

Piano, Sheet Notation and MIDI

1 Piano Keys

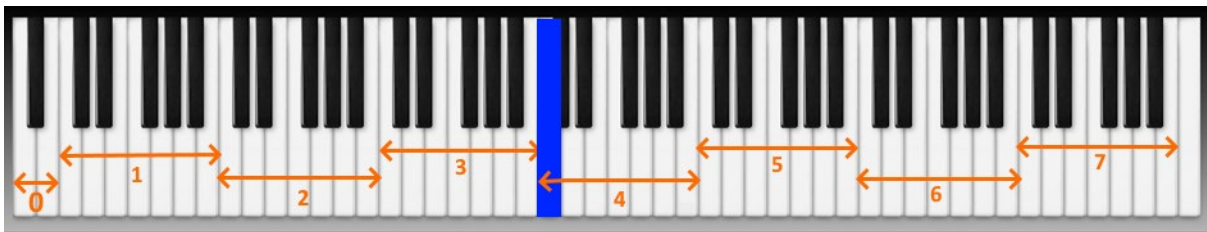
You all know what a piano looks like. Standard pianos have 88 keys, 52 white and 36 black keys. The white keys play full notes, the black keys half notes.



You'll find more information on pianos and their history in Wikipedia

<https://en.wikipedia.org/wiki/Piano>.

The 88 keys are divided into seven full Octaves and four extra keys.



Each Octave, represented by the orange bars above, contains the full notes c,d,e,f,g,a,h represented by the white keys in each octave. The black keys increase the key to the left by half a note. C becomes (in English) c-sharp, they alternatively decrease the key on the right by half a note, so D becomes D-flat. C-sharp and D-flat therefore represent the same key. Sonic Pi wants to make it easier to remember the scale and uses b instead of h. That way, you can easily remember the scale by using the alphabet.

The table shows the matching keys

Sheet Music	C	D	E	F	G	A	H	C	D	E	F	G	A	H	C	D
Sonic Pi	C	D	E	F	G	A	B	C	D	E	F	G	A	B	C	D
Alphabet						A	B	C	D	E	F	G				

In Sonic Pi the note starts with a colon, to signal we want to play a sheet note, followed by the full note and optionally the s for sharp (increase) or f for flat (decrease) for half notes. So,

```
play :c
plays the c note, and
```

```
play :cs
```

plays the black key to the right of the c (outside Sonic Pi the notation C# is used for c-sharp).

But which c or cs do we play? Each octave on the piano starts with a c. The orange number below the octave arrow in the picture above represents the octave number. In Sonic Pi the full notation for a sheet note is

`:<note>[s]<octave>`

Colon (:), introduces the note in sheet notation, followed by the note (c,d,e,f,g,a,h - or b in Sonic Pi), followed by the optional sharp or flat selector (s or f) and the note ends with the number of the octave from 1 through 7. So,

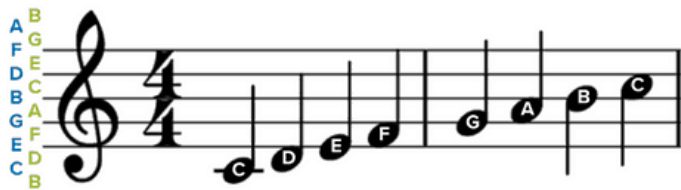
`play :c4`

Represents the blue key in the picture, the c key in the 4th octave,

2 Sheet Notation

You may be familiar with sheet notation to represent music. To explain all keys and modifiers would take a long time for the purposes of this challenge, but if you are interested you can check out this website: <https://www.musicnotes.com/now/tips/how-to-read-sheet-music/>.

If you play a musical instrument, then you will know how a note on a sheet translates into a key on the piano. The picture below shows the sheet notes which match the 4th octave from the section above:

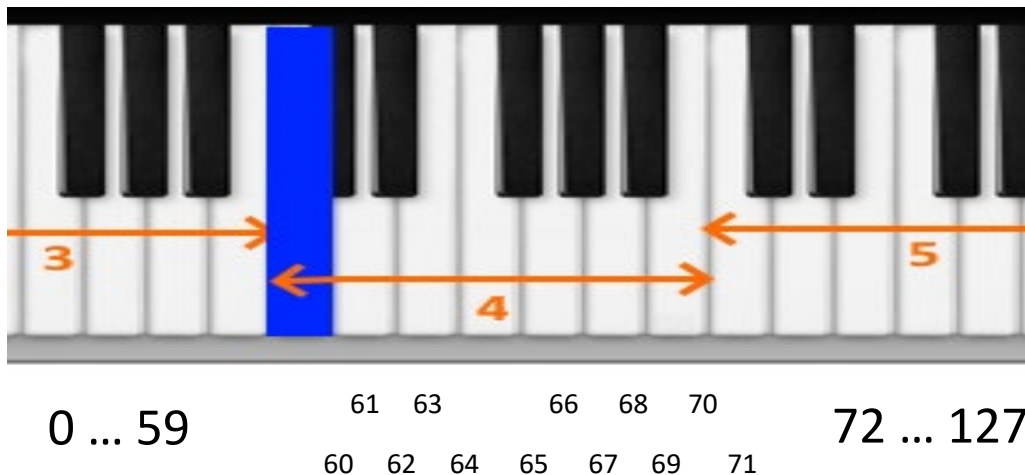


In Sonic Pi notation this would be played by

```
# Simple scale from C4 to C5
play :c4
sleep 1
play :d4
sleep 1
play :e4
sleep 1
play :f4
sleep 1
play :g4
sleep 1
play :a4
sleep 1
play :b4
sleep 1
play :c5
```

3 MIDI Notation

MIDI stands for *Musical Instrument Digital Interface*. The standard describes how electronic instruments communicate with each other. MIDI introduced a simple notation to match numbers with the keys on a piano. MIDI however starts lower than the piano keys, not with octave 1, but with octave -1 and goes through octave 9. Piano keys are numbered through so not distinguishing between the white (full note) and the black (half note) keys. This makes it easier as we don't have to use the sharp or flat (s or f, #) modifiers as introduces above.



The top row (61, 63, ..) represent the black keys in the octave, the lower row (60, 62, ..) the white keys.

The table below is used to simply match a Note and Octave with a MIDI number.

Note	Octave										
	-1	0	1	2	3	4	5	6	7	8	9
C	0	12	24	36	48	60	72	84	96	108	120
C#	1	13	25	37	49	61	73	85	97	109	121
D	2	14	26	38	50	62	74	86	98	110	122
D#	3	15	27	39	51	63	75	87	99	111	123
E	4	16	28	40	52	64	76	88	100	112	124
F	5	17	29	41	53	65	77	89	101	113	125
F#	6	18	30	42	54	66	78	90	102	114	126
G	7	19	31	43	55	67	79	91	103	115	127
G#	8	20	32	44	56	68	80	92	104	116	
A	9	21	33	45	57	69	81	93	105	117	
A#	10	22	34	46	58	70	82	94	106	118	
B	11	23	35	47	59	71	83	95	107	119	

To find the MIDI number for :c4 just select the note, C, on the left and the octave, 4, from the top

Note	Octave										
	-1	0	1	2	3	4	5	6	7	8	9
C	0	12	24	36	48	60	72	84	96	108	120
C#	1	13	25	37	49	61	73	85	97	109	121
D	2	14	26	38	50	62	74	86	98	110	122
D#	3	15	27	39	51	63	75	87	99	111	123
E	4	16	28	40	52	64	76	88	100	112	124
F	5	17	29	41	53	65	77	89	101	113	125
F#	6	18	30	42	54	66	78	90	102	114	126
G	7	19	31	43	55	67	79	91	103	115	127
G#	8	20	32	44	56	68	80	92	104	116	
A	9	21	33	45	57	69	81	93	105	117	
A#	10	22	34	46	58	70	82	94	106	118	
B	11	23	35	47	59	71	83	95	107	119	

And you find 60 as the corresponding MIDI number.

The C4 through C5 scale played in Sonic PI using MIDI notation is

```
# Simple scale from C4 to C5 in MIDI
play 60
sleep 1
play 62
sleep 1
play 64
sleep 1
play 65
sleep 1
play 67
sleep 1
play 69
sleep 1
play 71
sleep 1
play 72
```

You now should be able to freely translate between notations in Sonic PI. If you have a tune you play on a musical instrument or you have the sheet notes you should be able to translate this into Sonic PI notation and play the tune on your computer!