

# Teacher Tool 262: The Mathematics of Music

## Study Guide

Study Guide for Math 1: The Mathematics of Music

<b>Program Description and Objectives</b>	Page 2
<b>Program Format</b>	Page 2-3
<b>Standards</b>	Page 3-4
<b>Program-Related Activity Suggestions</b>	Page 4
<b>Vocabulary</b>	Page 4



## The Mathematics of Music

**Original Date: March 8, 2018**

**Grade Levels: 4-8**

### Program Description:

Even though mathematics and music, as well as mathematicians and musicians, are often put in separate, distinct categories, the reality of the matter is there is much overlap between the two. Musical pieces are read much like you would read math symbols. Both disciplines incorporate patterns, ratios, and proportions. Pythagoras realized that different sounds are produced when using different weights and vibrations. And research continues to reveal connections in the brain between the disciplines and indicators of success of those incorporating both disciplines in their thinking and creative processes.

In this program, we study some examples of the relationship between the two disciplines as we investigate the math within the measure. We invite you and your student to clap, tap, and sing along while exploring the musical concepts of beat, rhythm, notes, rests, and meter and examining the relationship between those concepts and mathematical concepts such as fractions, division, proportion, and ratios. Additional details on program content and order can be found in the Program Format section included later in this document. Materials related to activities highlighted in the program are referenced in the Pre-Program Activities section included later in this document and also available on our Educate.Today website.

**Find the Archived Program and Preparatory Materials At:** <https://educate.today/videos/4409>

### Program Objectives:

1. Students will engage in critical and creative thinking.
2. Students will identify, explain, and demonstrate their understanding of the musical concepts of beat, rhythm, notes, rest, meter, and measure.
3. Students will identify, explain, and demonstrate their understanding of the mathematical concepts of fraction, division, and measurement.
4. Students will build on their current understanding of, and develop new insights into the relationship between mathematics and music.

**Program Format:** The areas listed below are explored during the program. **Time codes are provided in blue to help locate specific segments in the program.**

**I. Welcome and Introductions**—Host Howard Shalowitz welcomes everyone to the program, provides program overview, and invites e-mail questions throughout the program. **(00:00 to 02:52)**

### II. Exploring the Mathematics of Music

**A. Part 1 with James McKay—Understanding Rhythm, Beat, and Notes (02:53 to 16:16)**

1. **Opening:** Mr. McKay introduces himself and begins the session by explaining beats and rhythms and how they are connected to math. This is what we call the “Mathematics of Music”

#### 2. Introduction:

- a. Turn on rhythm track and explain the difference between beat and rhythm.
- b. Model examples of a rhythm/ model for the students how to clap that rhythm and have them to repeat and clap it after me.

3. **Rhythm:** Explain how words have rhythms. We will say the words in time and have students repeat the words after me.

#### 4. **Expand Rhythm Concept:**

This section will consist of the following **Interactive Activity**: Have students share their name with those sitting around them. Ask students to identify a rhythm from the examples that closely relates with how their name sounds. Have them share their findings with others at their tables and with the Internet/VC/TV audience.

5. **Rhythm and Counting: Mr. McKay** demonstrates how to clap and count the rhythm and have students repeat the exercise.

6. **Music and Math Links**: We'll look at the different types of notes used to express rhythm and beat and transition to the next section where Ms. Vance will discuss fractions and make more comparisons between fractions and notes. Student questions dealing with the Mozart Effect and other topics are included.

#### B. **Part 2 with Alicia Vance—Comparing Notes and Fractions (16:17 to 26:41)**

Students help Ms. Vance present the following concepts. At the end of the segment other music concepts related to the mathematical concepts of fractions, ratio, and proportion are highlighted as well..

1. What is a Fraction?
2. What is a Whole Number?
3. What is  $\frac{1}{2}$ ?
4. What is  $\frac{1}{4}$ ?
5. What is  $\frac{1}{8}$ ?

#### C. **Part 3 with Sherry Jones—Making Music from the Notes and Fractions (26:42 to 36:54)**

Miss Jones summarizes concepts and also introduces us to the bell choir captain who leads the Jennings Junior High Bell Choir in performances. We see the bell choir perform and also engage in summary activities dealing with reading music, counting rhythm, and relating both to mathematics.

**III. Summary and Closing**—Host Howard Shalowitz summarizes major concepts (36:55 to 40:40) learned in the program, thanks guests, schools, and audience, and closes the program.

#### **Featured National Standards:**

The following **Common Core Standards for English/Language Arts and Literacy in History/Social Studies, Science and Technical Subjects** are referenced in this program:

#### **Grades 3-6 College and Career Readiness Anchor Standards for Reading**

7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

#### **Grades 3-6 College and Career Readiness Anchor Standards for Writing**

6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

#### **Grades 3-6 College and Career Readiness Anchor Standards for Speaking and Listening**

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

**The following Common Core Standards for Mathematics** are referenced in this program:

1. Develop understanding of fractions as numbers
2. Extend understanding of fraction equivalence and ordering
3. Build fractions from unit fractions
4. Apply and extend previous understandings of multiplication and division
5. Understand ratio concepts and use ratio reasoning to solve problems.
6. Analyze proportional relationships and use them to solve real-world and mathematical problems.

**The following National Standards for Music Education** are referenced in this program:

Content Standard 4: Composing and arranging music within specified guidelines

Content Standard 5: Reading and notating music

Content Standard 8: Understanding relationships between music, the other arts, and disciplines outside the arts

**Program-Related Activity Suggestions:** The activities below are designed to give your students the opportunity to extend their understanding of concepts explored in the program. They incorporate the following handouts that are available on our Educate.Today website at <https://educate.today/videos/4409>.

**Handouts:**

Fractions of Notes

Notes 1

Notes 2

Pie and Measure

Pie Pieces

**1. Create Your Own Fraction Equations:** Using any of the pie and pie pieces manipulatives, have students create their own fraction equations at random. To do this, copy and cut apart multiple copies of each fraction/pie piece. Place those pieces in a bag or box for students to draw from. In addition, take another piece of paper and cut it into fourths. On each fourth put one of the following equation symbols: addition, subtraction, division, and multiplication. Depending on the grade level of your students, use the equation symbols that apply to the level of math you are teaching. Have students, working individually, in small groups, or as a whole class, draw an equation symbol from a separate bag or box. Then have students pull any number of fraction pie pieces that you would like them to put into the type of equation fitting the symbol they drew. Have students calculate the equation created and continue repeating as you wish.

**2. Create Your Own Musical Measures:** Using any of the notes and measures manipulatives, have students create their own musical measures to clap and sing. To do this, copy and cut apart multiple copies of each note and measure piece. Place those pieces in a bag or box for students to draw from. Have students, working individually, in small groups, or as a whole class, draw notes from the bag. Have them place their notes on the measure piece or another measure of their own. Have students share their musical composition with each other and have students clap or sing out the rhythm and beat of each.

**3. Define Your Terms:** Have students create a sentence of their own correctly using each of the vocabulary words below.

**Vocabulary:**

The following terms and their definitions are highlighted in the program.

Beat, Fraction, Measure, Meter, Note, Proportion, Ratio, Rest, Rhythm