

Music 208 Winter 2014
 John Ellinger, Carleton College

Music Theory Fundamentals

Pitch

Pitch refers to how high or low a note sounds.

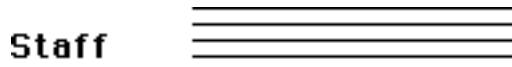
Pitch Ranges

Pitch ranges are often referred to in terms of the human singing voice.

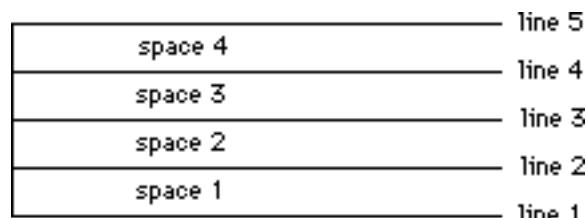
- Soprano, a high woman's voice
- Alto, a low woman's voice
- Tenor, a high man's voice
- Bass, a low man's voice

Music Staff

Music is written on a music staff that consists of five lines and four spaces.



You can refer to the lines and spaces as follows.

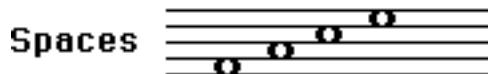
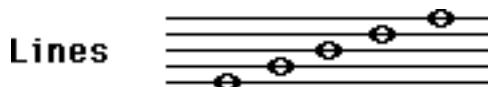


The plural of staff is staves. Staves are often connected by a brace or bracket and bar lines.



Lines And Spaces

Notes can be drawn on a line or a space. A note on a line is centered on the line. A note in a space is contained within the space between the lines.



In hand written music be careful to center notes on the line or draw them completely within the space. Otherwise, the note is ambiguous. Are the following two notes on lines or spaces?



Ledger Lines

Ledger lines are used to extend the range of the staff. Ledger lines can appear above or below the staff. They maintain the spacing of the staff lines and extend slightly beyond each note head. Ledger lines never extend

further than necessary.



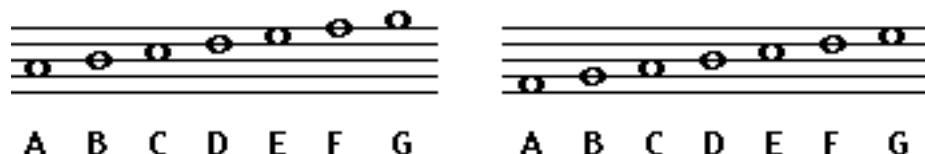
Low / High

The higher up the staff the note appears, the higher the pitch.



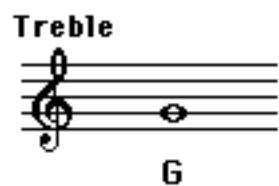
Musical Alphabet

The musical alphabet consists of the letters A B C D E F G. Each letter corresponds to a specific line or space on the staff. As you move forward through the musical alphabet the pitch of each note gets higher. You could arbitrarily assign any staff line or space to represent the note A. The names of the other lines and spaces would follow from there.



Clefs

A clef symbol is placed at the beginning of each staff to fix the location of a specific pitch on a specific staff line. The two most common clefs are the Treble and Bass clefs.



When we put clefs into the example given earlier we get the musical alphabet from A to G in each of these four clefs.



Choice Of Clefs

Clefs are chosen to match the range of a voice or an instrument so that the majority of notes fall within the staff.

Poor clef choice	Good clef choice - same notes

When these notes are notated in treble clef many ledger lines are necessary. However, they fit nicely in the bass clef.

Treble Clef

Treble clef is part of a family of clefs known as G clefs. The curl in the treble clef symbol locates the note G on the staff.



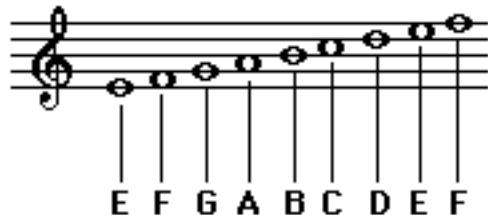
The names of notes on the lines of the treble clef (EGBDF) can be remembered by the saying

Every Good Boy Does Fine or Elvis' Guitar Broke Down Friday.

The names of notes on the spaces of the treble clef (FACE) spell **FACE**.



When the line and space notes are combined, they form the musical alphabet.



Instruments that use the treble clef include the piano (right hand), violin, flute, trumpet, and guitar.

Bass Clef

The two dots in the bass clef symbol locate the line that represents the pitch F. Because it defines the pitch F, the bass clef is referred to as a F clef.



The names of notes on the lines of the bass clef (GBDFA) can be remembered by the saying

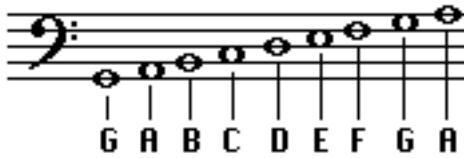
Good Boys Do Fine Always

The names of notes on the spaces of the bass clef (ACEG) can be remembered by saying

All Cows Eat Grass or All Cars Eat Gas.



When the line and space notes are combined, they form the musical alphabet.



Instruments that use the bass clef include piano (left hand), cello, bassoon, and tuba.

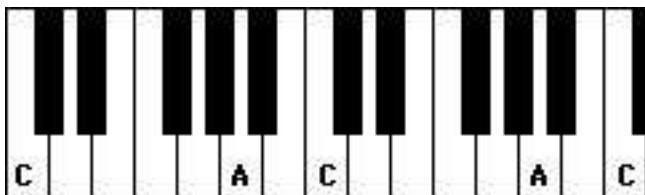
Piano Keyboard

The piano keyboard consists of 88 keys arranged in repeating groups of white keys and black keys. Low notes are on the left side of the piano keyboard. High notes are on the right side of the piano keyboard. As you move from left to right on the piano, the pitch of each note gets higher.



Black Key Groups

The black keys of the piano are arranged in groups of twos and threes. Using these black key groups you can identify any note on the keyboard. For example, C is always the white key immediately to the left of a two black key group, and A is always between the second and third black key in a three black key group.



Keyboard White Keys

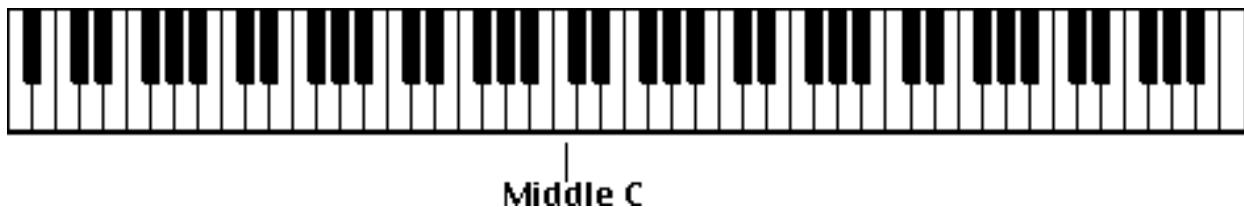
The white keys on the piano correspond to the musical alphabet A B C D E F G. You can always locate the note A on the piano by finding a group of three black keys and then playing the white key between the second and third black key. Then names of the other white keys follow from

there. The musical alphabet is repeated a little over seven times on the white keys of the piano keyboard.



Middle C

Middle C is the C that is found in the middle of the piano keyboard.



Pitch, Clefs, Staff, And Keyboard Combined

In each clef there is an exact correlation between the letters of the musical alphabet, the notes on the staff, and the piano white keys. As the pitch of each note rises, you move forward through the musical alphabet, you move to the right on the piano, and you move up on the musical staff. Notice that each letter name has its own white key on the piano and its own corresponding place on the music staff.

Treble Clef Range On The Piano

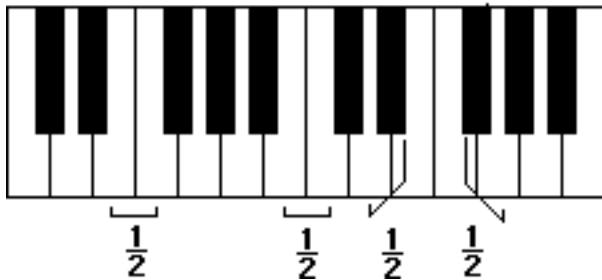
A diagram illustrating the Bass Clef range on a piano. The top part shows a musical staff with a bass clef and note heads corresponding to the keys C, D, E, F, G, A, B, C, D, E, F, G, A. Below the staff is a piano keyboard with these keys labeled. A vertical line marks 'Middle C' on the keyboard. The bottom part shows a piano keyboard with the keys labeled C, D, E, F, G, A, B, C, D, E, F, G, A, with a vertical line marking 'Middle C'.

Bass Clef Range On The Piano.

A diagram illustrating the Bass Clef range on a piano. The top part shows a musical staff with a bass clef and note heads corresponding to the keys E, F, G, A, B, C, D, E, F, G, A, B, C. Below the staff is a piano keyboard with these keys labeled. A vertical line marks 'Middle C' on the keyboard. The bottom part shows a piano keyboard with the keys labeled E, F, G, A, B, C, D, E, F, G, A, B, C, with a vertical line marking 'Middle C'.

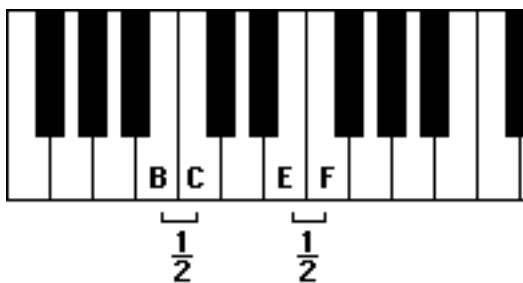
Half Steps

The half step is the smallest unit of pitch used in Western music. Half steps occur naturally on the piano between any two adjacent piano keys, white to black, black to white, or white to white.



Naturally Occurring Half Steps (Nohs)

Two half steps occur naturally in the musical alphabet A B C D E F G, between B-C and E-F. They are referred to as Naturally Occurring Half Steps, NOHS. On the piano they are the white keys pairs that do not have a black key between them.



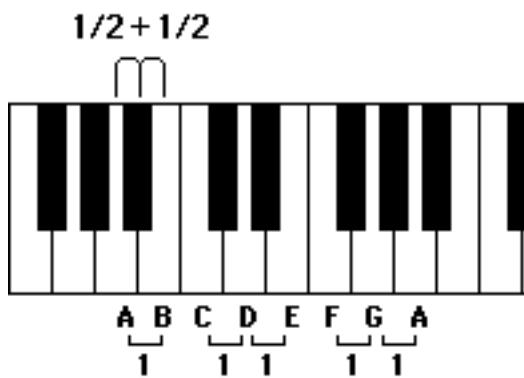
Whole Steps

Two consecutive half steps make a whole step. Whole steps occur on the piano between the first and third key of any three adjacent piano keys, white to white, black to black, white to black, or black to white.

E - F#	White - Black	
Bb - C	Black - White	
D - E	White - White	
Gb - Ab	Black - Black	

Naturally Occurring Whole Steps (Nows)

Whole steps occur naturally on the piano white keys, and in the musical alphabet A B C D E F G, between every letter pair except B-C and E-F. There are five pairs of naturally occurring whole steps: A-B, C-D, D-E, F-G, and G-A.

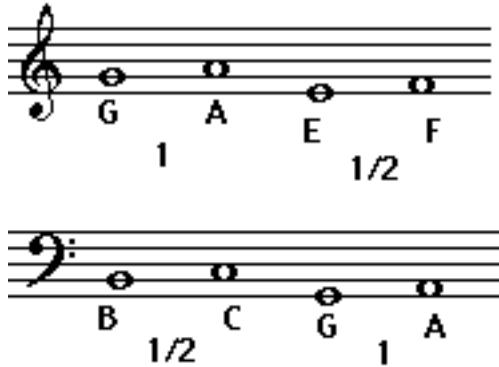


Visual Recognition Of Whole Steps And Half Steps

Notice that it's impossible to visually distinguish whole steps and half steps on a music staff without a clef.



You need to know the clef in order to know where B-C and E-F are.

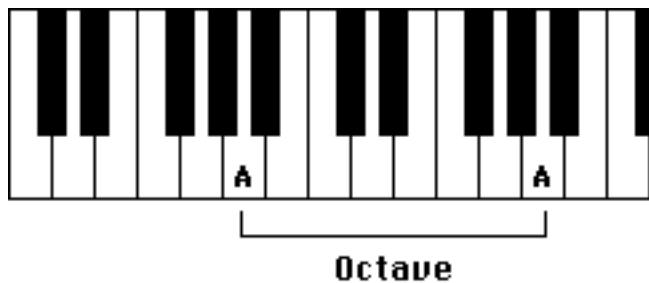


Intervals

An interval is the distance between two notes. The size of an interval is measured in half steps. The size of a half step is one half step. The size of a whole step is two half steps.

Octave

Another important interval is the octave. An octave is the interval between two notes that have the same name and are twelve half steps apart. If you start on any note of the piano and then play twelve successive half steps up or down you'll reach the note that has the same name as the one you started from. Those two notes are an octave apart. The root "oct" refers to the fact that an octave spans eight alphabet letters. An 88 key piano has a range of seven and a half octaves. We'll be studying more about intervals in Unit 11.



Accidentals

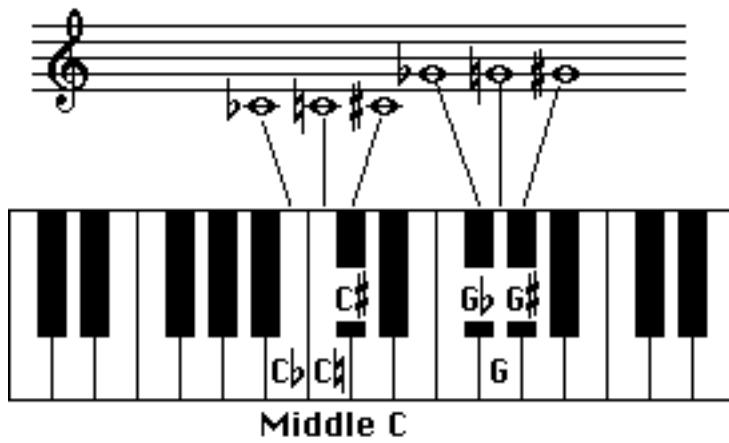
Accidentals are symbols that alter the pitch of a note. Five accidentals are used in music notation: the flat, sharp, double flat, double sharp, and natural.

Name	Symbol	Effect
Flat	♭	lowers pitch by half step
Sharp	♯	raises pitch by half step
Double Sharp	𝄪	raises pitch by whole step
Double Flat	𝄫	lowers pitch by whole step
Natural	♮	cancels previous accidental

In music notation accidentals precede the note they affect. However, in speaking or text the accidental follows the note name. You say or write "G sharp" or "G#", not "sharp G."

Single Accidentals

Single accidentals raise or lower the pitch of a note by a half step. They are the sharp, flat, and natural. Single accidentals are very common in music.



Double Accidentals

Double accidentals raise or lower the pitch of a note by two half steps or one whole step. They are the double sharp and double flat. Double

accidentals are much less common than single accidentals.

Natural

The natural is used to cancel a previously used sharp or flat. The following example illustrates an important musical rule.

Rule: Once an accidental is used within a measure it remains in effect until you reach the end of the measure or it is altered by another accidental.

Accidentals And Keyboard Black Keys

Most, but not all, accidentals that appear in a piece of music are played on the black keys of the piano. The key immediately to the right (higher pitch) of any white key is called that key sharp. For example, the black key immediately to the right of D is called D#.

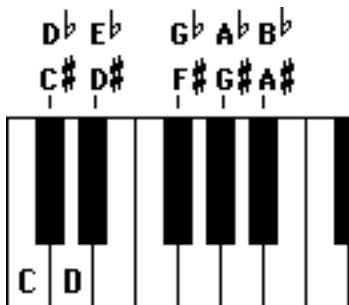
The key immediately to the left (lower pitch) of any white key is called that key flat. For example, the black key immediately to the left of E is called Eb.

Because there is only one black key between D and E, that black key has two different names. You cannot hear the difference between D# and Eb, but you can see the difference when they are written.



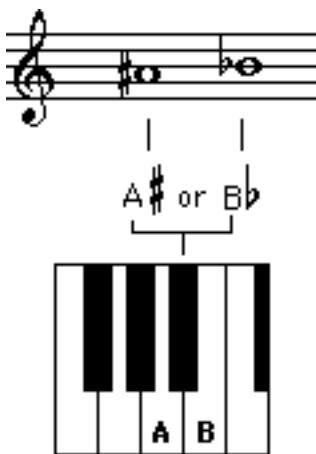
Names Of Black Keys

Black keys can be named with either sharps or flats. On the piano keyboard the black key between C and D can be thought of as a half step higher than C and called C# or as a half step below D and called Db. The names of the black keys using sharps would be: C# D# F# G# A#. The names of the same black keys using flats would be: Db Eb Gb Ab Bb.

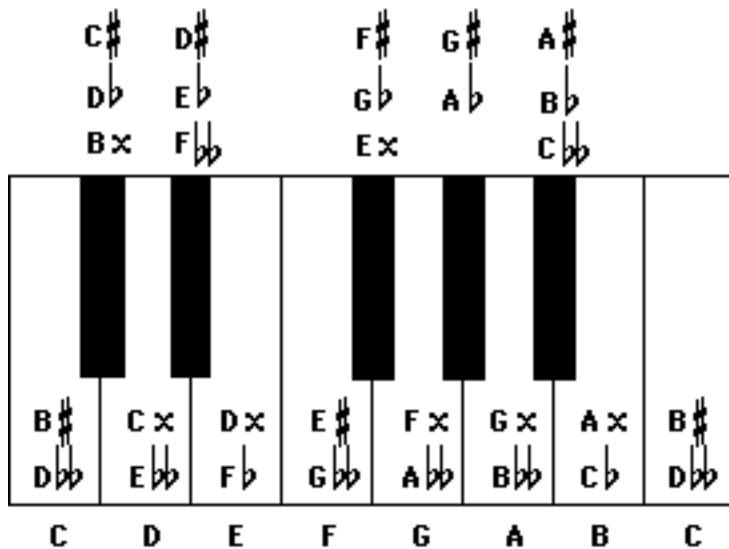


Enharmonic Notes

Two notes that sound the same but have different names are called enharmonic notes. A# is the enharmonic equivalent of Bb.



The piano is an enharmonic keyboard because every key of the piano can represent three notes with the exception of G#-Ab.



B# and C are enharmonic notes. In this case B# is the same white key as C. Other enharmonic white key pairs are: E#-F, B-Cb, and E-Fb.

Chromatic Scale

The chromatic scale is the scale of half steps. When you play every black and white key on the piano in sequence, you're playing the chromatic scale.

Here's the chromatic scale from A to A written first using sharps, then using flats. In the second example, note the use of the natural sign to cancel the flat on the previous note.

The first staff shows an ascending chromatic scale from A to A with sharps. The second staff shows a descending chromatic scale from A to A with flats.

When writing an ascending chromatic scale, sharps are preferred. When writing a descending chromatic scale, flats are preferred. The preferred form keeps the number of accidentals to a minimum.

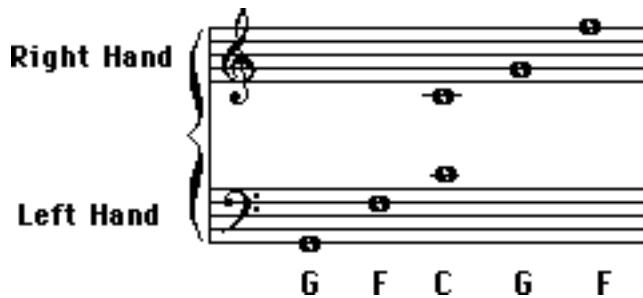
Diatonic/Chromatic Half Steps And Whole Steps

Half steps and whole steps can be further classified as diatonic or chromatic. The distinction lies in the alphabet letter name of the notes. If the two notes have different alphabet letter names they are diatonic. If they have the same alphabet letter name they are chromatic.

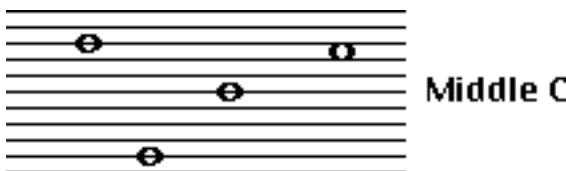
1. A - Bb: Diatonic 1/2 step
2. A - A#: Chromatic 1/2 step
3. D - E: Diatonic Whole step
4. D - Dx: Chromatic Whole step

Grand Staff

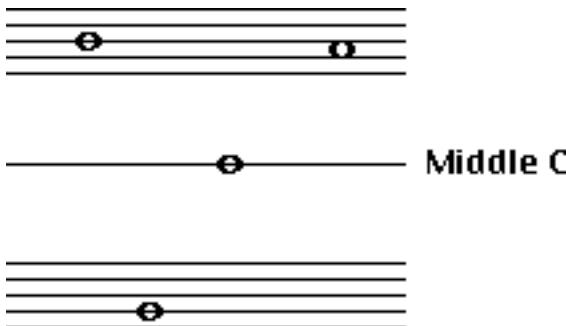
The grand staff consists of the treble clef and bass clef joined by a brace. All piano music is written using the grand staff, treble clef for the right hand and bass clef for the left hand.



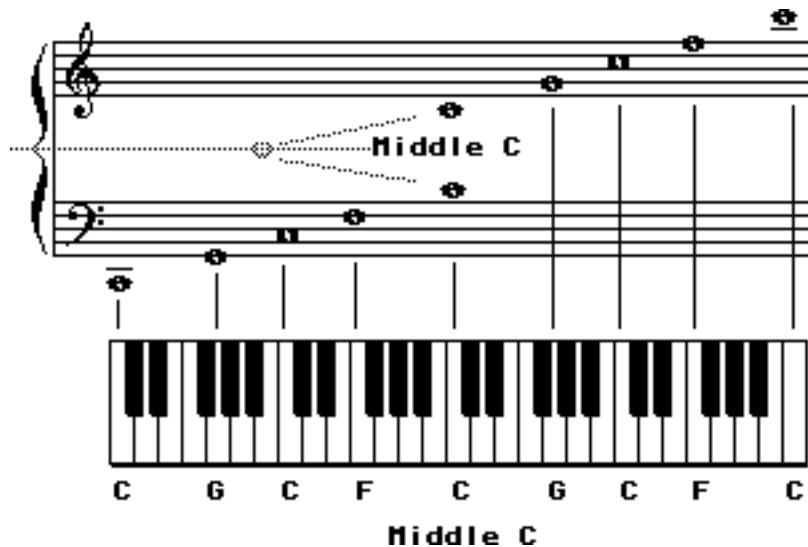
In the early history of music notation, an ancestor of the grand staff was the eleven line staff. It's hard to read an eleven line staff quickly. Is the last note on the 7th, 8th, or 9th space?



If you split the eleven line staff in the middle and move five lines up and five lines down it's much easier to identify specific lines and spaces.



When you erase the middle line, add the treble and bass clefs, and join them with a brace you get the grand staff.



Here's the eleven line example in the Grand Staff.



Although Middle C is an invisible staff line shared between the treble and bass clefs, Middle C is never written in the middle of the grand staff. It is correctly written using ledger lines above or below the staff. Ledger lines are spaced the same distance apart as the staff lines.

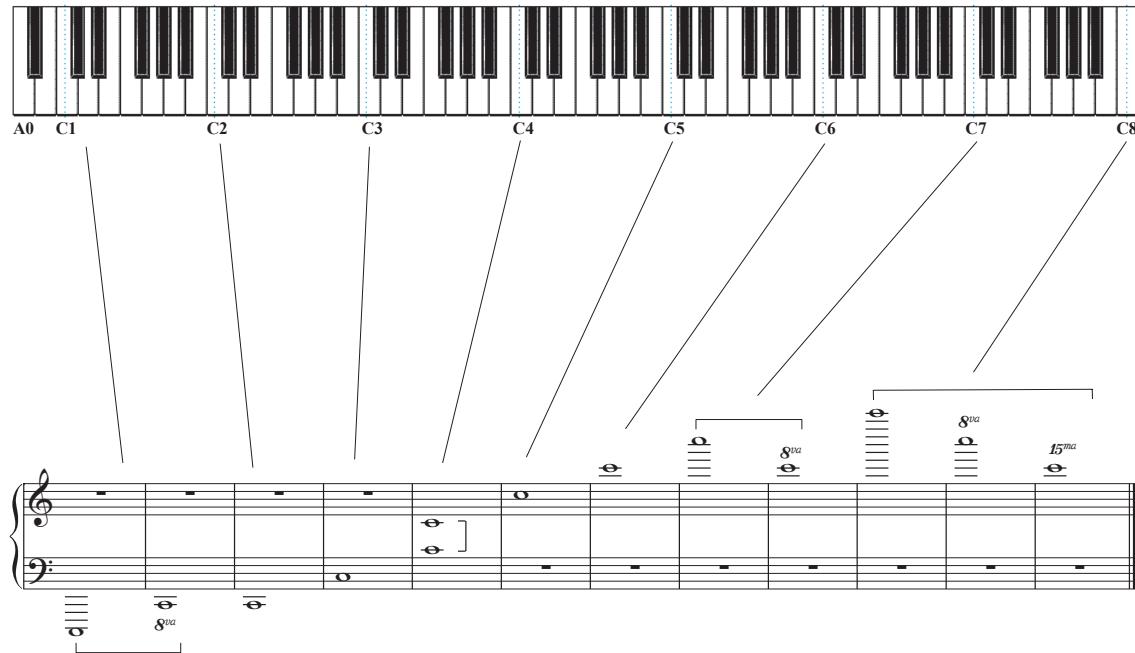
Wrong	Correct for treble clef	Correct for bass clef

Pitch Names

To uniquely name a pitch you have to identify three things, the alphabet

name, the accidental (if used), and the octave designation. Several systems of pitch names have been used. We'll use a common one that defines middle C as C4. All other note names derive from that. The octave designation changes on every C.

Piano Keyboard Reference



8Va

If you look closely at the music example shown above, you'll see the symbol 8va placed either above a note or below a note. The 8va symbol is Italian for ottava, or octave. When it is placed above a note, the note is played one octave higher. When it is placed below a note, the note is played one octave lower. It is commonly used to reduce the number of ledger lines needed to write very high notes or very low notes.

Note Name - MIDI Number - Frequency

Name	MIDI Note	Freq. Hz		Name	MIDI Note	Freq. Hz
A0	21	27.50				
A#/Bb0	22	29.14				
B0	23	30.87				
C1	24	32.70				
C#/Db1	25	34.65		C5	72	523.25
D1	26	36.71		C#/Db5	73	554.37
D#/Eb1	27	38.89		D5	74	587.33
E1	28	41.20		D#/Eb5	75	622.25
F1	29	43.65		E5	76	659.26
F#/Gb1	30	46.25		F5	77	698.46
G1	31	49.00		F#/Gb5	78	739.99
G#/Ab1	32	51.91		G5	79	783.99
A1	33	55		G#/Ab5	80	830.61
A#/Bb1	34	58.27		A5	81	880
B1	35	61.74		A#/Bb5	82	932.33
C2	36	65.41		B5	83	987.77
C#/Db2	37	69.30		C6	84	1046.5
D2	38	73.42		C#/Db6	85	1108.73
D#/Eb2	39	77.78		D6	86	1174.66
E2	40	82.41		D#/Eb6	87	1244.51
F2	41	87.31		E6	88	1318.51
F#/Gb2	42	92.50		F6	89	1396.91
G2	43	98.00		F#/Gb6	90	1479.98
G#/Ab2	44	103.83		G6	91	1567.98
A2	45	110		G#/Ab6	92	1661.22
A#/Bb2	46	116.54		A6	93	1760
B2	47	123.47		A#/Bb6	94	1864.66
C3	48	130.81		B6	95	1975.53
C#/Db3	49	138.59		C7	96	2093
D3	50	146.83		C#/Db7	97	2217.46
D#/Eb3	51	155.56		D7	98	2349.32
E3	52	164.81		D#/Eb7	99	2489.02
F3	53	174.61		E7	100	2637.02
F#/Gb3	54	185.00		F7	101	2793.83
G3	55	196.00		F#/Gb7	102	2959.96
G#/Ab3	56	207.65		G7	103	3135.96
A3	57	220		G#/Ab7	104	3322.44
A#/Bb3	58	233.08		A7	105	3520
B3	59	246.94		A#/Bb7	106	3729.31
C4	60	261.63		B7	107	3951.07
C#/Db4	61	277.18		C8	108	4186.01
D4	62	293.66				

D#/Eb4	63	311.13				
E4	64	329.63				
F4	65	349.23				
F#/Gb4	66	369.99				
G4	67	392.00				
G#/Ab4	68	415.30				
A4	69	440				
A#/Bb4	70	466.16				
B4	71	493.88				

Note Symbols And Duration

The the type of note head and the type of flag or beam attached to the stem represents the duration of the note. The duration is relative, not absolute. The note symbol only tells you how long one note lasts compared to other notes in the piece. The note's duration is also relative to the tempo. The same note symbol might last two seconds at a slow tempo, but only last half a second at a fast tempo.

Rest Symbols

A rest indicates silence. For every note symbol there is a corresponding rest symbol. Since rests are silent, there is no need to indicate a pitch in notation. However, the rest symbol does indicate how long the silence lasts.

Note And Rest Table

This table shows the names for each of the note and rest symbols used in music.

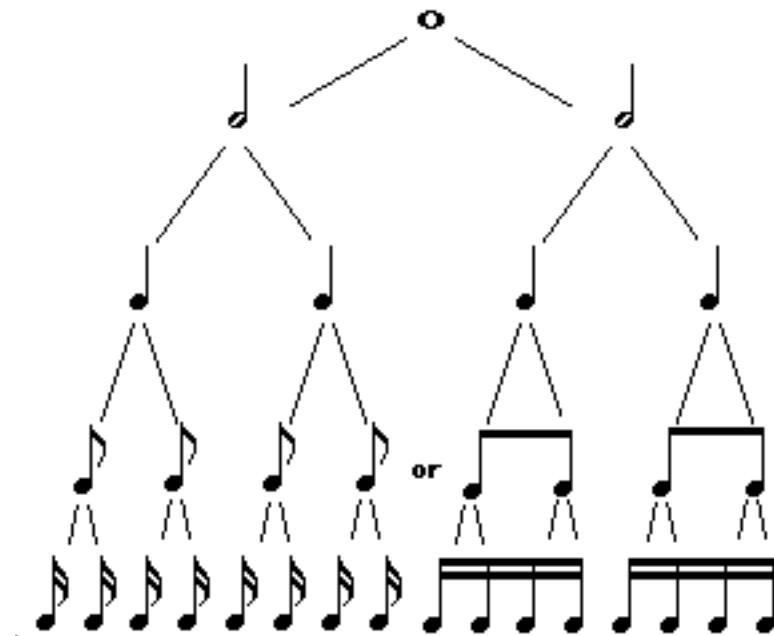
Note	Rest	Name
•		Whole
♩		Half
♪		Quarter
♫		Eighth

		Sixteenth
		Thirty second
		Sixty fourth
		One hundred twenty eighth

In the above table, each note or rest is twice as long as the note below it, and half as long as the note above it. The concept of note durations being half as long or twice as long is central to the understanding of musical rhythm. The notes get their names from their fractional value of a whole note.

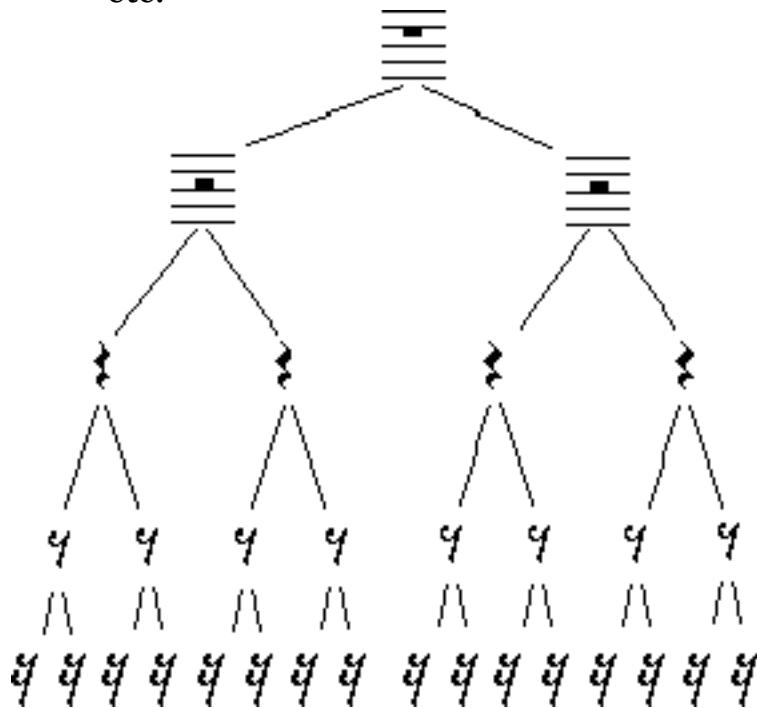
In the following figure, notes are represented as a tree. You can clearly see that

- One whole notes = two half notes
- One half note = two quarter notes
- One whole note = four quarter notes
- One half note = four eighth notes
- etc.



In this figure, rests are represented as a tree. You can clearly see that

- One whole rest = two half rests
- One quarter rest = two eighth rests
- One eighth rest = half a quarter rest
- One quarter rest = four sixteenth rests
- etc.



In the note and rest trees above, the values ranged from a whole note to a sixteenth note. If 32nd, 64th, and 128th notes and rests had been included, the tree would be much larger.

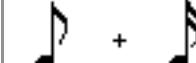
Beat Unit

The note value that gets one beat is called the beat unit. If the beat unit is assigned to the quarter note, then all other notes get a proportion of the quarter note.

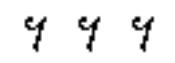
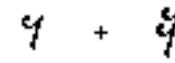
Not e	Rest	Name	Number notes equivalent in duration to one whole note	Number of beats using the quarter note as the beat unit
○	≡	Whole	1	4
♩	≡	Half	2	2
♪	♪	Quarter	4	1
♪	♪	Eighth	8	1/2
♪	♪	Sixteenth	16	1/4
♪	♪	Thirty second	32	1/8
♪	♪	Sixty fourth	64	1/16
♪	♪	One hundred twenty eighth	128	1/32

Dotted Notes

A dot following a note or rest increases its duration by half. The following examples assume the quarter note is the beat unit.

Name	Symbol	Equals	Equivalent	Beats
Dotted Half Note				3
Dotted Quarter Note				1 1/2
Dotted Eighth Note				3/4

Dotted Rests

Name	Symbol	Equals	Equivalent	Beats
Dotted Half Rest				3
Dotted Quarter Rest				1 1/2
Dotted Eighth Rest				3/4

Single, double (rare), or even triple (very rare) augmentation dots can be used. The first dot increases the note's duration by one half. The second dot increases the note's duration by one quarter. The third dot increases the note's duration by one eighth.



Note Value	Rhythmic Equivalent
Quarter Note	Quarter note = 1 beat
Dotted Quarter Note	Quarter note + Eighth note = $1 + \frac{1}{2}$ beats
Double Dotted Quarter Half Note	Quarter note + Eighth note + 16th note = $1 + \frac{1}{2} + \frac{1}{4}$ beats
Triple Dotted Quarter Half Note	Quarter note + Eighth note + 16th note + 32nd note = $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$ beats

Beat / Pulse

When you tap your foot or dance to music you're following the beat. The beat is a series of evenly spaced pulses. Anything that marks off equal units of time can be used as a beat source, your heartbeat, the sound of your footsteps on a steady walk, a clock ticking, or a metronome. These steady beats (ticks, pulses, clicks) exist outside of the music. The beat serves as the foundation of all musical rhythm and performance by providing a temporal grid on which the rhythm values are placed.

Beat Unit

Any note value can represent the beat. The note value that gets one beat is called the beat unit. If you choose the quarter note as the beat unit, then a half note will get two beats. However, if you choose the eighth note as the beat unit, then a half note will get four beats.

Rhythm

The organization of notes with respect to the beat is called rhythm. Sometimes notes will be played on the beat, sometimes between the beats, sometimes one note will last for several beats, and sometimes several notes will be played before the next beat.

Tempo

The speed of the beat is called tempo. In a fast tempo the beats are close together. In a slow tempo the beats are spaced further apart.

Metronome Markings

The tempo is indicated by a metronome marking in beats per minute. The notation M.M. $\text{♩} = 60$ indicates that there are 60 beats per minute, or one beat per second. M.M. is an abbreviation for Maelzel's Metronome, named after the inventor Maelzel. The notation M.M. $\text{♩} = 120$ indicates that there are 120 beats per minute, or two beats per second. The notation M.M. $\text{♩} = 90$ indicates that there are 90 beats per minute, or three beats every two seconds.

Tempo Markings

Tempo indications are often given by Italian terms, sometimes accompanied by a metronome indication in beats per minute. The following chart shows several common tempo markings. The metronome markings are approximate.

Beats/minute	Tempo Marking	Performed
M.M. $\text{♩} = 40$	Grave	Extremely slow
	Largo	Slow
	Larghetto	
	Lento	
	Adagio	
M.M. $\text{♩} = 60$	Andante	Medium slow, literally walking
	Andantino	
	Moderato	Medium
	Allegretto	Medium fast
M.M. $\text{♩} = 120$	Allegro	Fast

	Vivace	
	Presto	
M.M. $\text{♩} = 208$	Prestissimo	As fast as possible