D



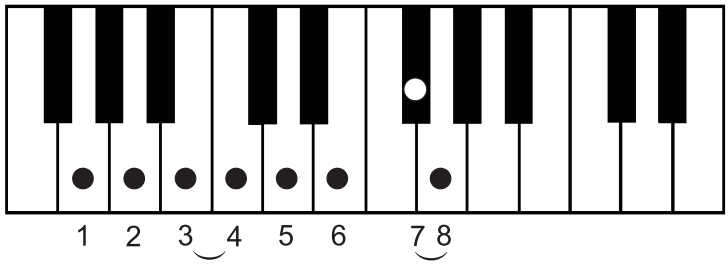
Key of A♭



Key of E

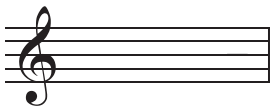


Key of G

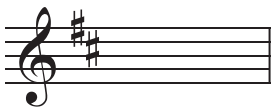


Key of B♭

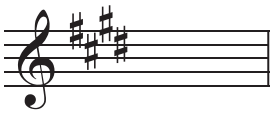
C



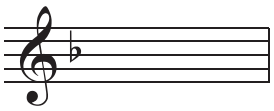
D



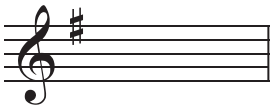
E



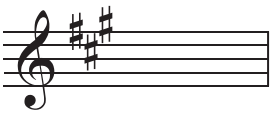
F



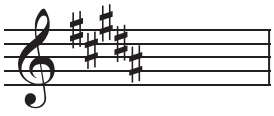
G

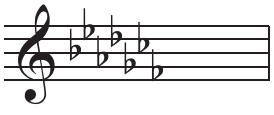


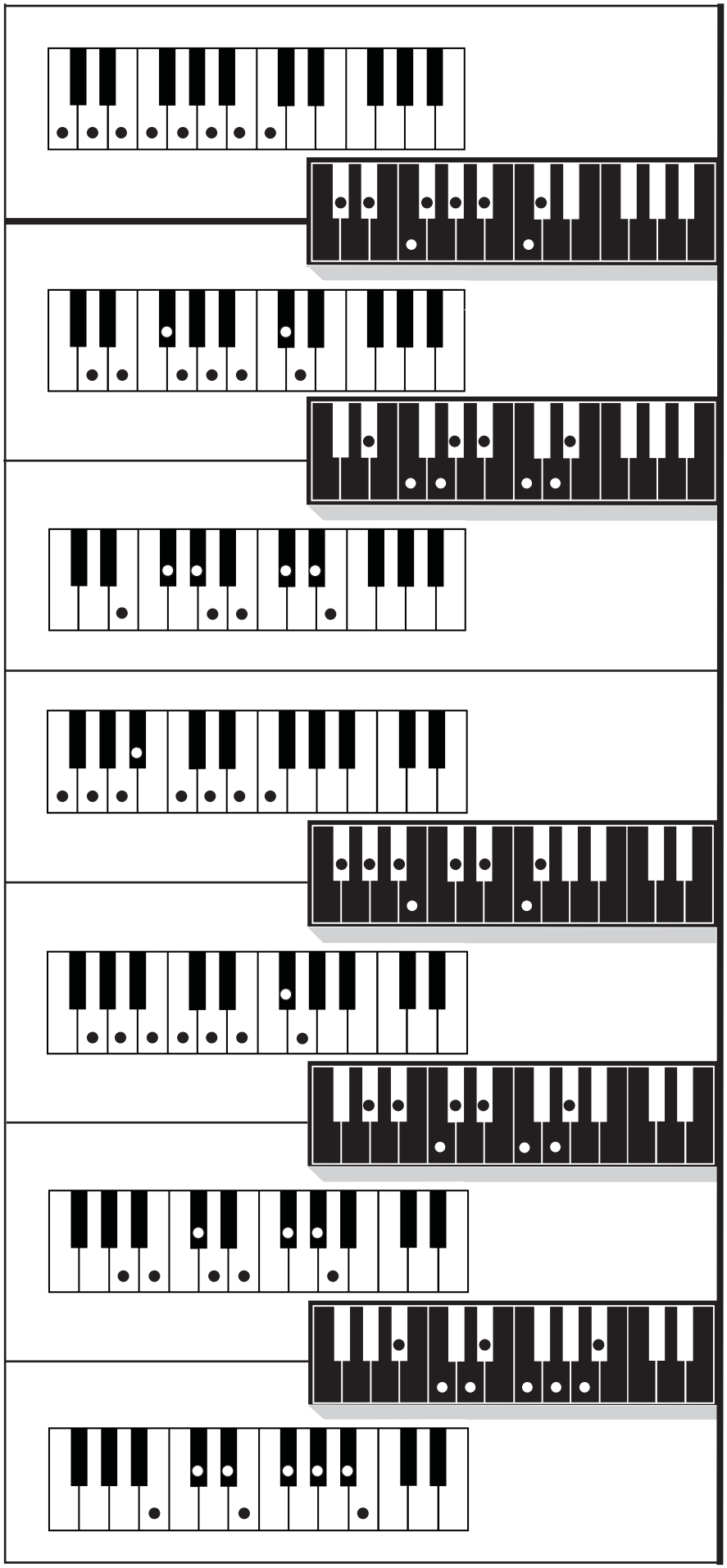
A



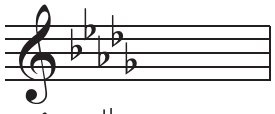
B or C♭

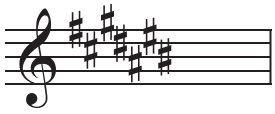




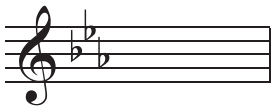


D♭ or C♯

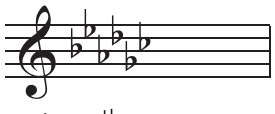


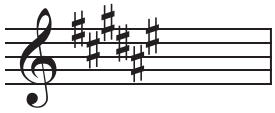


E♭

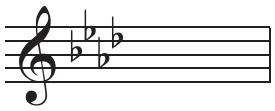


G♭ or F♯

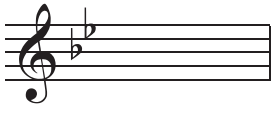




A♭



B♭

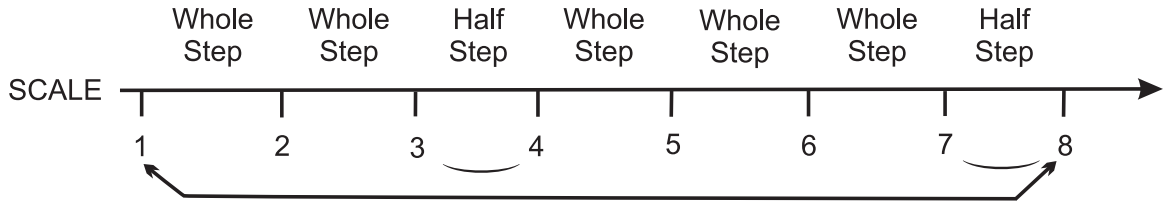


Keyed Up PIANO

Principle 3: Building Chords

All scales, in every key, are numerically the same. Note spacings are consistent throughout and each note of each scale is given a number from 1 through 8. There are no Sharps or Flats when you use numbers.

The diagram below is the ruler to figure out any scale.



Basic Major and Minor Chords

These two types of chords are the starting point to building chords.

Each of the 12 notes has its own scale. The notes of each individual scale order are used to create major and minor chords for that particular key.

The concept of scales has *nothing to do with individual alpha-named notes* but rather, only deals with the 1 through 8 numerical order.

No matter where you start, the numerical order always stays the same. When shifting the numerical order to start on another (root) note, the individual notes of each scale change but the numerical order doesn't.

Uniform Numbering Lets You Control All Keys The Same.

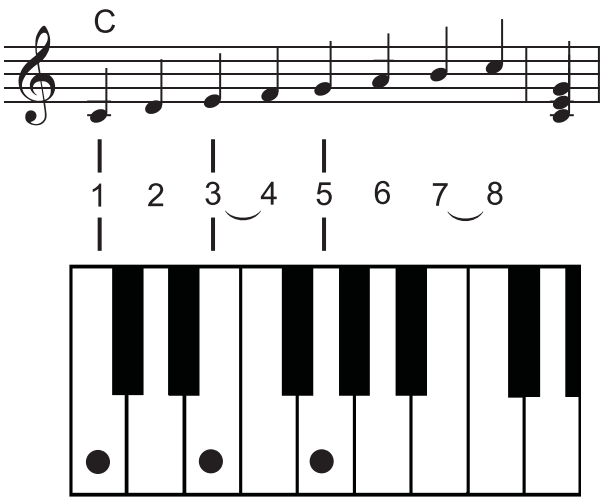
This gives you the power to control music numerically in ways you may not immediately comprehend.

The advantage of numbers over alpha-tones is that you can use it to build and count numbers. You cannot count the alphabet!

Numbers let you keep track of where you are; build chords; transpose and chart chordal progressions. With numbers you apply the symetry of music uniformly from one key to another.

MAJOR CHORD

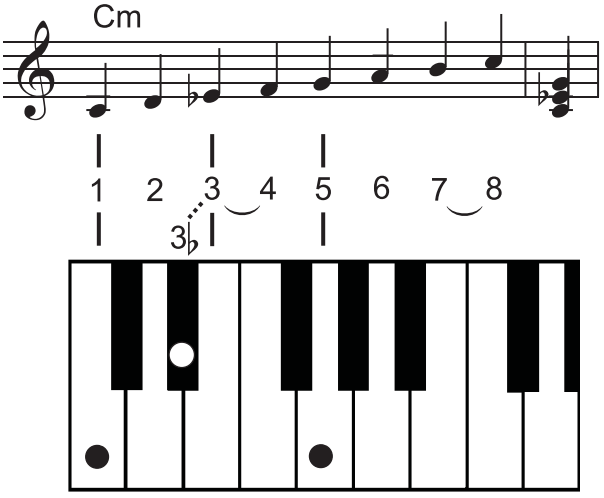
- Has the numerical order of 1-3-5 which corresponds with the first, third and fifth tones of a major scale.
- The root note gives the chord its name.
- There is a major chord for each of the twelve notes in an octave.



MINOR CHORD

This is a slight modification of a major chord in that the third note of the scale is flatted.

- Has the numerical order of 1-3♭-5 as it relates to the major scale.
- The root note gives the chord its name followed with an “m” (e.g. Am).
- There is a minor chord for each of the twelve notes in an octave.



J.S. Bach is given credit for the invention of “Even Temperment.” He wrote the Well-Tempered Clavier to demonstrate the advantages of "even tempered" tuning.

Principle 4: Creative Variables of Music

Music is totally based on mathematics. All melodies can be broken down structurally into three categories:

- Pitch
- Meter
- Tempo

Individually, each variable is singular to itself; void of artistic qualities. However combined, they work harmoniously together and create endless possibilities for original composition.

Pitch

Pitch refers to the number of vibrations or cycles per second (CPS) of any note. The lowest note of the keyboard vibrates at about 27 CPS and the highest note; over 4000. Between the highest and lowest notes, the number of possible pitches is infinite.

The piano is tuned using 12 "standard pitches" which are internationally accepted. Standard pitch sets the A note above middle C at 435 CPS. All other pitches are tuned to a mathematical ratio of A.

Even Temperament

Oddly enough, if a piano is tuned PERFECTLY to "A" using the exact science of pitch, it affects being able to play in tune in other keys. This is because the vibration ratio for A scale is not the same as the C scale (or any other key). When tuning using PERFECT PITCH, certain keys will sound fine but others will be way off and unusable.

This was a major problem tuning keyboard instruments prior to the 1700s.

Enter the concept of even temperament. This is a way of tuning a piano "imperfectly" so one could play reasonably well in all 12 keys. It was not an overnight success but did became the standard tuning around the 1700s.

Notes

A note (or rest) is a symbol that shows two different properties:

- On the staff, note identifies a specific tone.
- Relevant to the time signature, a note shows a duration of time.

Rests

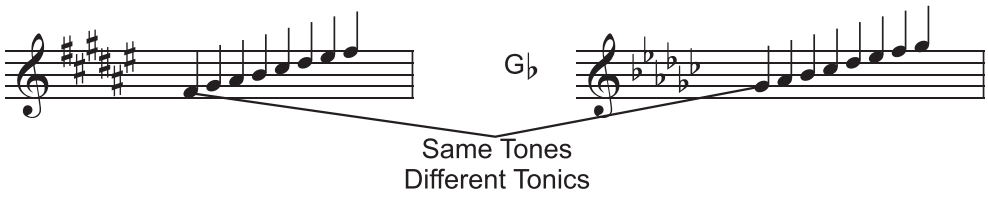
Each note has a corresponding rest that holds the same relative time and duration as the note.

Tones

Specific tones are identified on the staff using notes.

However the terms “Note” and “Tone” are not same. “Note” is a measure of duration while “Tone” measures the pitch. A tone can can be identified as two separate notes on the staff.

For example, F♯ and G♭ are the same tone but written differently on the staff.



Duration

Duration is the length of time a note or rest is held. Its time value is proportionate to whatever counting system is being shown in the time signature.

Tempo

Tempo is the rate of speed that beats are counted. It varies in speed from slow to fast depending on the speed of the song. Whatever the speed, the tempo is always even and the beats are uniformly counted. For classical music, composers generally use Italian terms.

Largo; Lento; Adagio	=	slow
Andante; Moderato	=	moderate speed
Allegro; vivace; presto	=	very fast

A more accurate way to tell the speed is by reading a metronome setting (if there is one). A metronome is a device that ticks out a certain rate of speed for one beat in relation to the time frame of one minute.

A metronome setting may say ♩ = MM 60 (Malzel's metronome)

This means that a beat (in this case, a quarter note) is counted every second. That is a good thumbnail timeframe for most songs as it coincides with the average walking pace or your heartbeat.

If the setting says ♩ = 90, the speed is 90 beats per minute and so on. . .

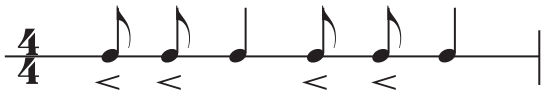
Metronome settings and Italian terms are common to classical music but popular music often mostly uses terms like fast, slow or moderate. Sometimes you will other directions to guide you like "With feeling," "Lively," "Sweetly," or "Bluesy."

Rhythm

Rhythm is closely related to tempo in that it moves forward at the same pace. Whereas, tempo is counted in even lengths of time, rhythm is made up of variable time patterns that fit within the tempo. Rhythmic patterns are syncopated with accented and unaccented beats which make the sense of beat more pronounced.

4/4 tempo (void of accent)

Rhythm is accented within the tempo



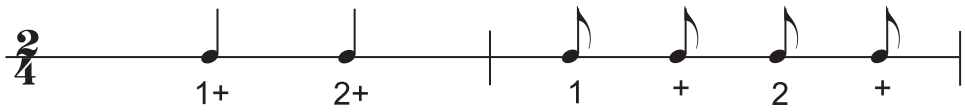
Meter

Meter refers to the division of a musical composition into uniform measures or bars. If melody were to be considered a statement, meter is the uniform time frame of a measure in which that statement must be made.

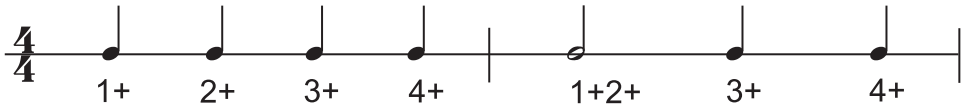
Meter is shown by the top number of the time signature. It is a grouping of beats that must be accounted for in each measure. For the sake of showing these groupings, two kinds of meter are used in music:

Duple (Double) Meter

2/4 shows 2 beats (or the equivalent of 2 beats) per measure.



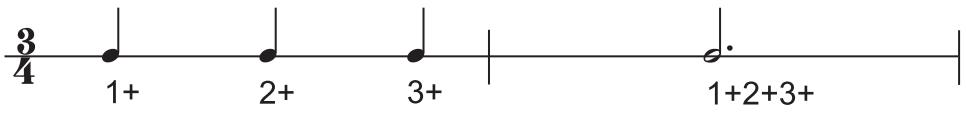
4/4 time is called compounded duple meter and shows 4 beats per measure.



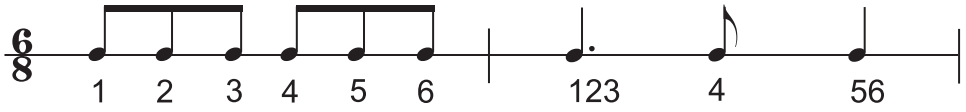
If the time signature can be divided into itself by 2 (or in even increments), it is duple meter. 4/4 = 1 (divided into itself); 2/4 = ½ (even increment)

Trimeter (Triple) Meter

Trimeter shows shows 3 beats per measure or the equivalent of three beats.



Trimeter may also be compounded:



If you can reduce the fraction of the time signature so the top number is equal to 3, it is trimeter (6/8 = 3/4; 2/8 = 6/4 = 3/2).

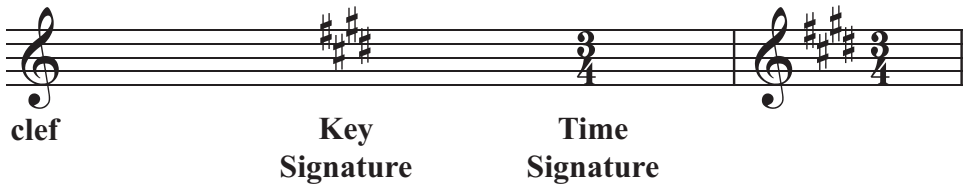
Most music uses the time signatures shown above but occasionally a unique time signature is used. In all cases, "weird" time signatures are usually odd and cannot be divided into themselves. Odd time signatures: 5/4, 5/8, 7/4, 10/16. Many are possible although they may be rare.

MUSIC is a complex art because it is based on counting different things at the same time. Each segment (pitch, tempo, rhythm, durations, etc.) plays its own unique part in adding to the musical form. For there to be music, all must interact together at the same time.

Principle 5: Counting Variables of Music

Time Signatures

The time signature is located at the beginning of a song following the clef and the key signature. It sets the numerical pattern or meter for the entire song and appears as a fraction.



The **top number** identifies	-	How many beats per measure
The **bottom number** identifies	-	What kind of note gets one beat.

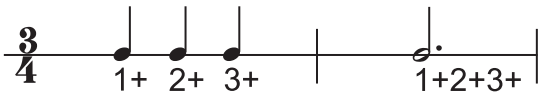
The most commonly used time signatures are:

4 beats to the measure
4 quarter note gets one beat

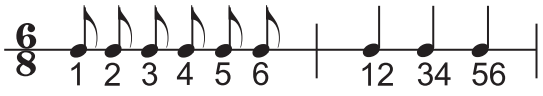
2 beats to the measure
4 quarter note gets one beat

2 beats to the measure
2 half note gets one beat

3 beats to the measure
4 quarter note gets one beat



6 beats to the measure
8 eighth note gets one beat



All About Notes

The note pyramid on the right shows the breakdown of notes. Each tier shows the same number of beats (in this case four) and how all notes relate to each other mathematically. The counting value will vary depending upon the beat note designated in the time signature. For our examples here we will use 4/4 as the time signature.

- **Whole Note:** The biggest of all notes, it counts 4 beats.
- **Half Note:** ½ the value of a whole note, it counts 2 beats.
- **Quarter Note:** 1/4 of a whole note, this note counts as one beat.
- **Eighth Note:** 1/8th of a whole note, this note counts as half of a beat.
- **Sixteenth Note:** 1/16th of a whole note, this note counts 1/4th of a beat.

Note values continue to divide in half. The next note is a 32nd and then a 64th, etc. . . 32nds and higher notes are rare to popular music.

Counting Note Values

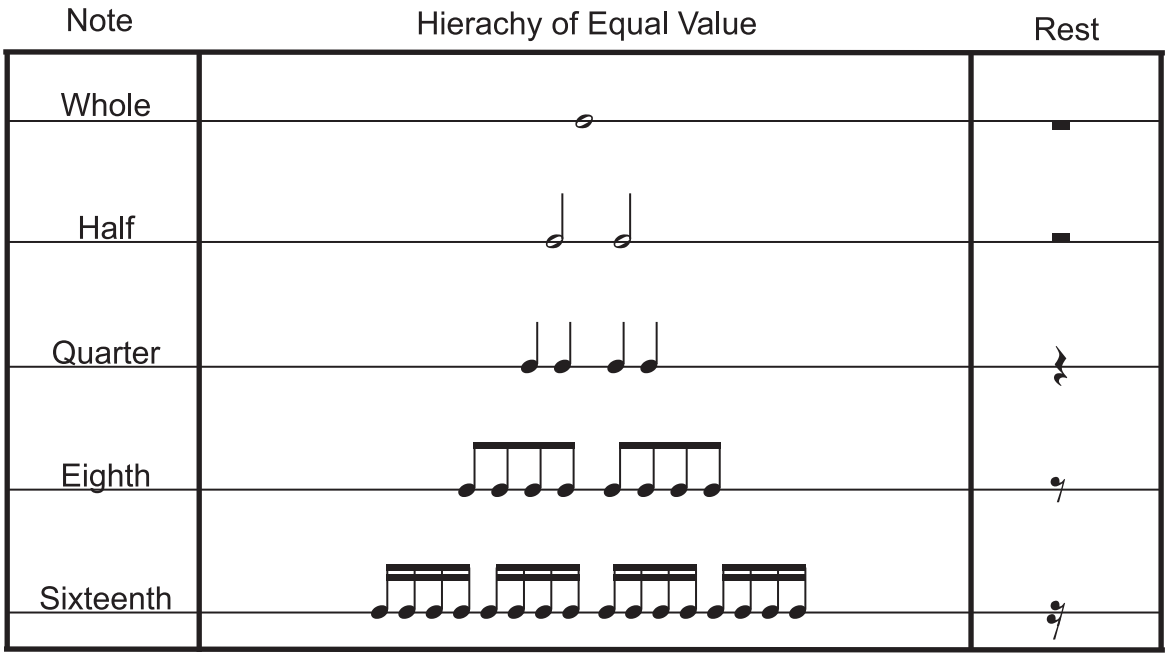
The easiest way to count is to divide each beat into a half beat (equal to the eighth note) and count 1 + 2 + 3 + 4 +. The examples below are based on 4/4 time.

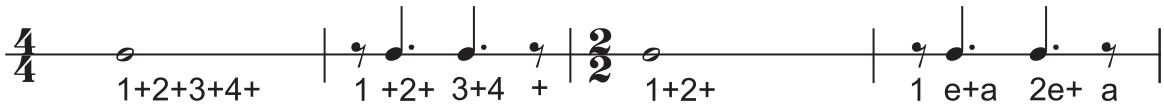
• **Whole Note:**	=	1 + 2 + 3 + 4 +
• **Half Note:**	=	1 + 2 +
• **Quarter Note:**	=	1 +
• **Eighth Note:**	=	1 (or +)
• **Sixteenth Note:**	=	1, e, +, a (any one of these syllables)
• **Dotted Notes:**	=	note value plus one half

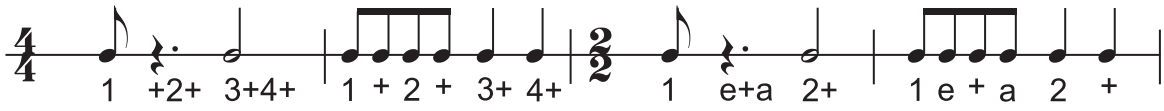
Rests

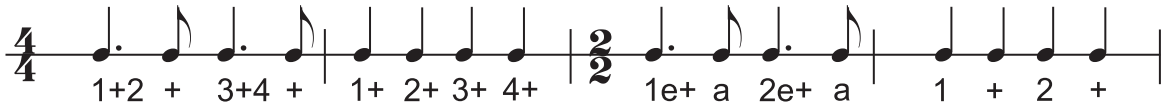
Rests are are silent beats that are not played. Each note has a corresponding rest which represents and holds the same counting value as the note itself. Rests can also be dotted to increase their value.

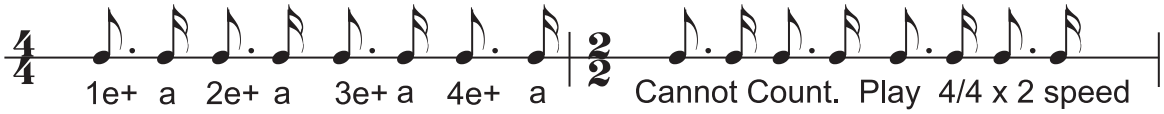
Study the exercises and count out loud to establish the meter.


Note
Hierachy of Equal Value
Rest
Whole
Half
Quarter
Eighth
Sixteenth


1+2+3+4+
1 +2+ 3+4 +
1+2+
1 e+a 2e+ a


1 +2+ 3+4+
1 + 2 + 3+ 4+
1 e+a 2+
1 e + a 2 +


1+2 + 3+4 +
1+ 2+ 3+ 4+
1e+ a 2e+ a
1 + 2 +


1e+ a 2e+ a 3e+ a 4e+ a
Cannot Count. Play 4/4 x 2 speed


1 e + a 2 e + a 3 e + a 4 e + a
1 e + a 2 e + a
1 e + a 2 e + a

What Is A Beat?

A beat is a regular and rhythmical unit of time. On average, a beat lasts for about one second; give or take a little. A "second" is a good ballpark rule.

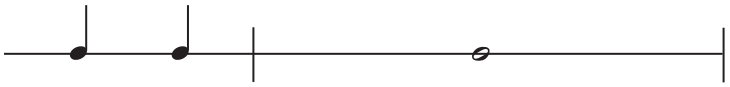
A beat must produce a rhythmical pulse within a reasonable time frame. 8 beats per second is not reasonable. Likewise, 1 beat every 5 seconds is not reasonable. It must have a "pulse" quality.

Different time signatures will change **the size** of the beat note but the duration of the beat will always remain the same. **Size of the beat note has nothing to do with the length of the duration.** The duration is always reasonably static.

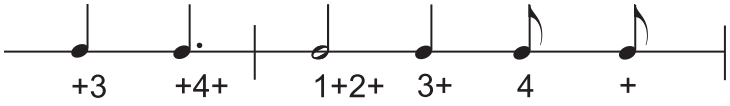
Counting One Beat

Primary Base Count 1+

The primary base count for one beat, in any time signature, is 1 + (one-and). If a beat lasts for one second, then the 1 + phrase divides the beat into two half-beats. If four beats are linked together in a measure, then the primary base count for the measure is 1 + 2 + 3 + 4 +.



Count these half-beats out loud. A grouping of 4 quarter notes will take approximately 4 seconds.



Limiting counting to the primary base count only allows you to play only the beat note (1+) and the half-beat note (1 or +). Though this may be okay for some melodies, in most cases another layer of notes must be added to show more detailed rhythms in the song. That's where the **secondary base count** comes in.

Secondary Base Count 1 e + a

1 + divides a beat into half beats. 1 e + a divides a beat into fourths. Each syllable of the 1 e + a phrase is equal to a quarter beat.

Count 4 beats of 1 e + a (1e+a, 2e+a, 3e+a, 4e+a). The entire phrase rolls off your tongue naturally and should take about 4 seconds to say.

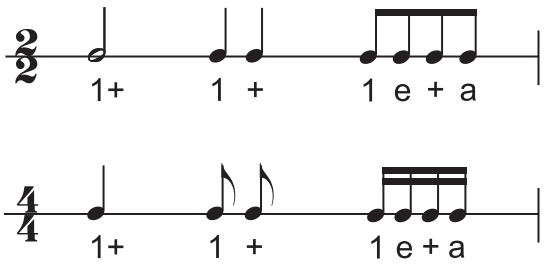
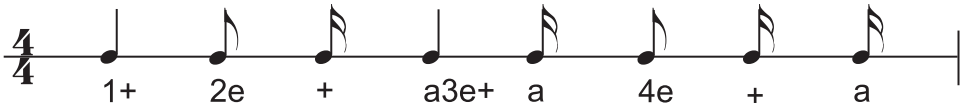


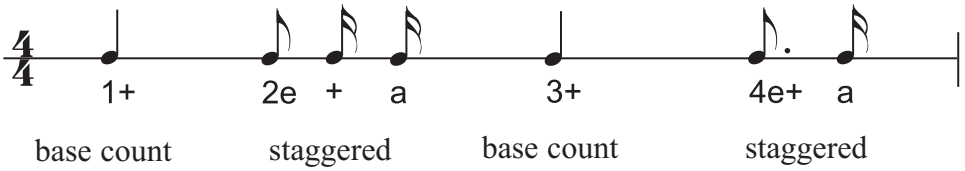
Figure 5.1
The 1e+a phrase adds a third layer of notes to the basic 1+ counting system.

Rules for combining 1 + and 1 e + a

- When counting basic beat and half-beat notes, use the 1 + phrase wherever possible.
- Use the 1e+a phrase only when it is needed to show quarter beats.
- Whenever the 1e+a phrase is used, it must always be completed. This means that occasionally a beat note might occasionally be counted e+a2; +a2e; or a2e+.



- Using the 1e+a phrase staggers the base count of the measure. Always continue using the phrase until the base primary count (1 +) falls back in sync with the meter of the measure.



Alternate Ways of Counting

Sometimes the direct approach to counting is better.

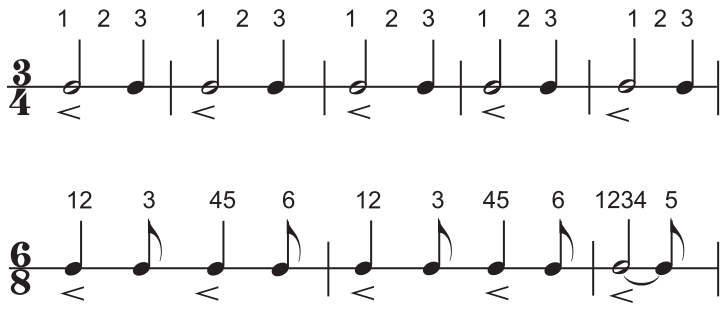


Figure 5.2
Straight counting is *sometimes* preferable in 3/4 and 6/8 or any time signature.

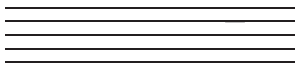
“People make a mistake who think that my art has come easily to me. Nobody has devoted so much time and thought to composition as I. There is not a famous master whose music I have not studied over and over.”

Amadeus Mozart

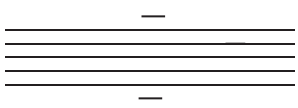
Principle 6: Alpha Notation on The Staff

Alpha is a technology you use to write *exactly what you mean* on paper. It's the communication vehicle of music. While it is VERY VERY IMPORTANT, this principle is only one out of seven. Alpha shows the expression but numbers control the music.

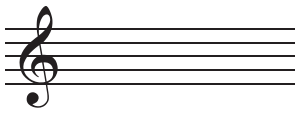
ALPHA IS THE CONVERSION OF NUMBERS INTO LETTERS.



Staff: Comprised of five (5) lines and four (4) spaces in chronological alphabetical order, it is the medium for writing notes.

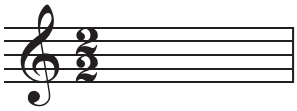


Ledger Lines: Short lines above or below the staff used to signify notes outside of the staff. They are extensions of the staff.

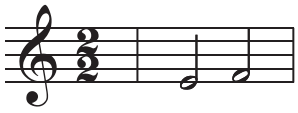


Treble Clef: Sometimes called the "G clef", this clef signifies all of the notes above Middle C; usually played with the right hand.

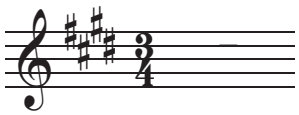
Bass Clef: Sometimes called the "F clef", this clef signifies all of the notes below Middle C; usually played with the left hand.



Time Signature: A symbol, commonly in the form of a numerical fraction, placed on the staff, to the right of the clef to indicate the meter.



Measure: A metrical unit between two bars on the staff; a bar in accordance with the time signature.

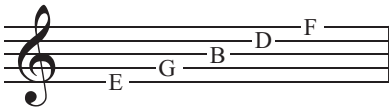


Key Signature: Sharps or flats placed, on the staff, to the right of the clef and to the left of the time signature to indicate the key.

Repeat Sign: A complimentary pair of symbols showing, at the far end, to repeat a previous part of a composition and the return point of such a repetition. Usually seen at the end of a verse before the beginning of another verse.

Treble Clef

Like the keys of the keyboard, the notes of the Treble Clef run in chronological alphabetical order when reading from the bottom to the top.

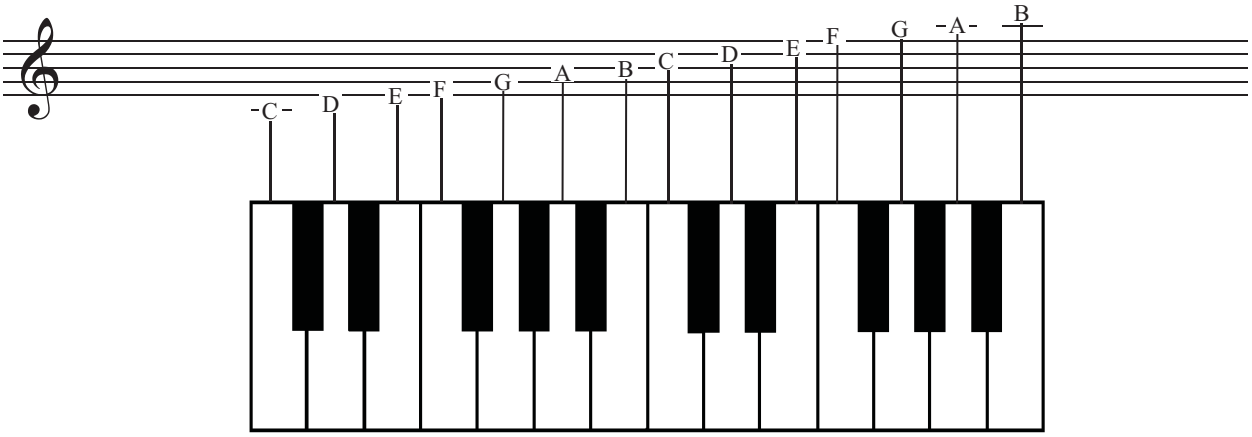


Remember the names of the lines of the Treble Clef by thinking of the phrase:

Every Good Boy Does Fine

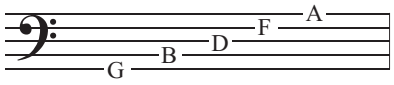
The spaces, reading from the bottom to the top, spell **FACE.**

This illustration shows how the notes of the Treble Clef staff relate to the piano keyboard. Ledger lines are used to expand the staff. Also notice, how all the notes an octave apart alternate between lines and spaces.



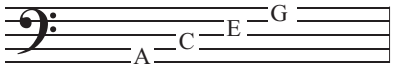
Bass Clef

The bass is played with the left hand and is read on a staff that is slightly inverted from that of the Treble Clef. The notes of the lines and spaces run in alphabetical order from the bottom to the top.



Remember the names of the lines of the Bass Clef by thinking of the phrase:

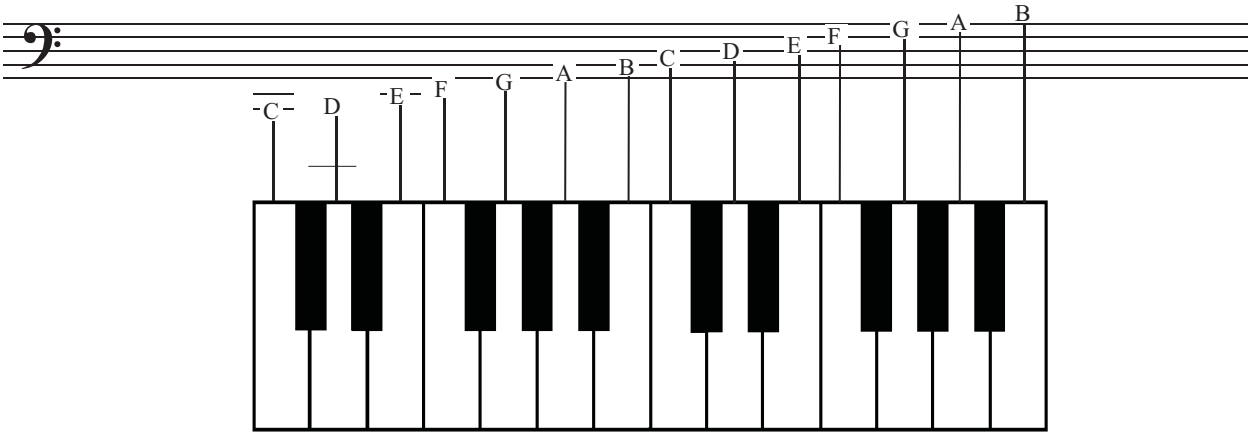
Good Boys Do Fine Always.



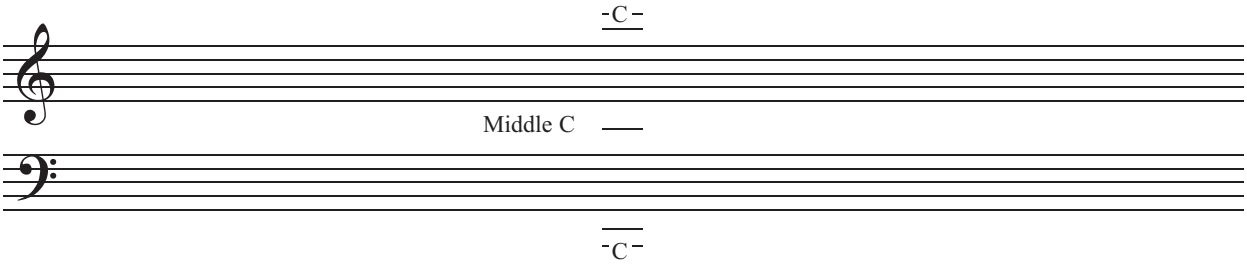
Remember the names of the spaces of the Bass Clef by thinking of the phrase:

All Cows Eat Grass.

This illustration shows how the notes of the Bass Clef relate to the piano keyboard. Once again, like the Treble Clef, all of the notes an octave apart alternate between lines and spaces.



There is only one line that divides the Grand Staff (Middle C).



Beethoven didn’t need his ears to know his music made sense. He could hear the pitches in his head, but more remarkably he could see his creativity in the math.

Principle 7: The Machine

The "Machine" has nothing to do with the art of music or creativity. It's a simple process that churns out the answer to any question you have when you need it. It is the numerical process for managing music.

The Science of Music is
The Technology That Combines
Numbers and Letters Together

It's goes much further than the Circle of 5ths or Circle of 4ths. When you add context to what the science is designed to do (fuse alpha and numbers), it makes much more sense.

Music is Based On Numbers

Modern-day training does not emphasize this fact enough. We live in a "following" world where we sight read and concentrate on written music over the numerical improvisational engine.

Without a strong "numbers" point of view, you have no basis to build your knowledge to teach yourself to get better.

Alpha Is a False Science

"Alpha" is not a "science" but rather, a way to show (or interpret) written music in a certain style or key. Alpha is very specific to exactness while numbers let you interpret things more broadly in your own way.

The Alpha technology of reading, writing and interpreting music has a lot of baggage. To learn music it is a necessity, but slow. Your progress is based on how well you sightread (and that's usually the weakest link in any player's ability). If you can't read well, it holds you back and that can frustrate you.

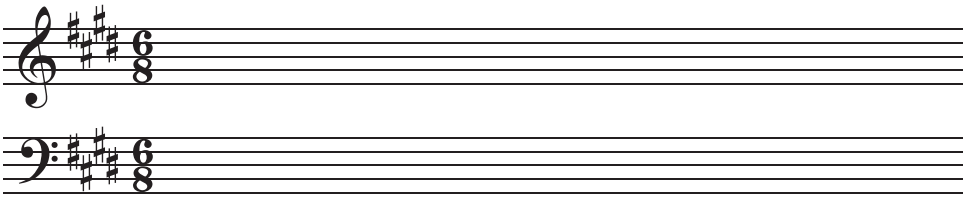
The Alpha Mindset

We develop the "Alpha Mindset" from the start, learning the names of the lines and space and the piano keyboard. Alpha is our first exposure to music and we get too comfortable with it and don't even think about the numbers side.

It's the downfall to becoming a better musician faster. We're comfortable with the idea of "sightreading," and numbers just never get around to being important. Now, you know better.

Major Key Signatures

The key signature is written at the beginning of all staffs behind the clef (treble and bass) . It shows the notes of a particular scales and identifies which notes are to be played sharp (♯) or flat (♭) throughout a song.



Three Things You Must Be Able To Do.

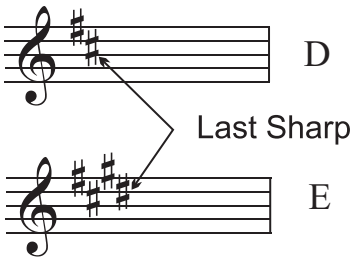
1. Identify the key;
2. Identify the progressive key (sharp or flat); and
3. Identify where to put the next notation (♯ or ♭)

Identifying The Key

Two rules apply:

Sharps (♯): The key is identified by the line or space directly above the last sharp. If there is only one sharp, it is the key of G.

Flats (♭): The key is identified as the second-to-last flat in the key signature. If there is only one flat, it is the key of F.



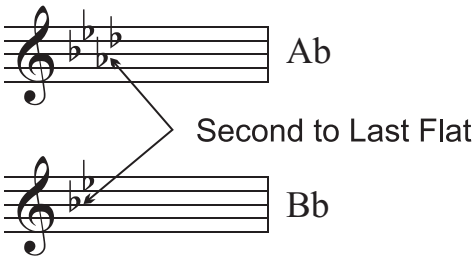
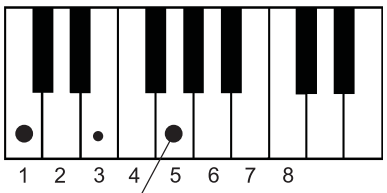


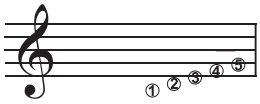
Figure 7.1 the ***"last"*** sharp or flat is the notation the furthest away from the clef.

Determining the Progressive Order of Keys

Sharps: Progressive sharped keys are added in 5ths in a distinct order. Find the next key by mapping out a root position major chord and locating the 5th.

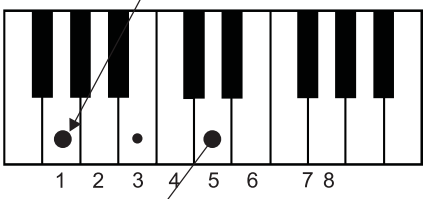
C

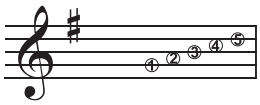




Map out a root position C chord. The 5th of C is G which is the first sharped key.

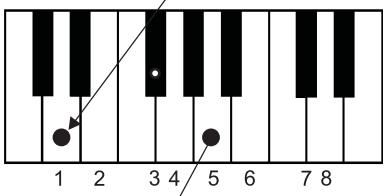
G

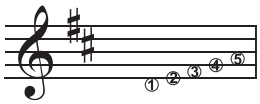




Map out a root position G chord. The 5th of G is D which is the second sharped key.

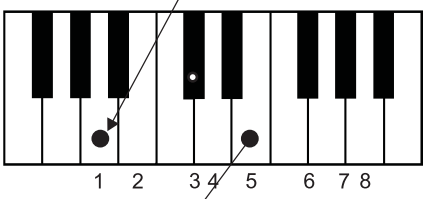
D

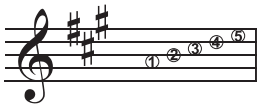




Map out a root position D chord. The 5th of D is A which is the 3rd sharped key.

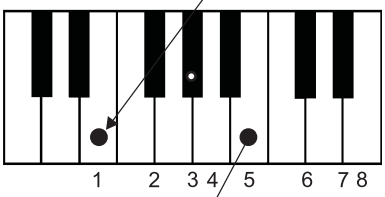
A

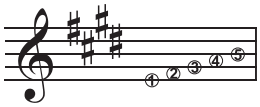




Map out a root position A chord. The 5th of A is E which is the 4th sharped key.

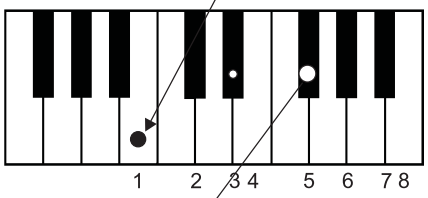
E

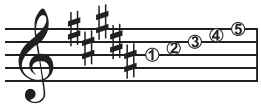




Map out a root position E chord. The 5th of E is B which is the 5th sharped key.

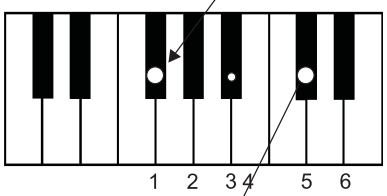
B

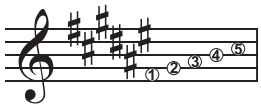




Map out a root position B chord. The 5th of B is F ♯ which is the 6th sharped key.

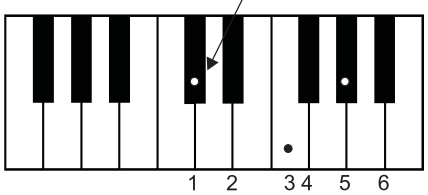
F♯

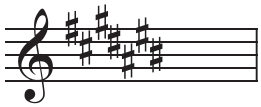




Map out a root position F ♯ chord. The 5th of F ♯ is C ♯ which is the 6th sharped key.

C♯



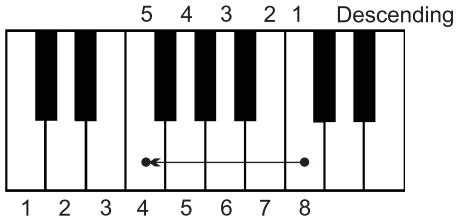


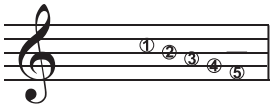
The key of C# is the last key of the Circle of 5ths.

Flats:

Determining the flatted key progression is where things start to get confusing. The Circle of Fifths turns both ways. It ascends by 5ths for sharps and it *descends* by 5ths for flats. While mathematically it makes sense, it's hard to comprehend but here goes. . .

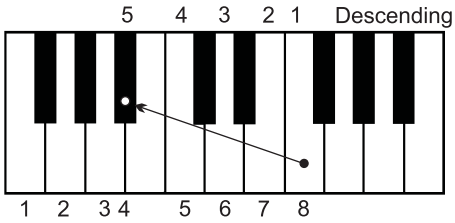
C

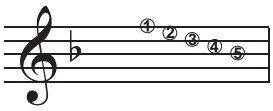




Starting on C, the 5th descending scale tone is F which is the 1st flatted key.

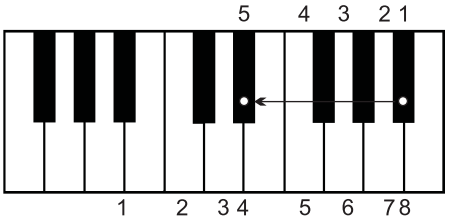
F

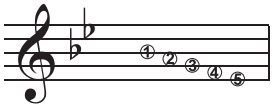




The 5th scale tone down from F is B♭.which is the 2nd flatted key.

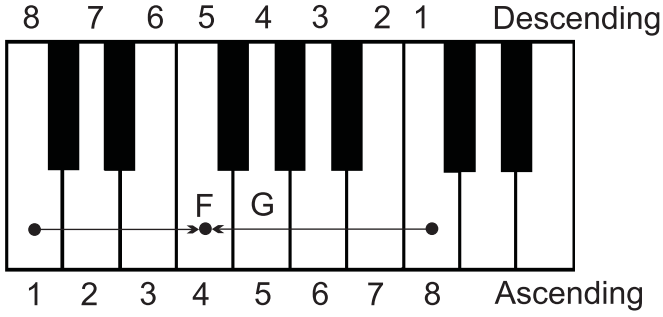
B♭





LET'S STOP RIGHT HERE and examine this traditional backwards thinking.

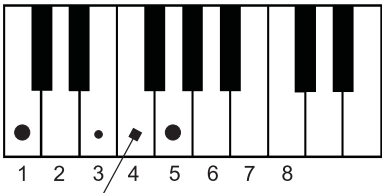
It is awkward to walk, talk or do just about anything backwards. *Descending* 5 scale tones to figure the *progressive* order of flatted keys is very confusing because "descending" and "progressive" are opposite concepts. When you descend by 5ths, you land on the 4th of the key (e.g. C descends to F).

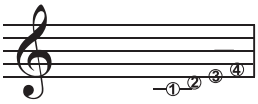


That means you must remember 2 different 5ths in two different directions; one of which is the true 5th of the scale and the other which is the 4th. ***Did you get all that???*** Whew...Going backwards is cumbersome, slow and confusing.

Traditional thinking is based on sharps (♯) being notes ***up*** from C and flats (♭) being notes ***down*** from C. Technically, you add for sharps and subtract for flats. But You can also figure out flats by adding in 4ths using the "Circle of 4ths."

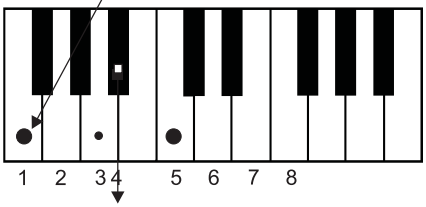
C





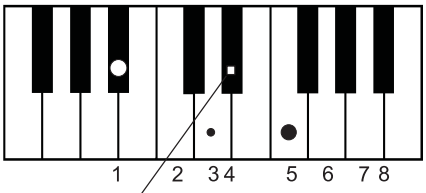
Map out a root position C chord. The 4th of C is F which is the 1st flatted key.

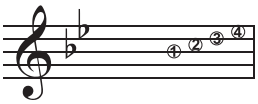
F



Map out a root position F chord. The 4th of F is B♭ which is the 2nd flatted key.

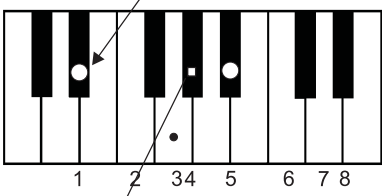
B♭

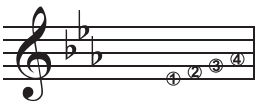




Map out a root position Bb chord. The 4th of B♭ is E♭ which is the 3rd flatted key.

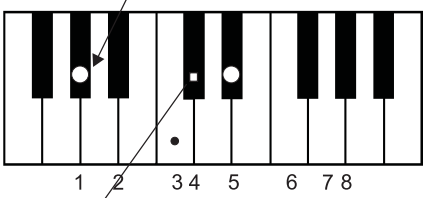
E♭

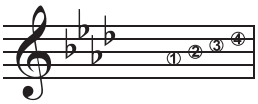




Map out a root position E♭ chord. The 4th of E♭ is A♭ which is the 4th flatted key.

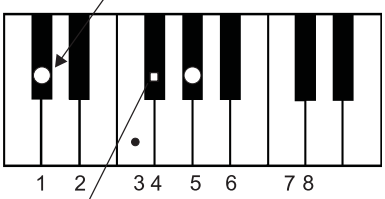
A♭

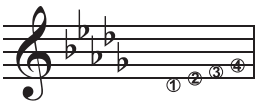




Map out a root position A♭ chord. The 4th of A♭ is D♭ which is the 5th flatted key.

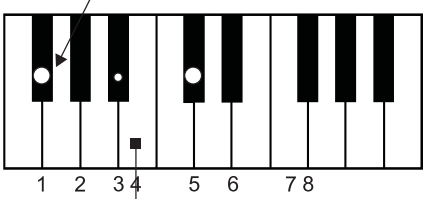
D♭

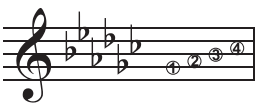




Map out a root position D♭ chord. The 4th of D♭ is G♭ which is the 6th flatted key.

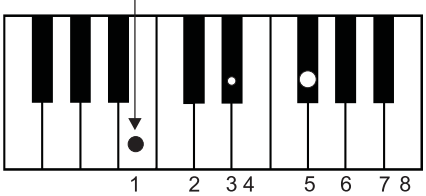
G♭

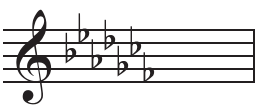




Map out a root position G♭ chord. The 4th of G♭ is C♭ which is the 7th flatted key.

C♭

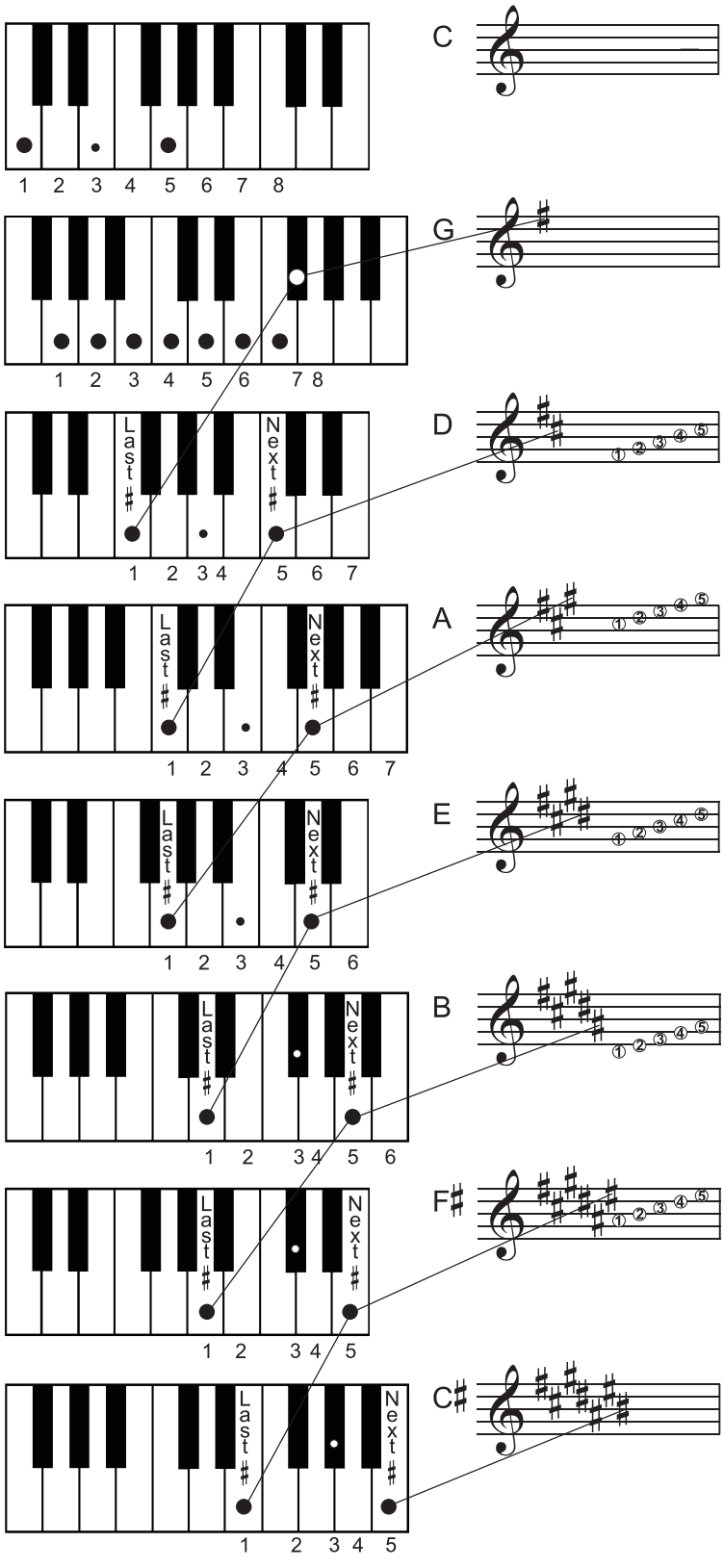




The Key of C♭ is the last key of the Circle of 4ths.

Determining the Progressive Order Of Key Notations

Sharps are added in 5ths. The starting point for each progressive notation is the "last" sharp that has been placed on the staff.



The Key of C is the starting point for all key progressions. The 1st sharped key is G

Counting up the G Major scale, the Key of G has 1 sharp (F) which is notated on the staff.

Map out a root position F chord. The 5th of F is C which is the 2nd notation shown on the staff.

Map out a root position C chord. The 5th of C is G which is the 3nd notation shown on the staff.

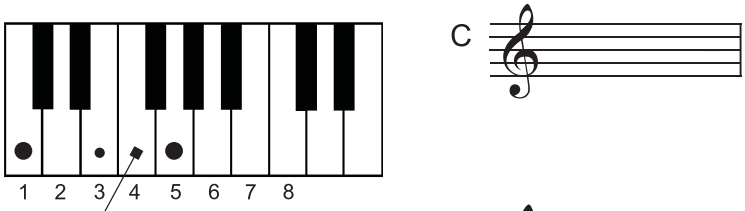
Map out a root position G chord. The 5th of G is D which is the 4th notation shown on the staff.

Map out a root position D chord. The 5th of D is A which is the 5th notation shown on the staff.

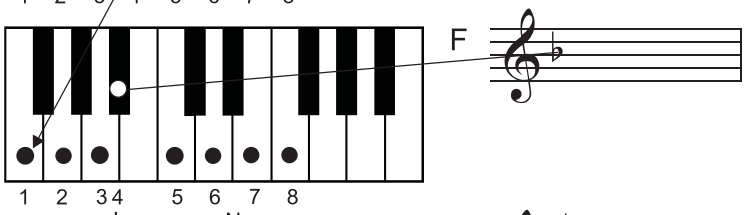
Map out a root position A chord. The 5th of A is E which is the 6th notation shown on the staff.

Map out a root position E chord. The 5th of E is B which is the 7th notation shown on the staff.

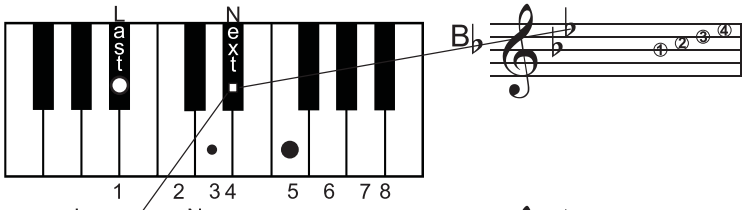
Flats are added in 4ths. The starting point for each progressive notation is the last flat that has been placed on the staff.



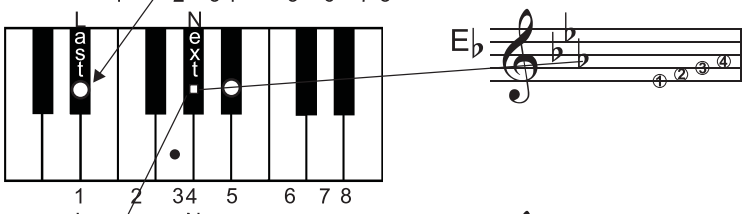
The Key of C is the starting point for all key progressions. The 1st flatted key is F.



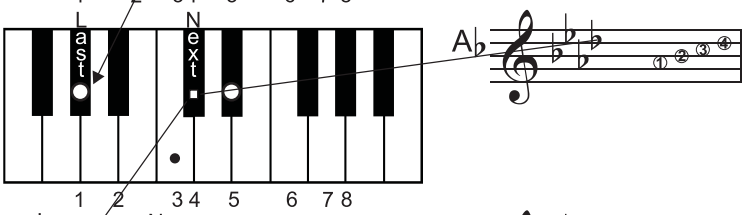
Counting up the F Major scale, the Key of F has 1 flat which is notated on the staff B♭.



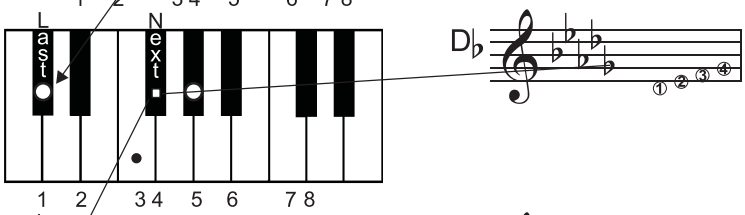
Map out a root position B♭ chord. The 4th of B♭ is E♭ which is the 2nd notation shown on the staff.



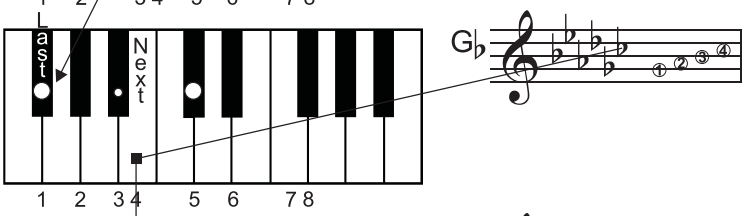
Map out a root position E♭ chord. The 4th of E♭ is A♭ which is the 3rd notation shown on the staff.



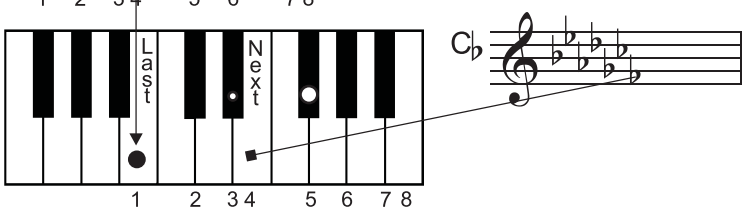
Map out a root position A♭ chord. The 4th of A♭ is D♭ which is the 4th notation shown on the staff.



Map out a root position D♭ chord. The 4th of D♭ is G♭ which is the 5th notation shown on the staff.



Map out a root position G♭ chord. The 4th of G♭ is C♭ which is the 6th notation shown on the staff.



Map out a root position C♭ chord. The 4th of C♭ is F♭ which is the 7th notation shown on the staff.

Circle of 5ths and Circle of 4ths

The procedure for identifying progressive key signatures is traditionally diagrammed using the Circle of 5ths and the Circle of 4ths. Progressive sharp keys rotate clockwise and flatted keys rotate counterclockwise.

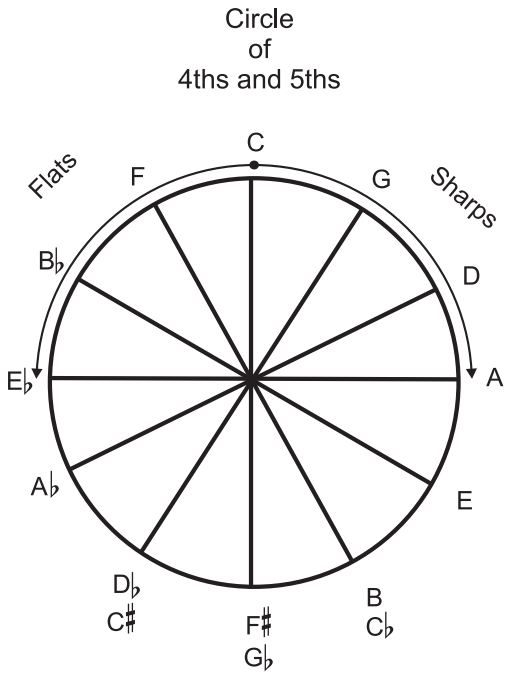


Figure 7.2
TheCircle of 4ths and 5ths; a mathematical miracle.

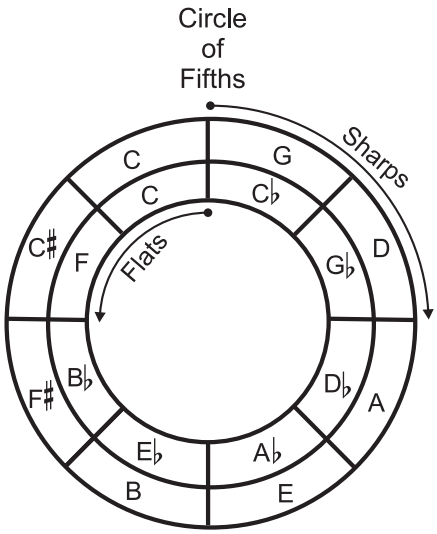
There is a certain redundancy to a single, inclusive circle that shows both progressions of sharp and flat keys as one in the same.

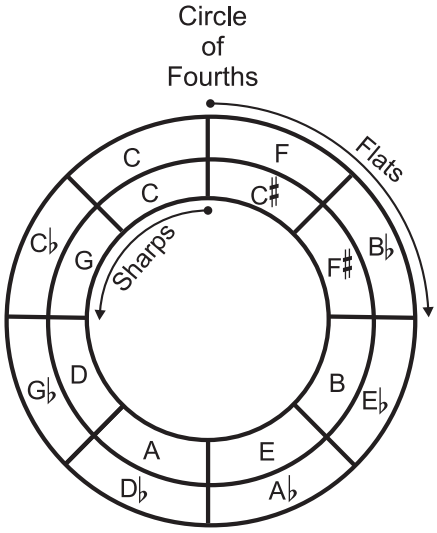
Broken down, if you increase tones by 5ths (clockwise), all the keys (including flatted keys) fall right in line.

If you increase tones by 4ths (counterclockwise), all the keys (including sharped keys), again fall right in line.

It's amazing how this works out so perfectly.

Progressive sharps are counted in 5ths and progressive flats more easily counted in 4ths. It's interesting how you can reach both major and minor results using either one of the circles. It's amazing symetry considering both are independent of each other. Either one works, your preference.

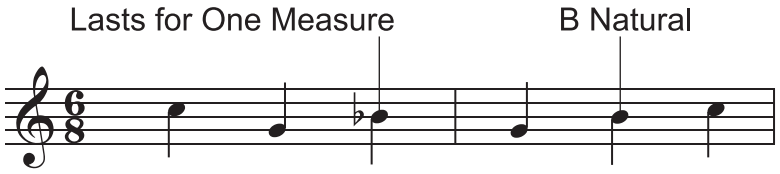




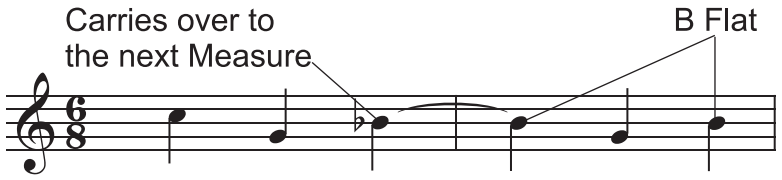
Accidentals

Accidentals are exceptions to the rules laid out in the key signature. There are six (6) types of accidentals: the sharp (♯), flat (♭), natural (♮), double sharp (𝄪), double flat (𝄫) and double natural (♮♮).

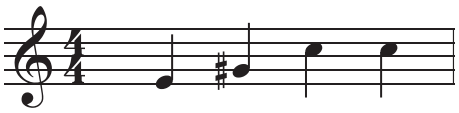
Accidentals apply to only one measure at a time and affect the same note anywhere in that measure.



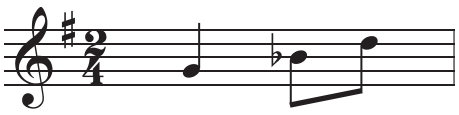
The only exception to the rule is a tied note extending into the next measure.



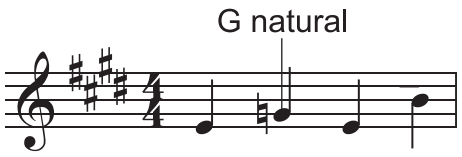
Usage



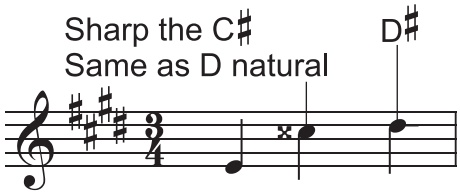
Sharp (♯): Placed on any natural line or space, this accidental indicates the note should be played sharp.



Flat (♭): Placed on any natural line or space, this accidental indicates the note should be played flat.

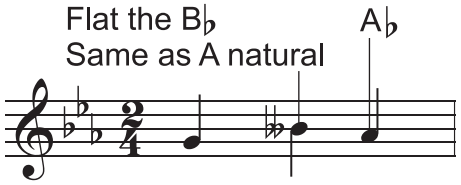


Natural sign (♮): Place this accidental on any line or space of the key signature or in front of any previously-sharped or flatted note to negate any previous accidental placement.



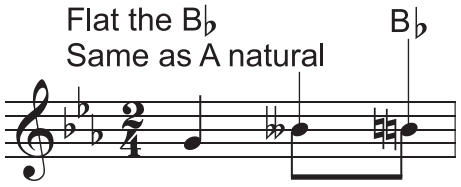
Double Sharp (𝄪): A double sharp will sharp an already-sharped note.

Placing a single sharp on an already-sharped line or space is not sufficient notation as that might only indicate a previously-naturalled sharp note should again be played sharp. Or, in certain rare cases, a single sharp may just be a reminder.



Double Flat (𝄫): A double flat will flat an already-flatted note.

Placing a single flat on an already-flatted line or space is not sufficient notation as that might only indicate a previously-naturalled flat note should again be played flat. Or, in certain rare cases, a single flat on an already-flatted line or space may just be a reminder.



Double Natural (𝄮): A double natural sign will negate the affects of a double sharp or a double flat.

A double natural is kind of redundant because you don't see a lot of double accidental notations on a regular basis, much less double notations that need to be restored to a previous note in the same measure. Still, technically it can happen.

Minor Key Signatures

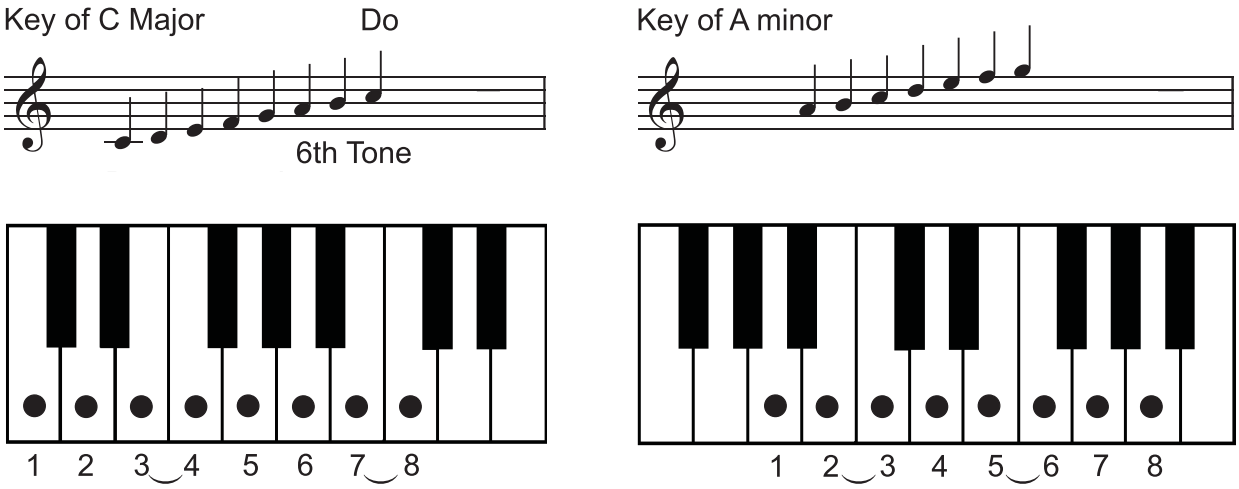
In addition to major keys, there are also three kinds of minor keys. This chapter covers the natural minor scale at length and then touches on the harmonic and melodic minor scales briefly at the end of this chapter.

Natural or Pure Minor Scale

Within every major key there is a "relative" minor key. Both relative major and minor keys share the same key signature. The tonic (or root) of a minor scale begins at the 6th tone of its relative major key.

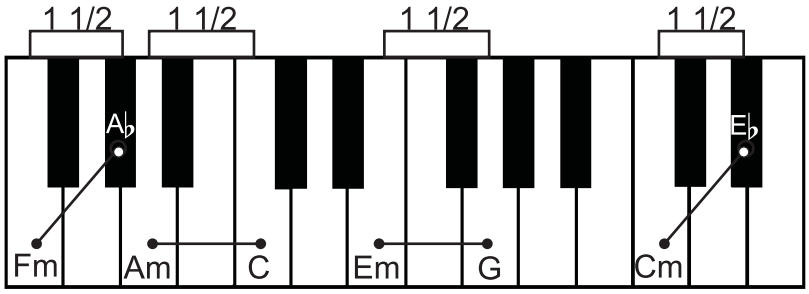
Again, a single key signature represents two different keys that start on two different root notes. One key is major and the other is minor.

The key of C Major sets the numerical order of all other major keys and the key of A Minor (the relative minor of C) sets the numerical order for all minor keys. Both keys of C major and A Minor are void of sharps and flats.

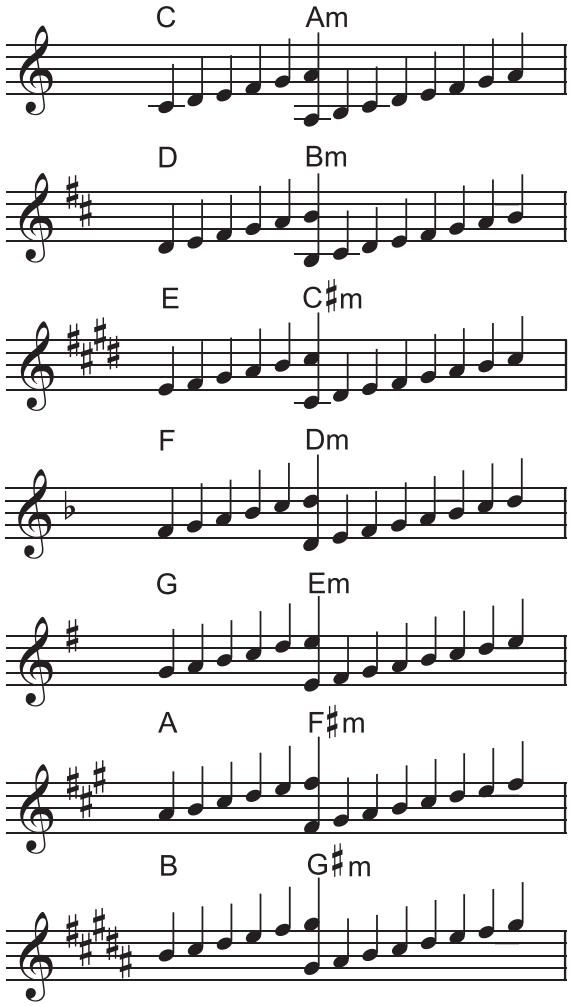


The numerical order of a minor scale (or key) is similar to a major key in that it consists of 8 notes that begin and end on the same note. However, for minor keys, the half steps are located between the 2nd / 3rd, and the 5th / 6th intervals. All the rest are whole steps. Compare the two relative C major and A minor scales (above) numerically.

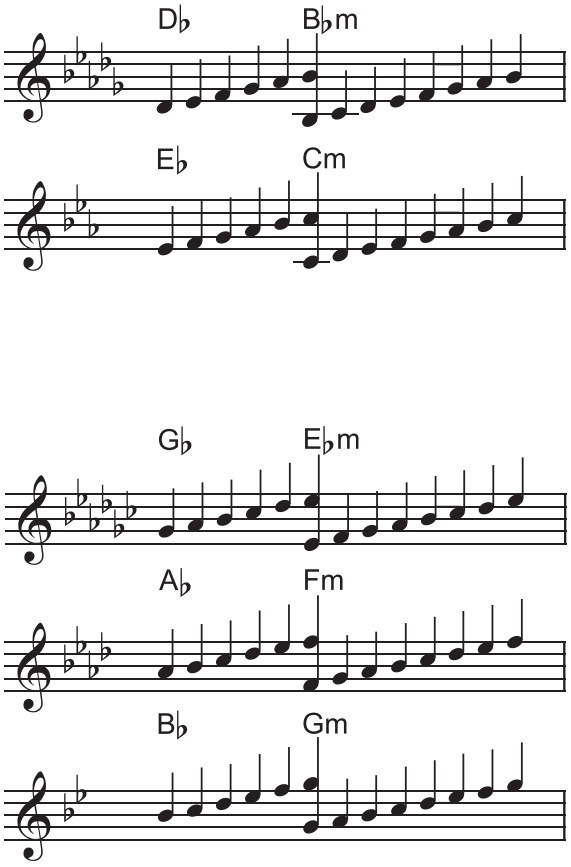
This comparison of C major and A minor shows the uniformity for determining other relative major and minor keys. The relative minor of a major key is located 1½ steps below the major key root. Similarly, relative major and minor CHORDS are always 1½ steps apart.



Major Key **Minor Key**



Major Key **Minor Key**

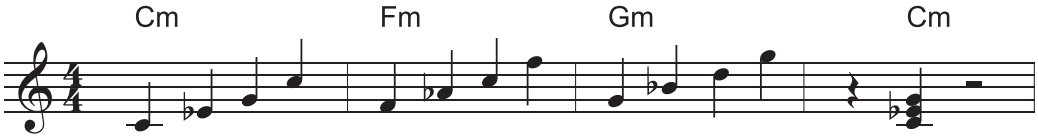


You are probably wondering why this information is so important to know. In classical music you see references to pieces being written in minor keys all the time (e.g. Beethoven's Sonata No. 1 in F Minor, Op. 2, No. 1). That makes things sound rather mysterious and high-brow. Why does a composer bother using a minor key? It has more to do with notating the musical composition than playing it.

If we transfer the minor key concept over to popular music, it's easy to see why writing a song in a minor key is helpful. Let's say we want to write a blues progression that is based around the 3 minor chords Cm, Fm and Gm.

You could write the song in the key of C Major. If you use the C Major key to write the minor chords, you must show the flatted third (1-3♭-5) of the minor chords as accidentals on the staff. The notation would look like this:

Key of C Major



However, if you write this exact same progression in the key of C minor (same as the E♭ Major key signature) you don't have to show accidentals.

Key of C Minor

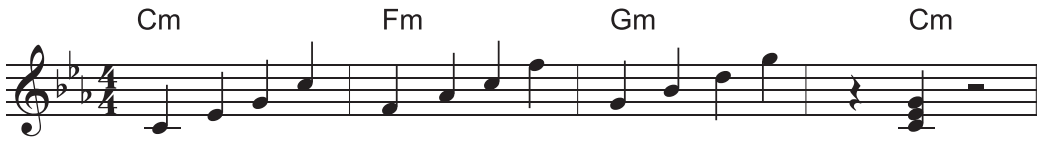


Figure 7.3 Use a minor key to write minor chords without accidentals.

This is important because the more accidentals you use when writing music, the harder the piece is to read. Using the minor key, you don't need to use accidentals at all. When writing a song that is basically minor in form and chord structure, the use of a minor key signature circumvents the need to pepper the arrangement with accidentals.

How to Determine Whether a Song is Major or Minor

Just looking at the key signature doesn't tell you whether a song is major or minor. To determine this, you must look at the arrangement. There may be some exceptions but in general, the following is true:

- If it starts and ends on a minor chord, it's probably a minor key.
- If it starts and ends on a major chord, it's probably a major key.

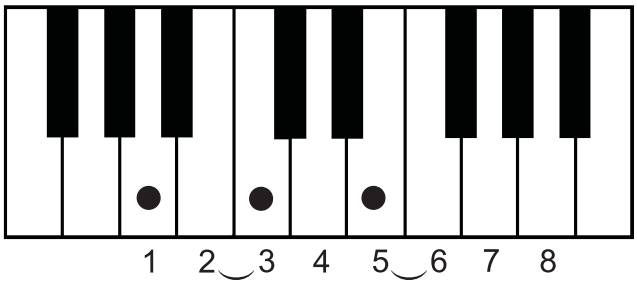
That being said, there is no rule that says a minor key will contain only minor chords. Nor is there any rule that says a major key must only contain major chords.

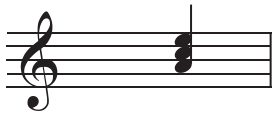
In a broader sense, let's relate this information to the numerical orders of major and minor chords. You have learned that a minor chord has the numerical order of 1-3♭-5. This is technically incorrect but is easy to understand within the confines of using a major scale as your base.

Technically, a minor chord is the basic 1-3-5 chord of a minor scale the same that a major chord is the 1-3-5 chord of a major scale. Whew!

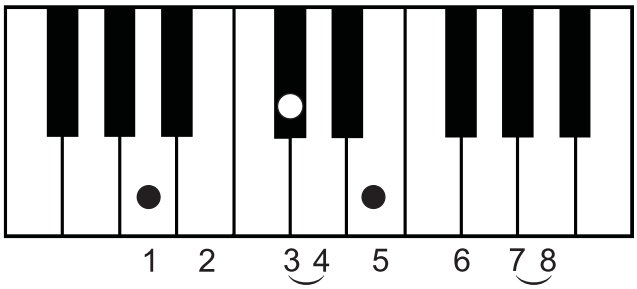
Now you know the technical. However, for the purpose of maintaining our sanity in this course we will continue to refer to major chords as 1-3-5 and minor chords as 1-3♭-5.

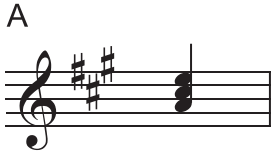
Key of A minor





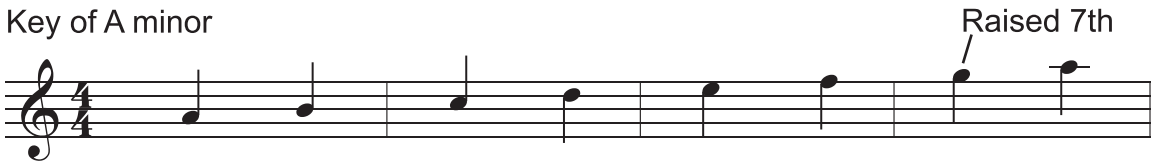
Key of A Major





Harmonic Minor Scale

This is based on the natural minor scale with a slight variation. In the harmonic mode, the 7th note of the natural minor scale is raised (sharped). This is the most frequently used minor scale.

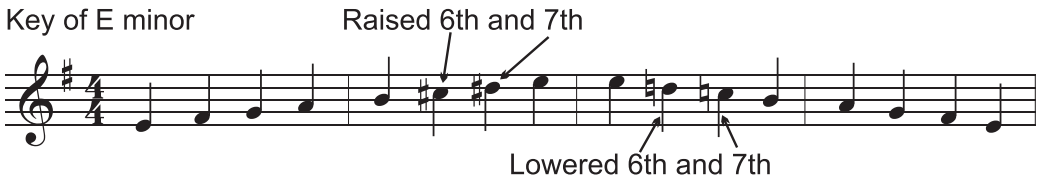


Melodic Minor Scale

This scale is also based on the natural minor scale with variations.

- When ascending, the 6th and 7th tones are raised (sharped).
- When descending, the 6th and 7th tones are lowered (flatted).

It produces a nice sound and is used as a base for improvisation.



Most musicians don't concern themselves much with minor keys. Some don't understand them at all and many misunderstand them. Understanding the Science of Music is your mindset to begin playing by ear.