Mathemusik

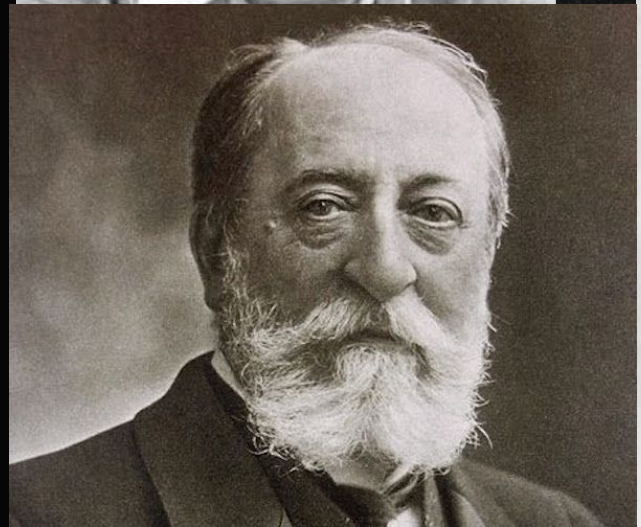
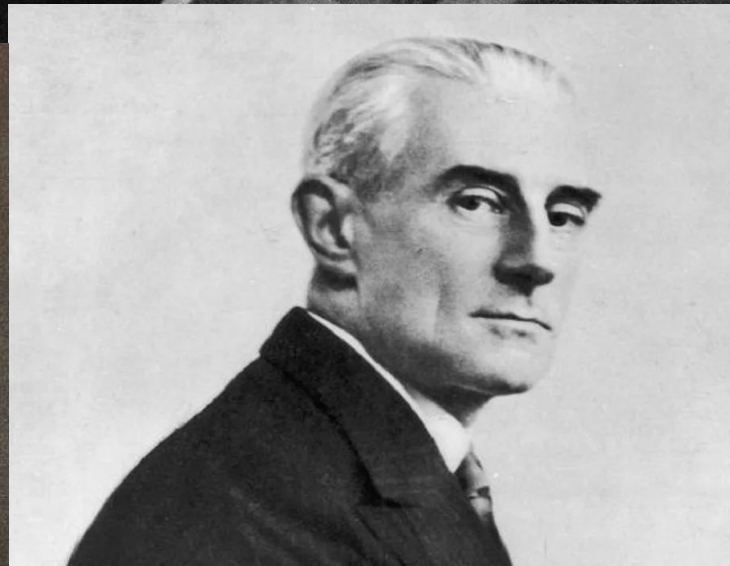
Claudio Olivera
Danielle Wood

“The fact is that music is not only a metaphorical art[;] it is made of mathematically measurable elements...so any explication of music must combine mathematics with aesthetics.”

-Leonard Bernstein

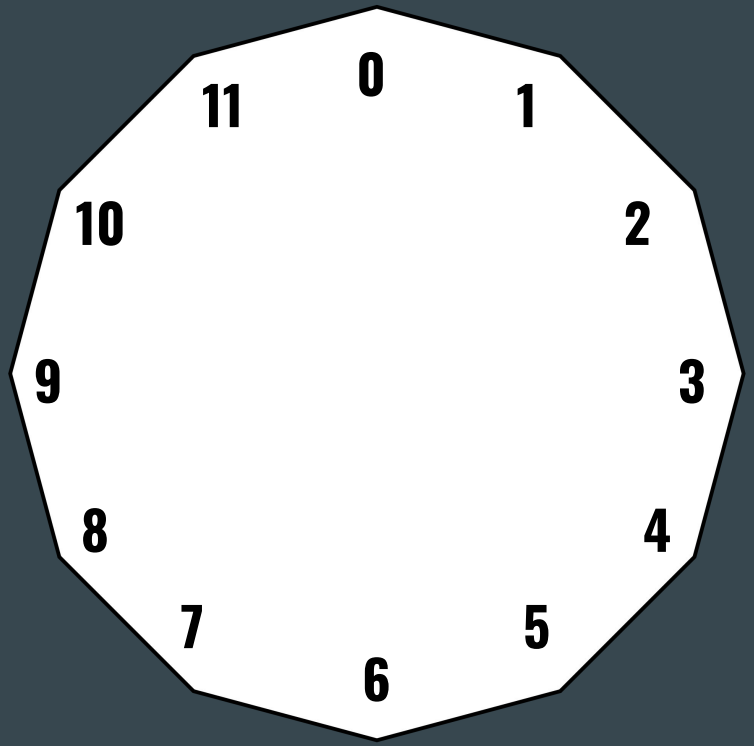
Finally, some answers!

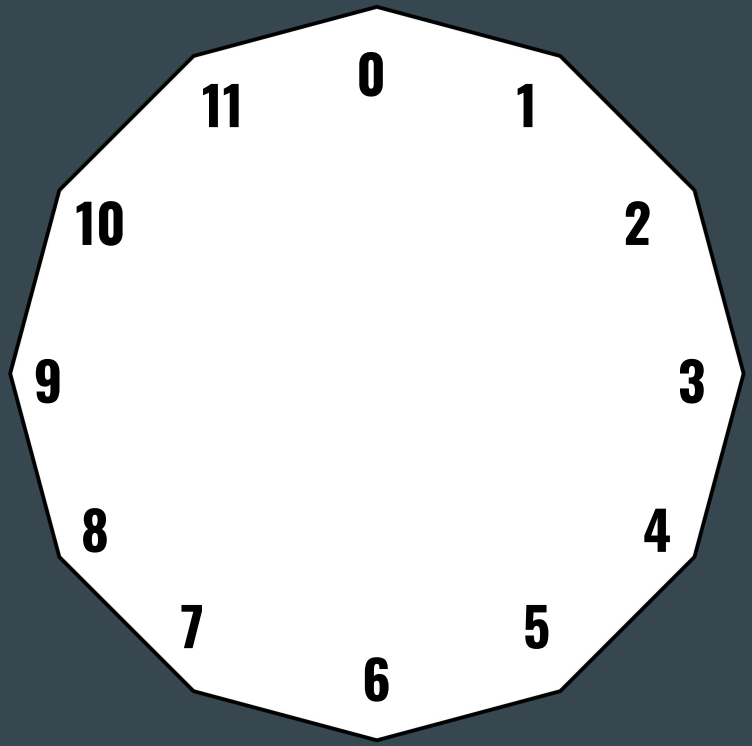
Denmark
Lithuania
Belarus
Germany
Poland
Czech Republic
Vienna
Slovakia
Ukraine
Austria
Moldova
Switzerland
Hungary
Romania
Croatia
Bosnia & Herz.
Serbia
Italy
Montenegro
Kosovo
Bulgaria
Macedonia
Albania
Greece

Rondo vs. Elegie

Rondo vs. Elegie

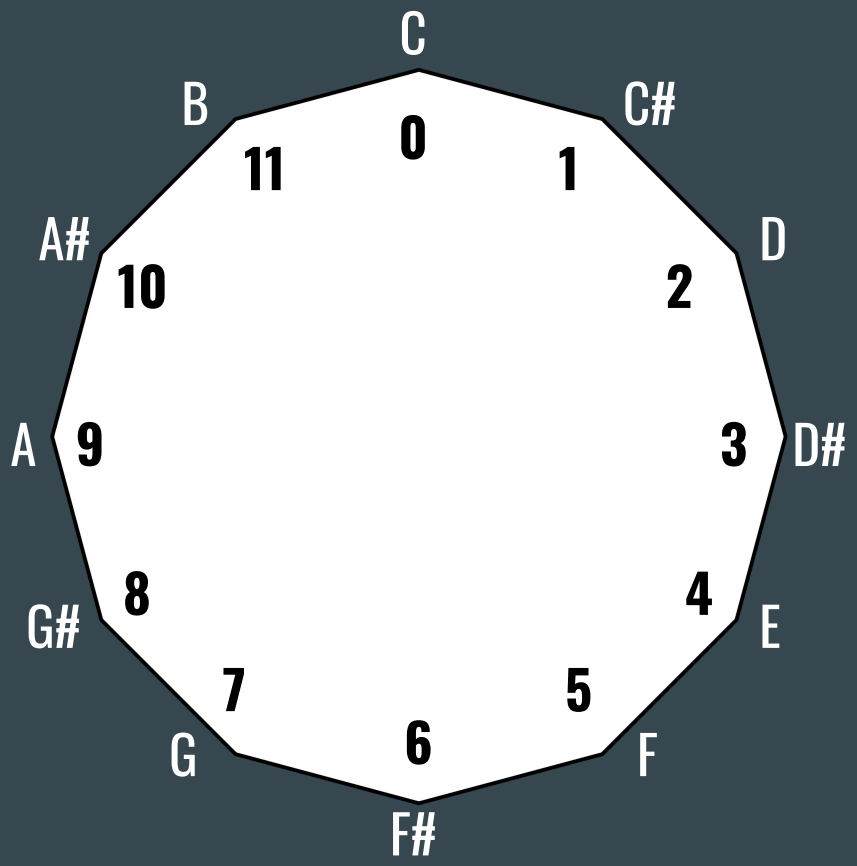

0
1
2
3
4
5
6
7
8
9
10
11

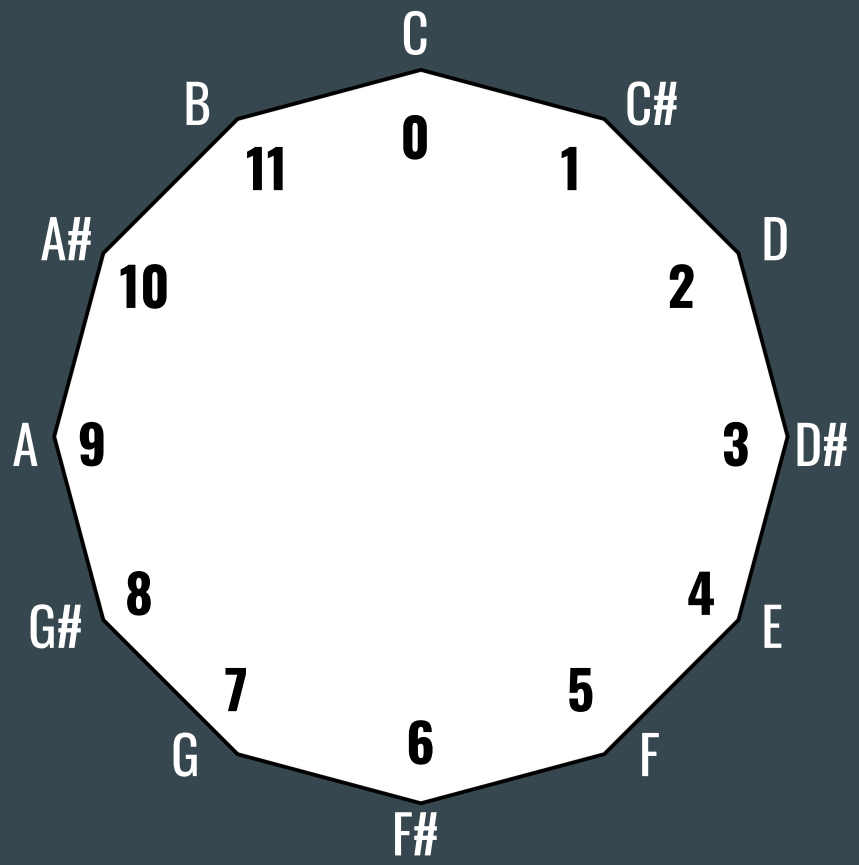


Examples:

0 2 5 1 7 6 11 10 9 4 8 3

8 3 1 10 9 6 7 0 2 11 9 5

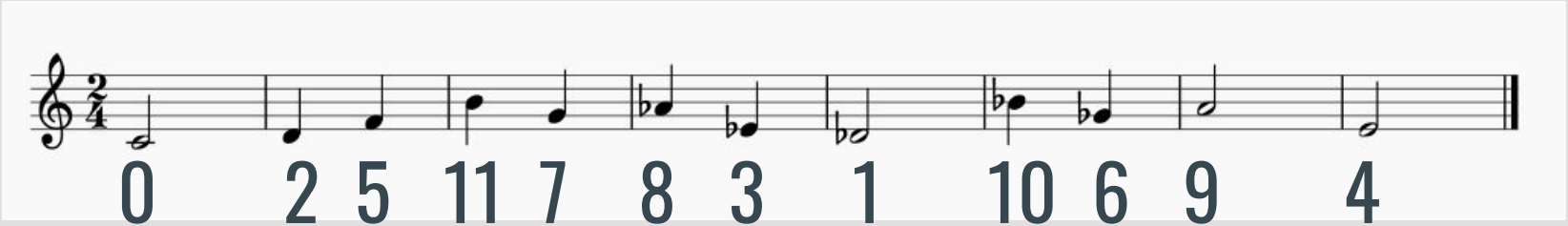

C
0
C#
1
D
2
D#
3
E
4
F
5
F#
6
G
7
G#
8
A
9
A#
10
B
11

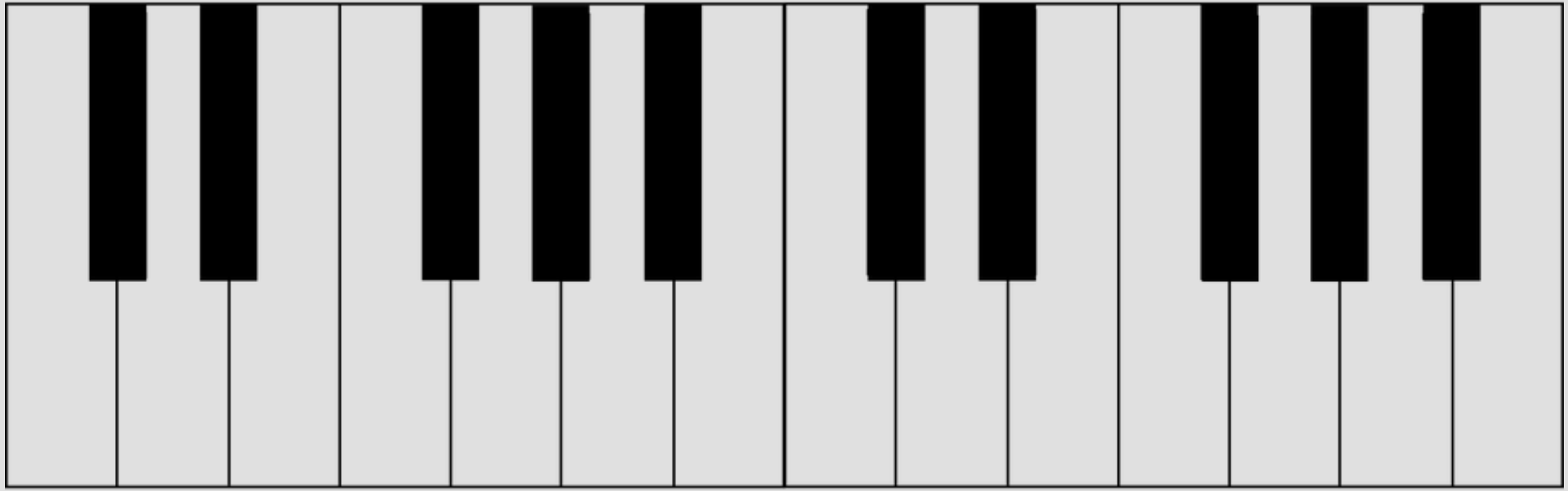


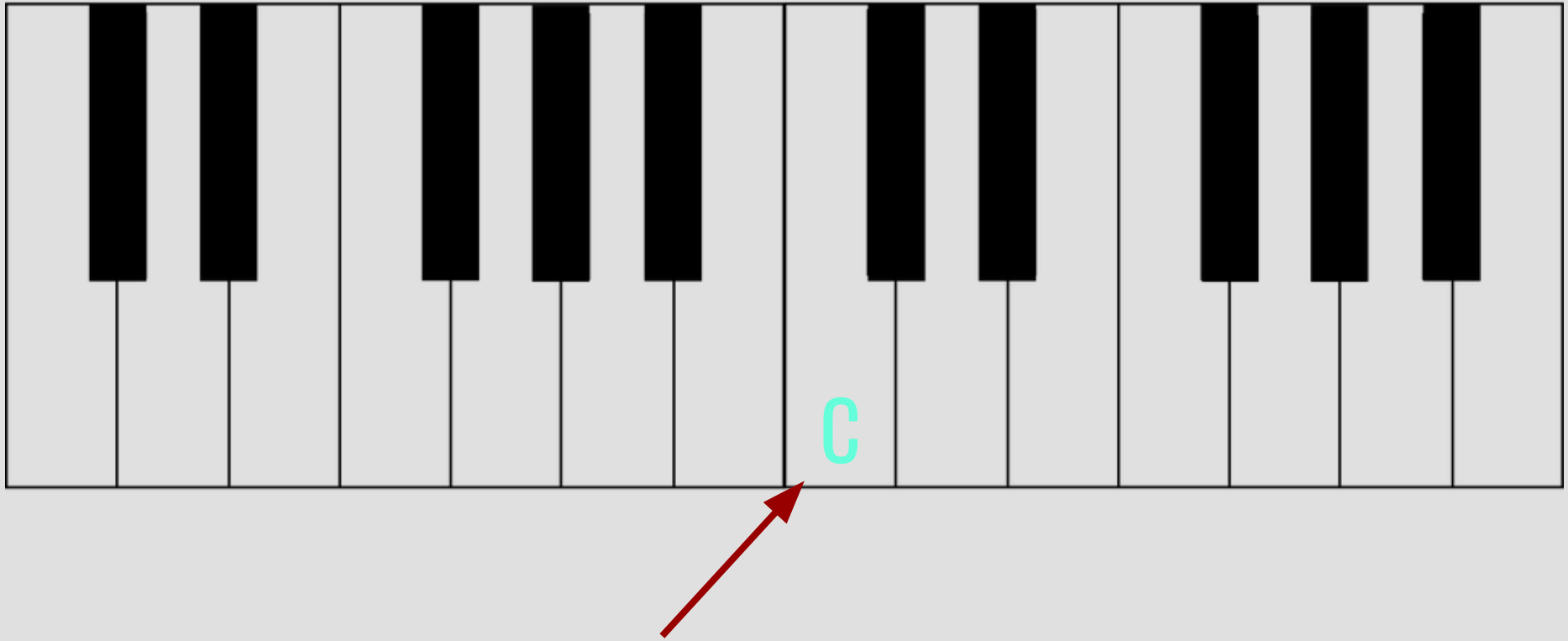
Examples:

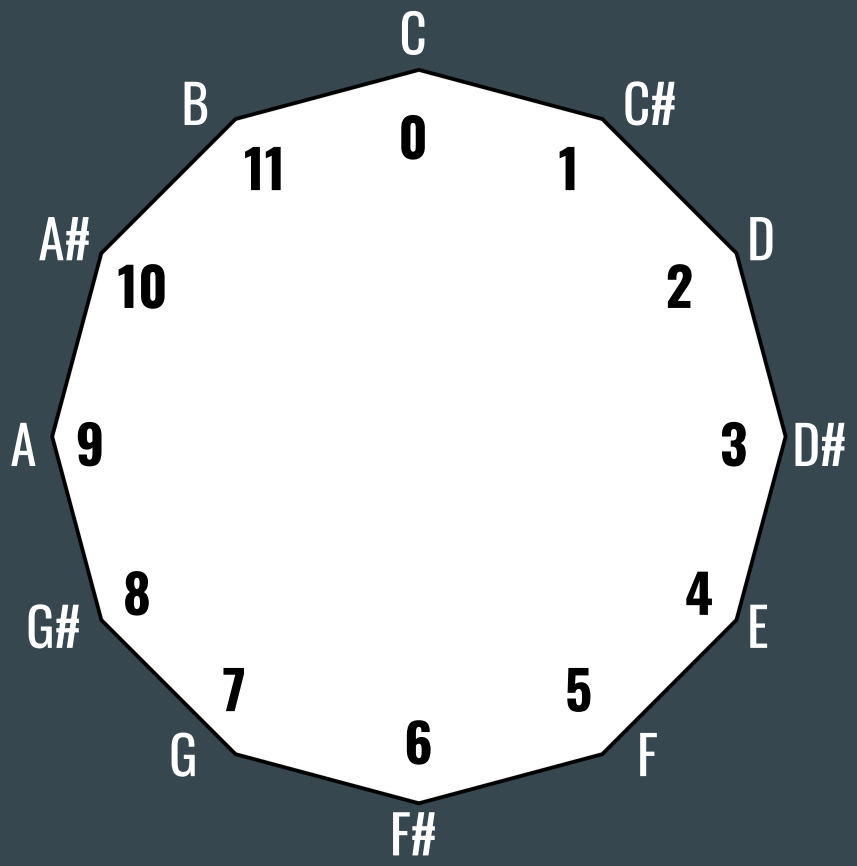
C D F C# G F# B A# A E G# D#
0 2 5 1 7 6 11 10 9 4 8 3

G# D# C A# A F# G C D B A F
8 3 1 10 9 6 7 0 2 11 9 5


0 2 5 11 7 8 3 1 10 6 9 4



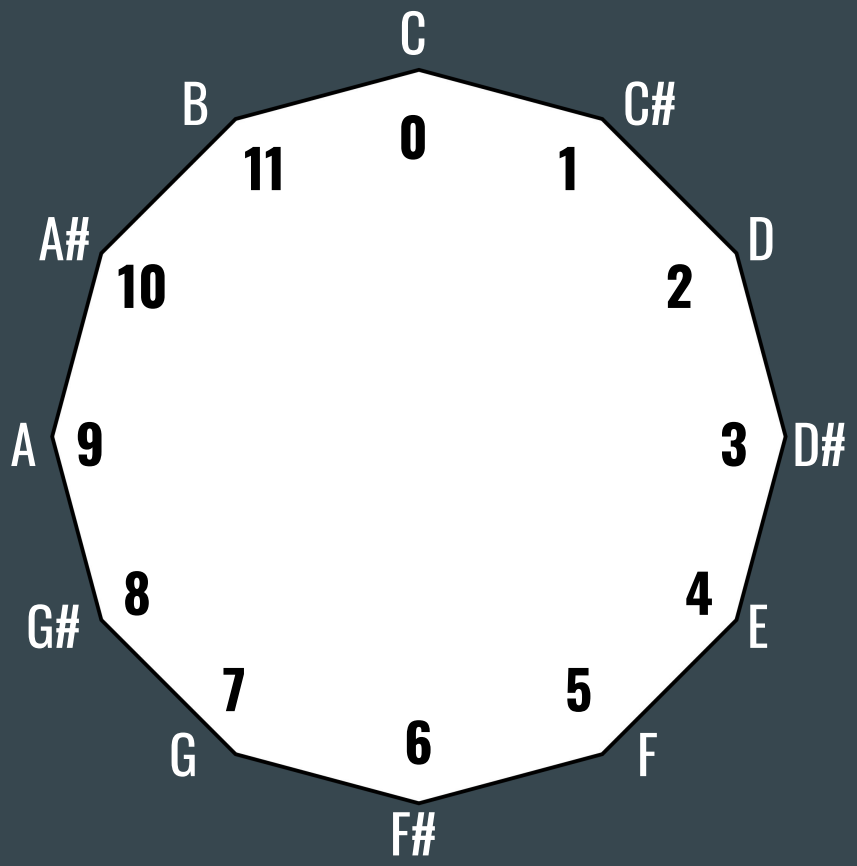

C



Poulenc Row:

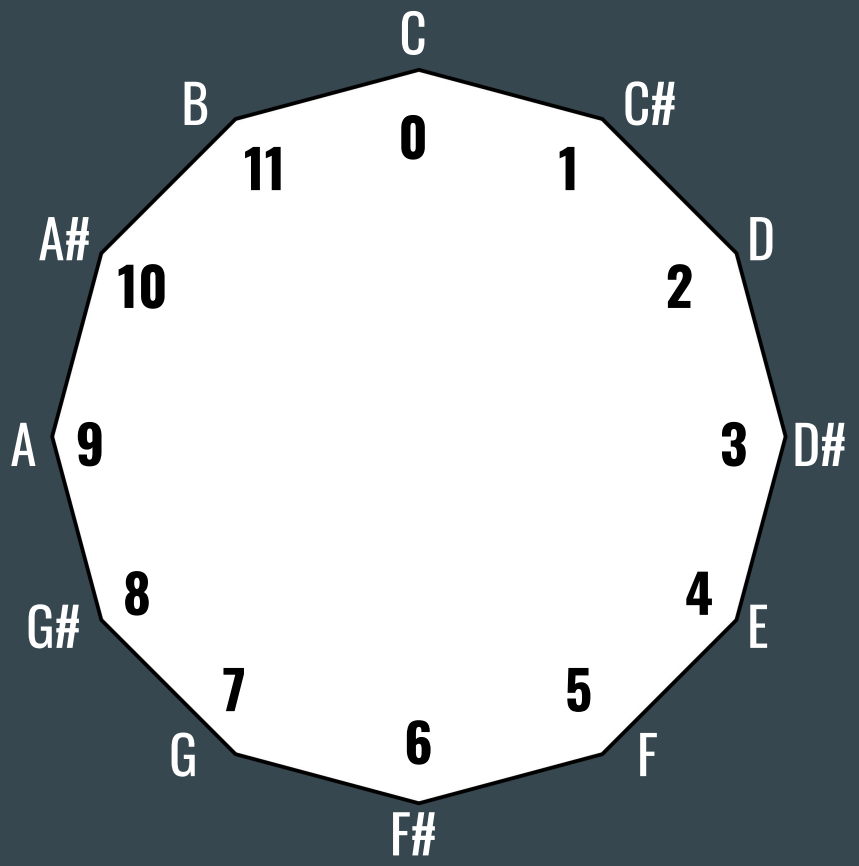
0 2 5 11 7 8 3 1 10 6 9 4

What is retrograde?



Poulenc Row:

0 2 5 11 7 8 3 1 10 6 9 4



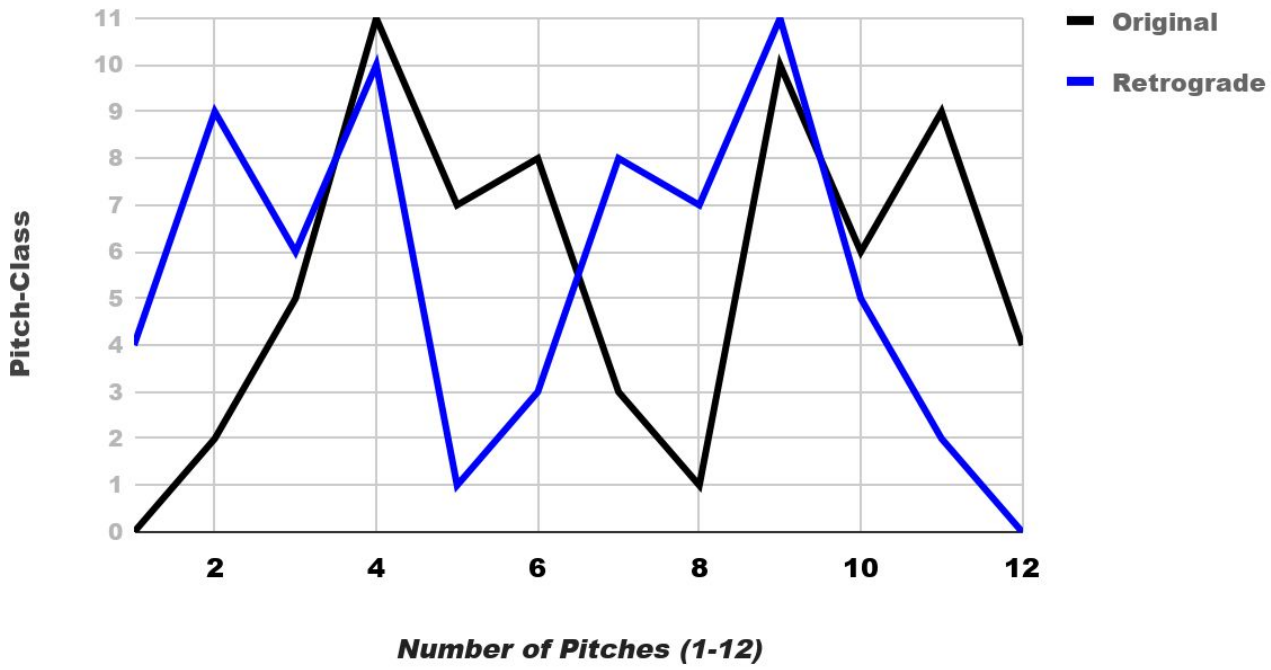
Poulenc Row:

0 2 5 11 7 8 3 1 10 6 9 4

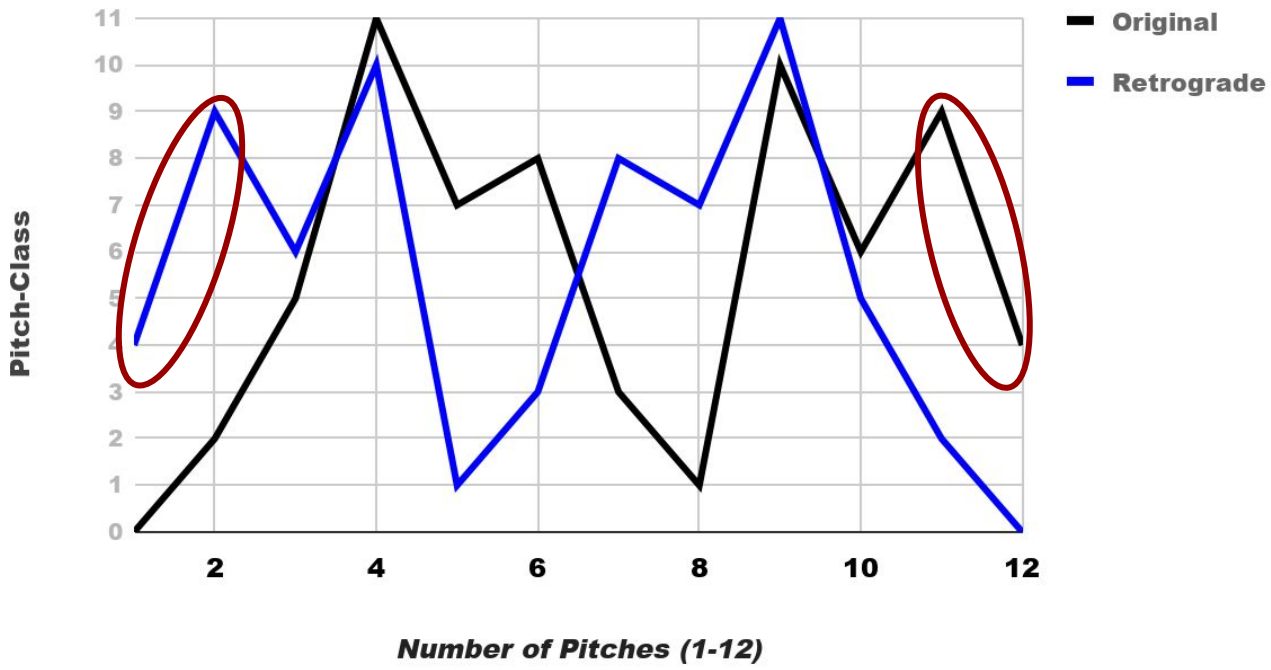
Retrograde:

4 9 6 10 1 3 8 7 11 5 2 0

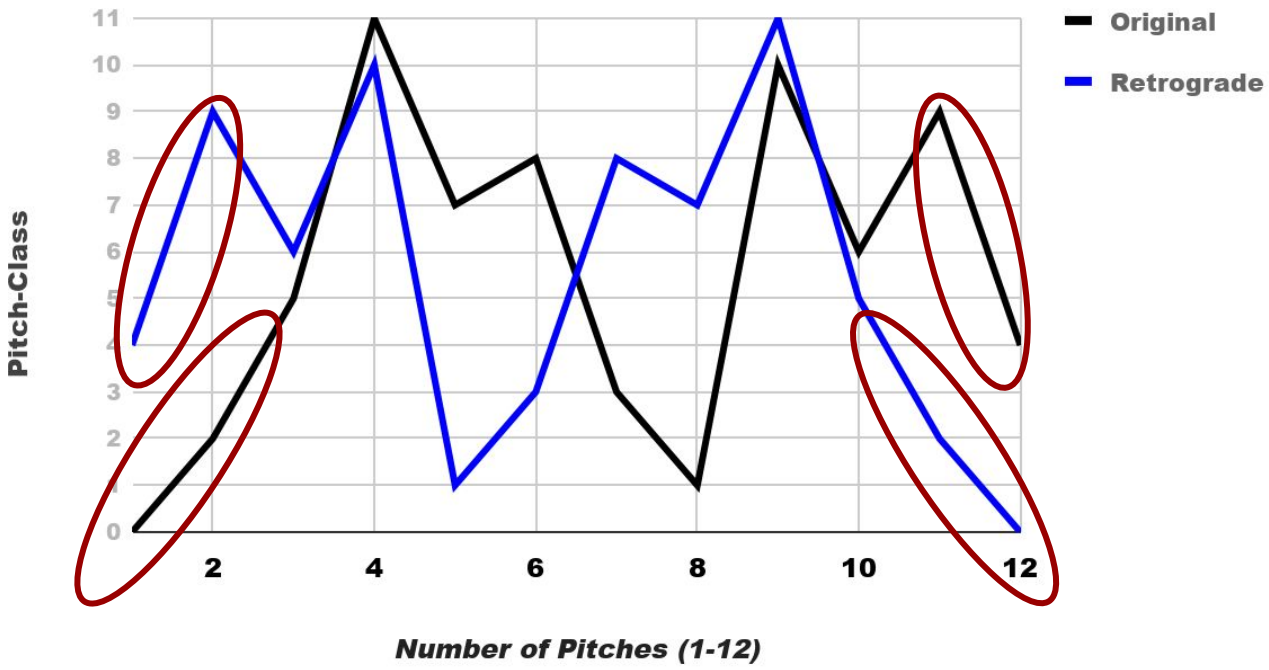
The Elegie Tone Row



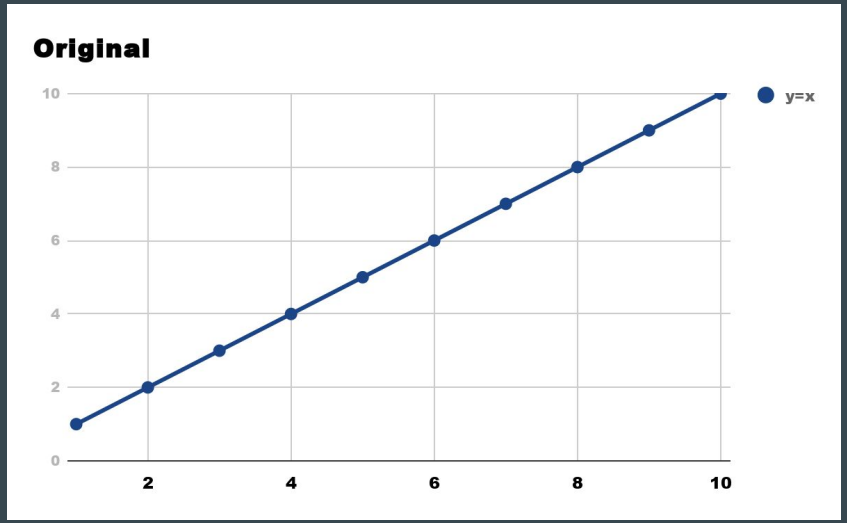
The Elegie Tone Row



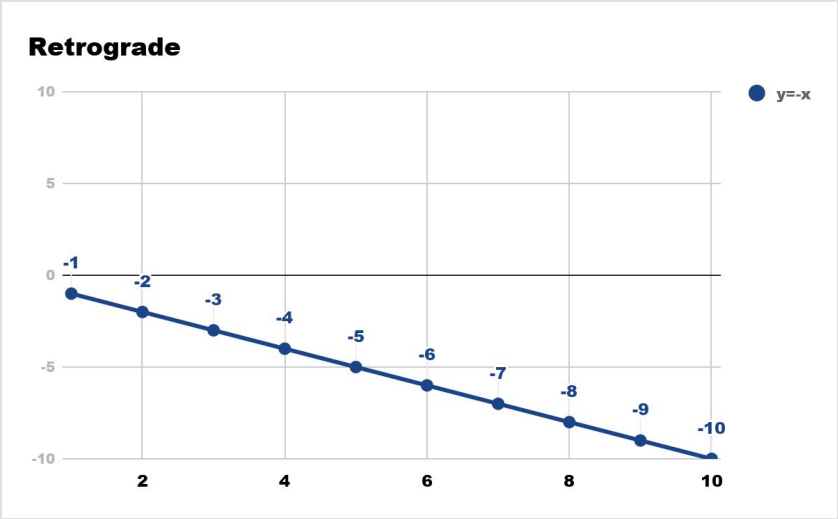
The Elegie Tone Row



y=x

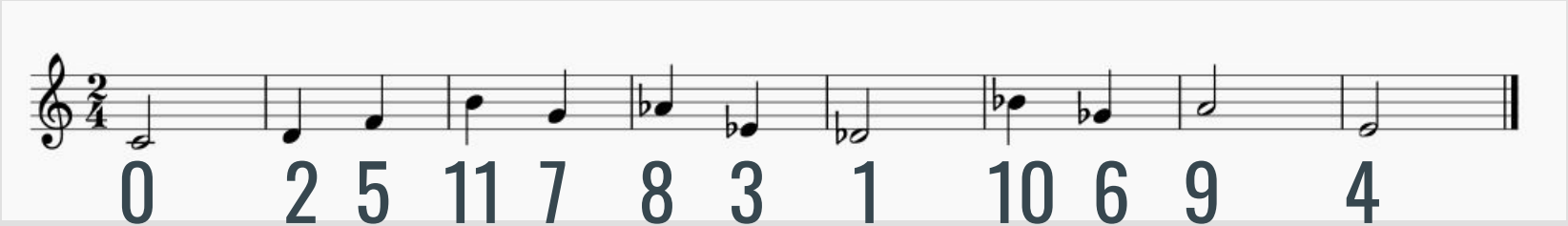

Original
y=x
10
8
6
4
2
0
2
4
6
8
10

y=-x


Retrograde
y=-x
10
5
0
-5
-10
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
2
4
6
8
10

Transposition / Transformation

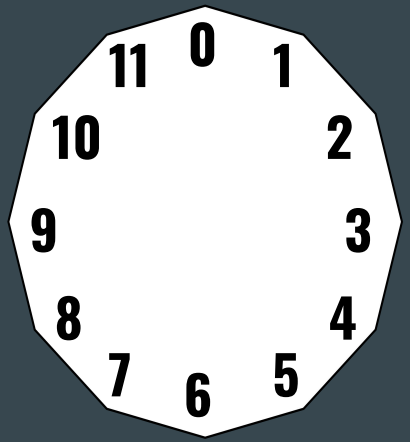
- Alters the starting pitch or number while maintaining the relationships between each number or pitch


0 2 5 11 7 8 3 1 10 6 9 4

Transposition / Transformation (by 3)

Original Tone Row		
0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon

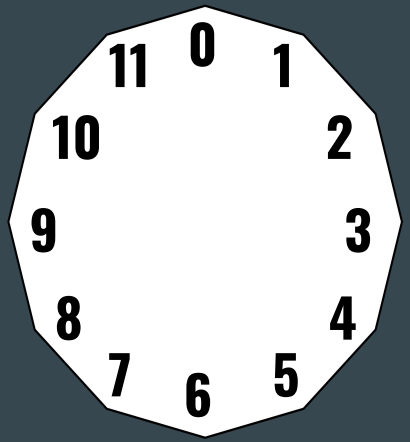


Transposed Tone Row

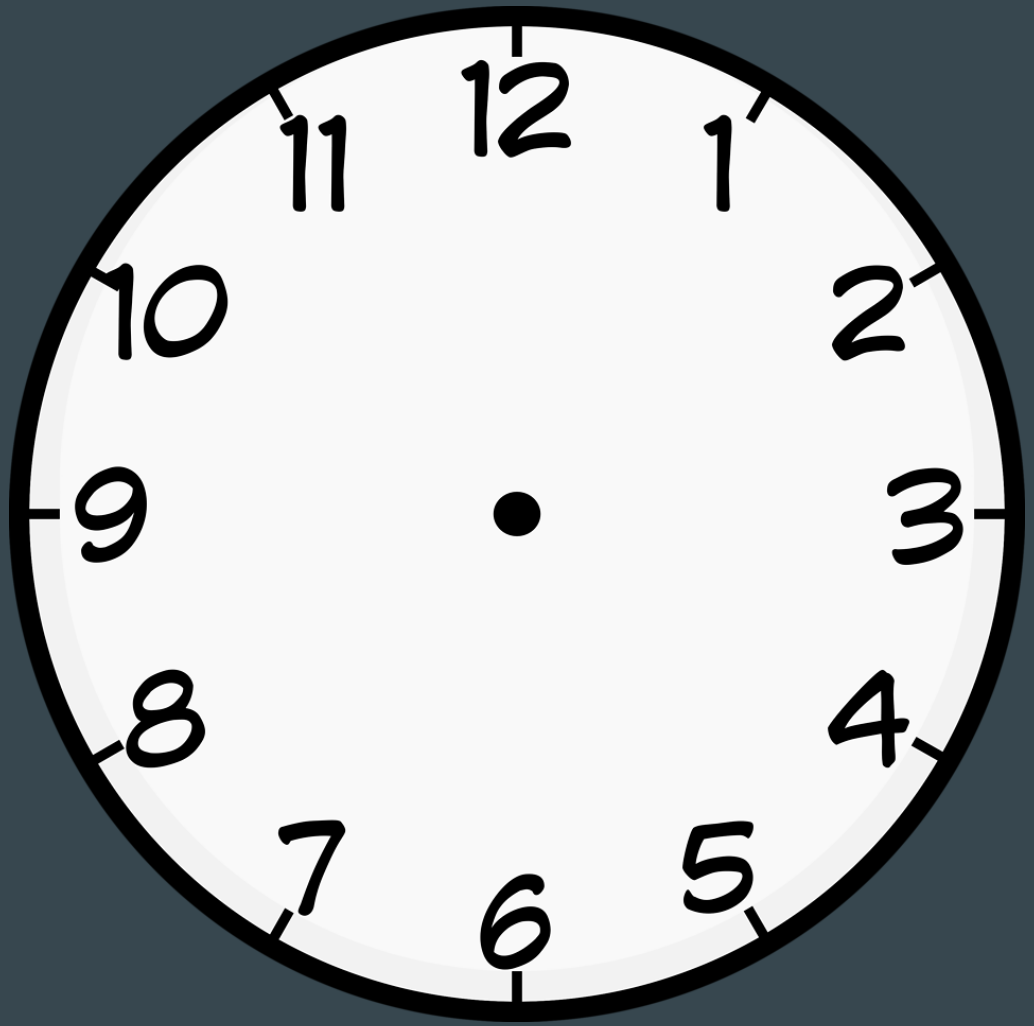
Transposition / Transformation (by 3)

Original Tone Row		
0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon



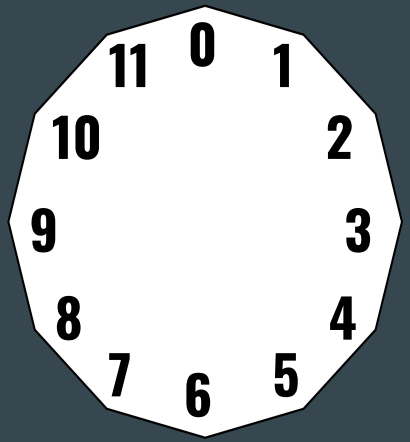
Transposed Tone Row		
3	5	8


12
1
2
3
4
5
6
7
8
9
10
11

Transposition / Transformation (by 3)

Original Tone Row		
0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon

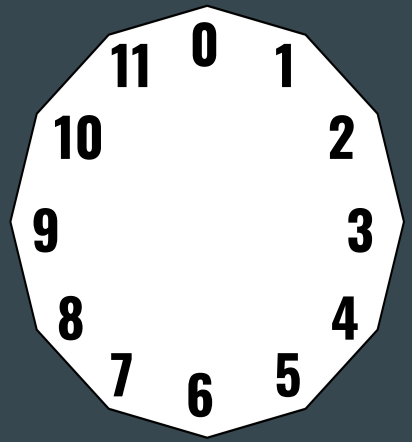


Transposed Tone Row		
3	5	8
2	10	11

Transposition / Transformation (by 3)

Original Tone Row		
0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon

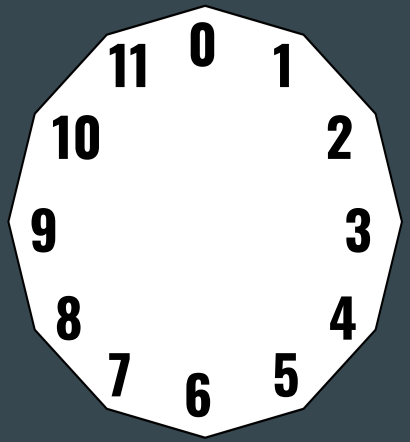


Transposed Tone Row		
3	5	8
2	10	11
6	4	1

Transposition / Transformation (by 3)

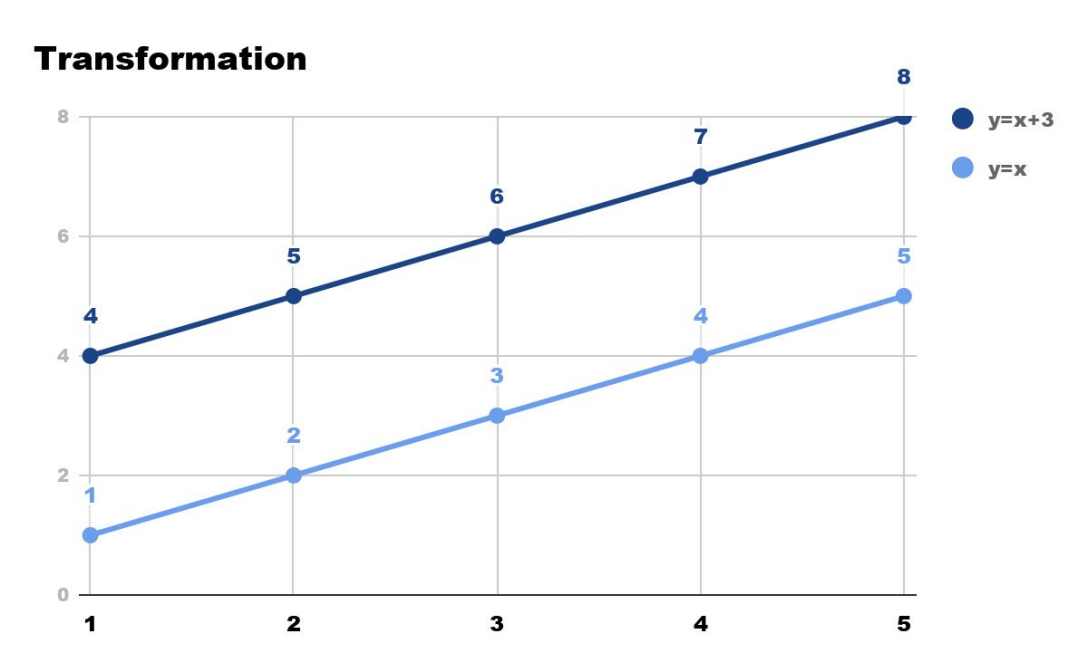
Original Tone Row		
0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon



Transposed Tone Row		
3	5	8
2	10	11
6	4	1
9	0	7

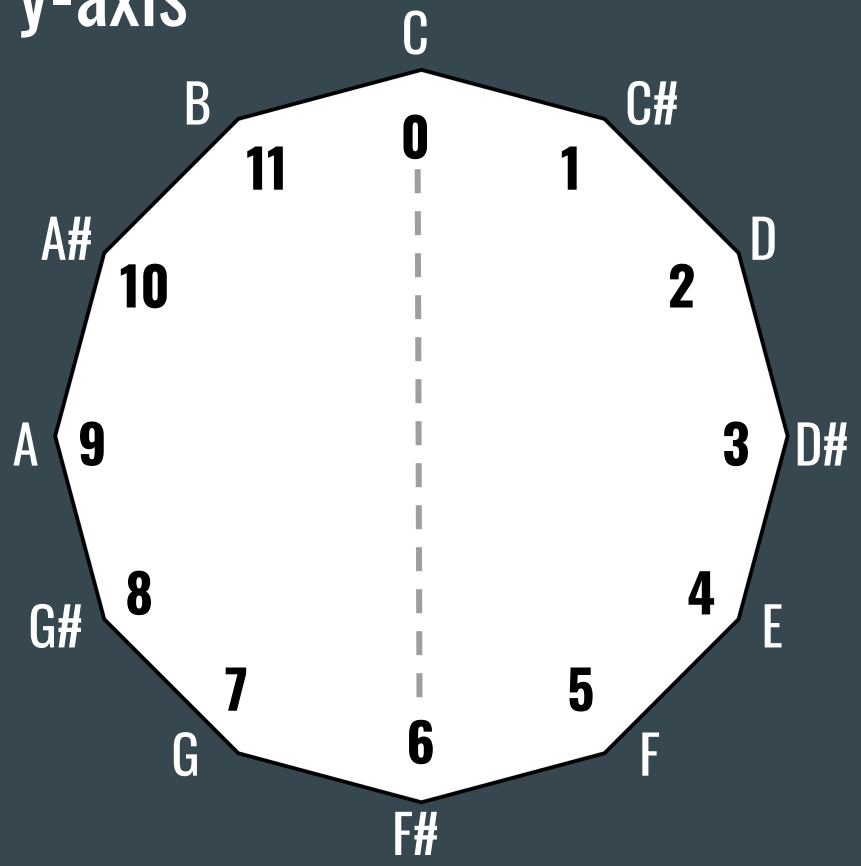
y=x+3



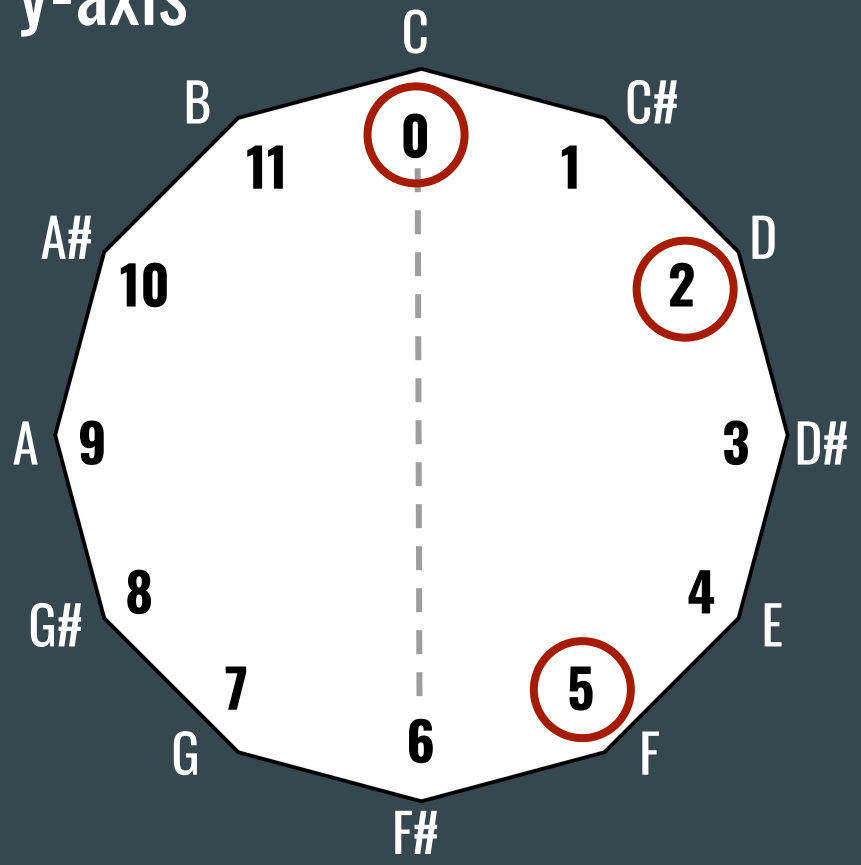
Inversion

- Maintaining the relationship between the pitches and reflecting over the “y-axis”

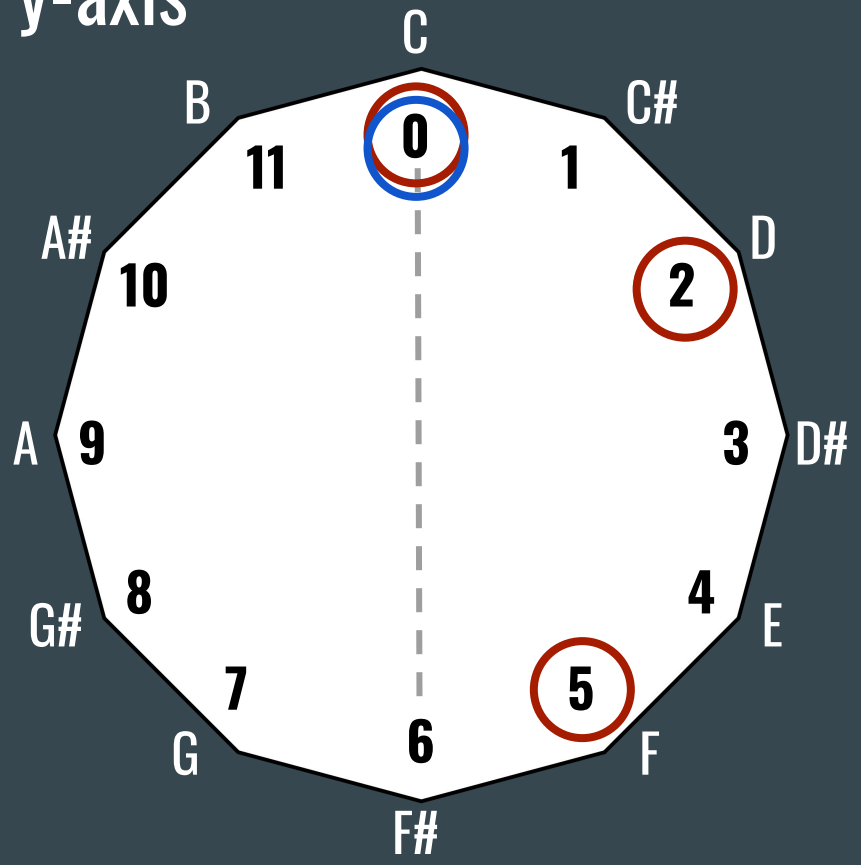
Reflection over “y-axis”



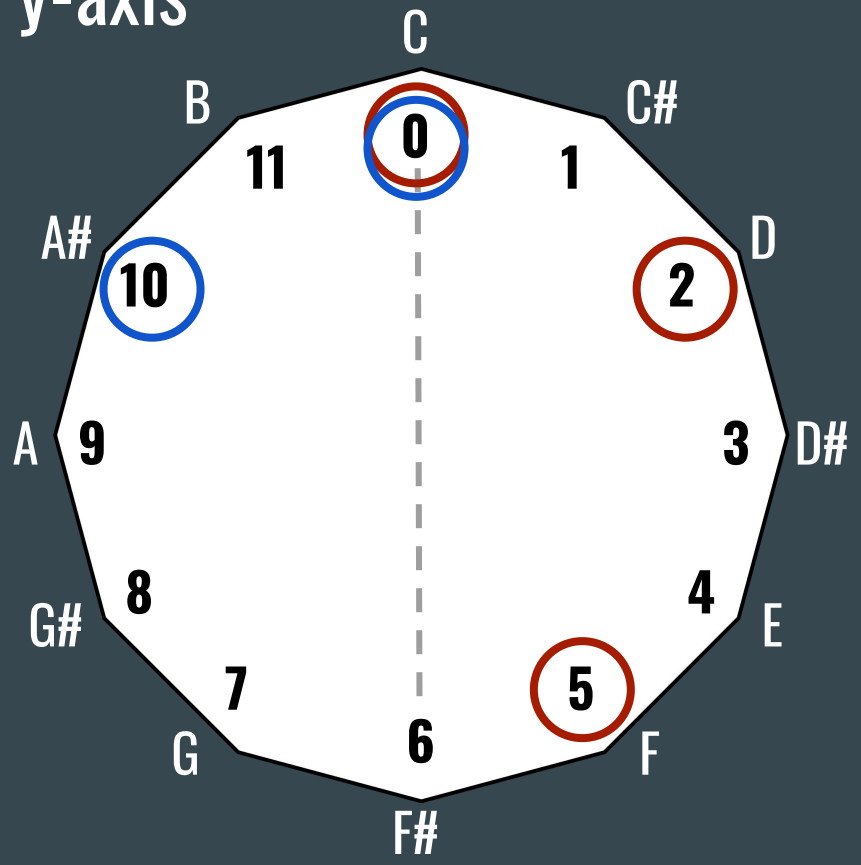
Reflection over “y-axis”



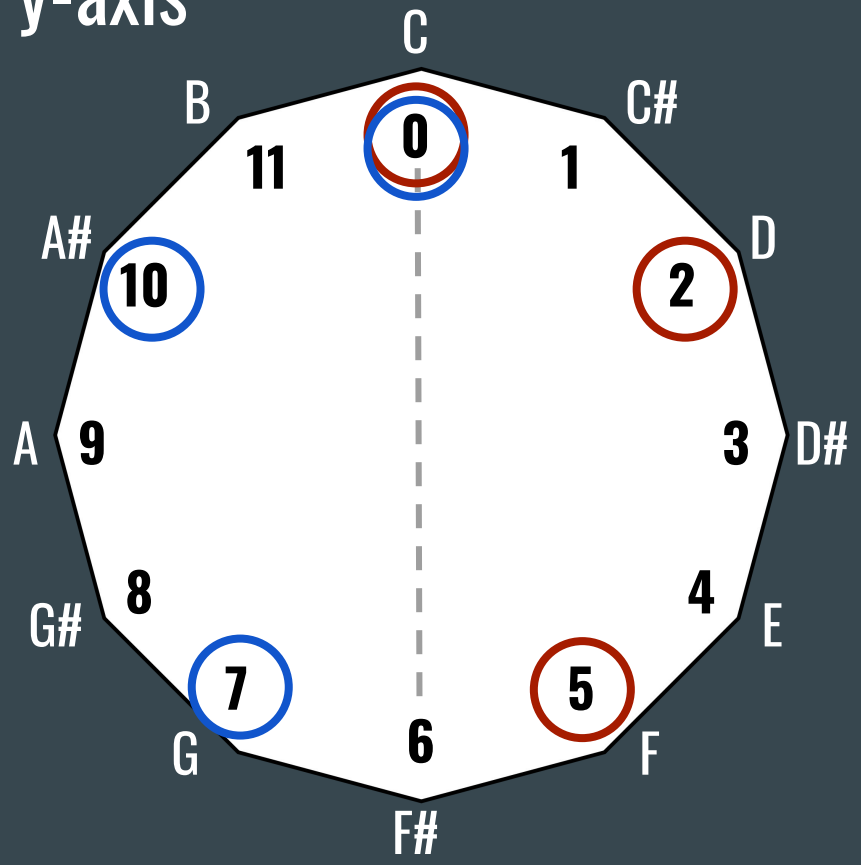
Reflection over “y-axis”



Reflection over “y-axis”



Reflection over “y-axis”

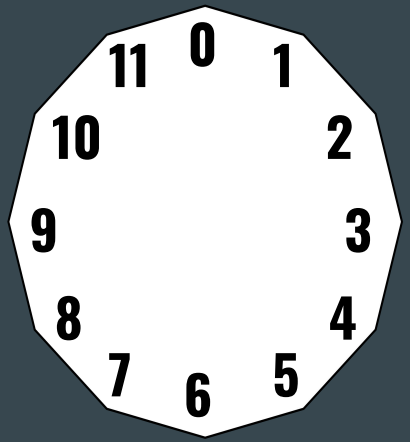


Inversion

Original Tone Row

0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon



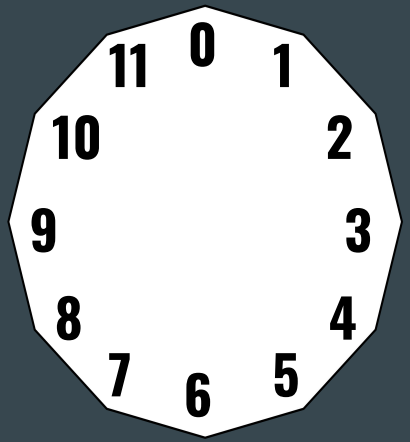
Inverted Row

Inversion

Original Tone Row

0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon



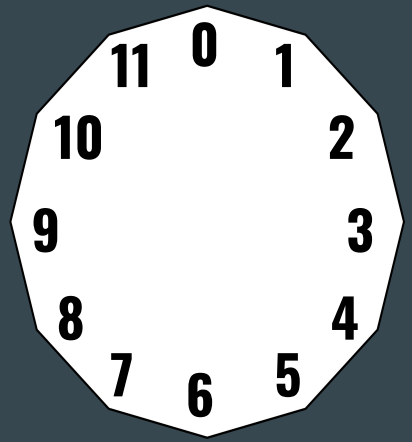
Inverted Row

0	10	7

Inversion

Original Tone Row		
0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon

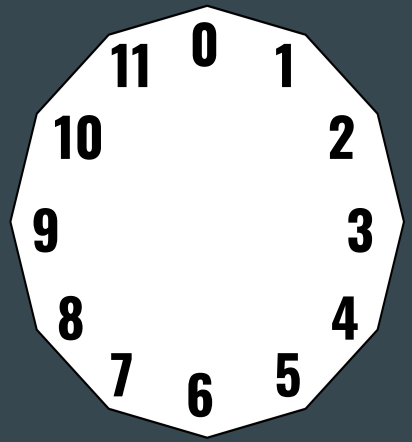


Inverted Row		
0	10	7
1	5	4

Inversion

Original Tone Row		
0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon

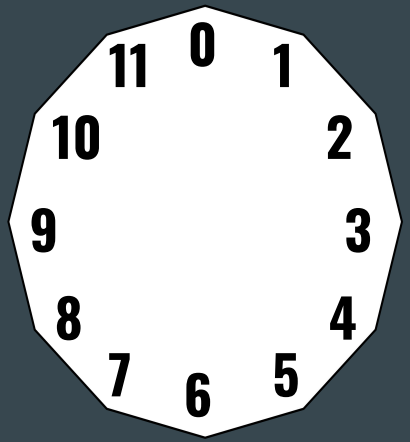


Inverted Row		
0	10	7
1	5	4
9	11	2

Inversion

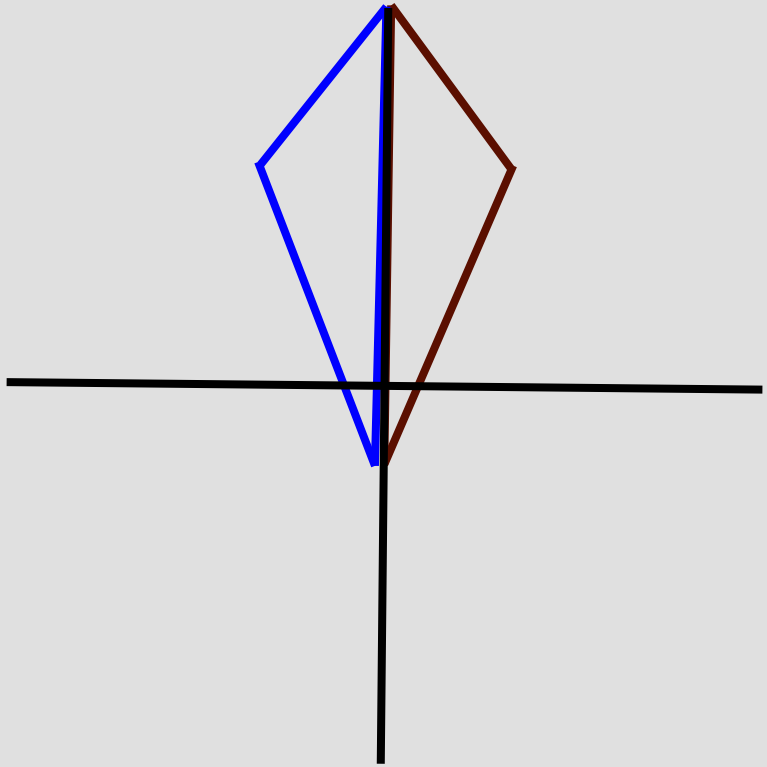
Original Tone Row		
0	2	5
11	7	8
3	1	10
6	9	4

Pitch Polygon

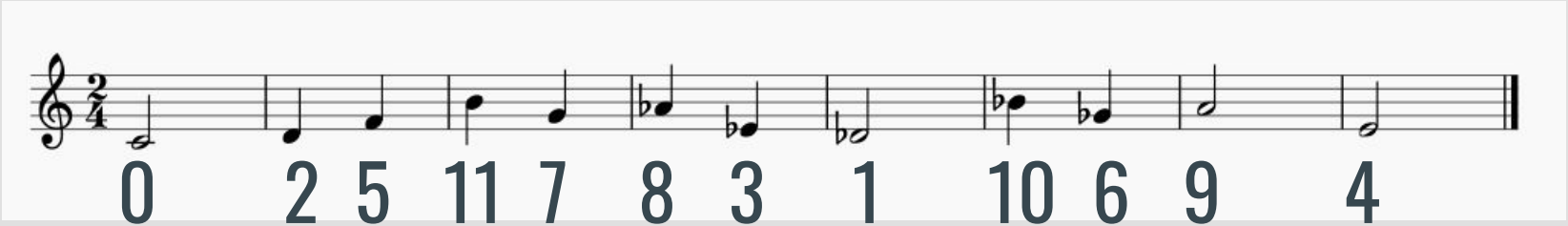


Inverted Row		
0	10	7
1	5	4
9	11	2
6	3	8

Reflection over y-axis



Polygon Assistant


0 2 5 11 7 8 3 1 10 6 9 4

How many tone rows did you hear?

Student Guesses

3

Student Guesses

3

6

Student Guesses

3

5

4

6

Student Guesses

11

3

5

4

6

Student Guesses

11

3

5

4

6

7

Student Guesses

11

3

5

4

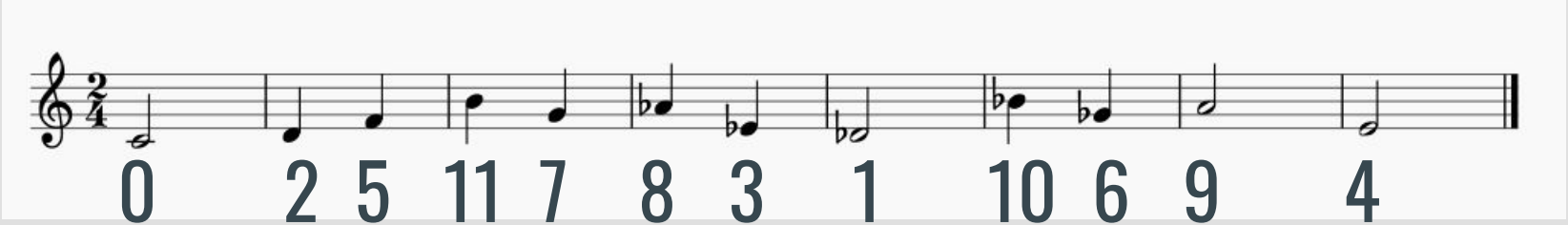
6

7

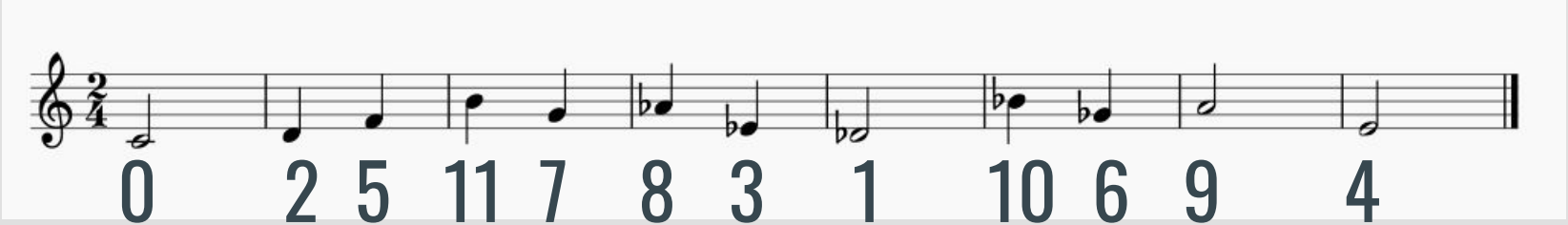
12

There were
TWO Tone Rows!!

Beginning of Piece (Solo Horn)
Row #1



Middle of Piece (Solo Piano)
Row #2



Thank you!!!

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