

## National Standards

### MUSIC

**Standard 3:** Improvising melodies, variations, and accompaniments

**Standard 5:** Reading and notating music

**Standard 6:** Listening to, analyzing, and describing music

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

### Technology Extension

Students may experience different types of percussion instruments and perform the canon online from the San Francisco Symphony at <http://www.sfskids.org/perform/>.

When the student groups are created, they may record their body percussion piece for playback with the group. Web 2.0 software can be used to combine the groups into different arrangements or combinations. Web 2.0 software to use for recording is Audacity <http://sourceforge.net/projects/audacity/>

The finished pieces can be posted online through:

**SoundCloud** <https://soundcloud.com/>

**VoiceThread** <http://voicethread.com/>

**Podbean** <http://www.podbean.com/>

Idea Contributed by Emily Threlkeld  
Technology by Ramsey Ray

2014 - 2015 © ArtsNOW  
100 Edgewood Ave, Suite 100  
Atlanta, GA 30303  
Phone: 404.688.2480  
Fax: 404.688.2424  
[www.artsnowlearning.org](http://www.artsnowlearning.org)

**ArtsNow**<sup>®</sup>  
Teaching and Learning Across the Curriculum

Curriculum guides provide differentiated ideas and activities aligned to a sampling of standards. The guides do not necessarily imply mastery of standards, but are intended to inspire and equip educators.

Form/Structure/Organization • Relationships • Patterns •  
Musical Notation • Rhythm • Probability



Explore rhythms, their notations and their sounds  
in relation to math!

## The Sound of Numbers

Using rhythmic experiences in music, the students will explore numbers and their relationships. Every aspect of music can be described mathematically. An understanding of patterns, the ability to develop operations, reveal functions, and being able to move toward higher levels of abstractions, can be strengthened through parallel music study. Dividing beats and meters, patterns, starting the same patterns at different times to create canons, and developing operations will be explored in this lesson.

**Essential Question: What do numbers sound like “out loud”? How can we use sound and experience to deepen our mathematical experience? How can we use rhythms to illustrate probability?**

### Process

- Lead the class in a brief discussion about rhythm in music and how the division of beats and the organization and grouping of rhythms in music is mathematical.
- Start a demonstration of such divisions and organization with a four-level rhythmic canon.
- Teach a four phrase using body percussion, with each phrase being comprised of eight beats.
  - 1<sup>st</sup> phrase – sixteen eighth notes (snapping)
  - 2<sup>nd</sup> phrase – eight quarter notes (clapping)
  - 3<sup>rd</sup> phrase – thirty two sixteenth notes (patting)
  - 4<sup>th</sup> phrase – four half notes (stamping)
- Model for the students the traditional notation, by having it written out, or with manipulatives such as Knot Knacks®.
- Repeat as with each phrase being comprised of four beats, and then two beats.
  - 1<sup>st</sup> phrase – eight, eighth notes (four eighth notes)
  - 2<sup>nd</sup> phrase – four quarter notes (two quarter notes)
  - 3<sup>rd</sup> phrase – sixteen, sixteenth notes (eight eighth notes)
  - 4<sup>th</sup> phrase – two half notes (one half note)
- Explore performing each pattern as a canon.
- Divide the class into four groups, one for each level of body percussion. Arrange them in order. Assign each level an instrument and have them perform as a layering of the rhythms.

### Probability Lesson

- Have students work in pairs. Each pair will share a large piece of paper (11 ½ x14) that is folded in half horizontally. With the paper open, each student will write a different rhythm on their side of the paper. They will have a choice of writing a quarter note, a set of eighth notes, a set of sixteenth notes or a quarter note rest.
- Explain that the students will use their finished products to create patterns that will be played to accompany music.
- Take up the papers and randomly select four of them to place on four chairs which have been placed at the front of the room. (Because they have been folded horizontally, they will sit nicely on the back of the chairs.)
- Use a pointer (a conductor’s wand works nicely) and review the length of the different symbols. The four beats are represented by the four chairs.
- Discuss the division of the beat. The beat never changes, but the length of the sounds within each beat does. The beat is constant, but the rhythm can change. Discuss the presence of fractions in music. Explain that the four chairs represent 4 beats in 4/4 meter.
- Turn on a music selection and have the students chant the rhythm represented by the patterns, then add body percussion, and finally add rhythm instruments. (Anything with strong rhythm works, such as *Sock Him In The Jaw* from the *Miss Pettigrew Lives For A Day* soundtrack.)
- After a few repetitions of the pattern, randomly turn one of the folded papers around, so that the pattern changes.
- Conclude with a discussion of the differences and similarities in the patterns performed.

### Materials

- 11 ½ x 14 paper (one sheet per pair of students)
- markers
- iPod docking station
- iPod
- music selection
- pointer (conductor’s wand)
- rhythm instruments
- four chairs
- paper and pencils for working the challenges and creating charts

### Vocabulary

#### Canon

Piece of music where one voice repeats the part of another, throughout the whole piece

#### Phrase

A single line of music played or sung. A musical sentence.

#### Measure

The unit of measure where the beats on the lines of the staff are divided up into two, three, four beats to a measure. Also called a bar.

#### Beat

A unit of measurement in rhythmic time

#### Rhythm

Combinations of long and short, or even or uneven sounds that establish a musical continuum and convey a sense of movement

#### Note Value

The relative duration of a musical note

#### Half Note

A note having the time value of two quarter notes or half of a whole note, represented by a ring with a stem

#### Quarter Note

A musical note having the time value of a quarter of a whole note or half a half note

#### Quarter Note Rest

A rest or break from playing for the duration of a quarter note

#### Eighth Note

A note having the time value of an eighth of a whole note or half a quarter note, represented by a large dot with a hooked stem

#### Sixteenth Note

A note having the time value of a sixteenth of a whole note or half an eighth note, represented by a large dot with a two-hooked stem

- The students will work together in groups of five to complete the following probability challenge. Distribute four of the completed papers to each of the groups. The rhythms written on their papers will determine which rhythms they use in their problem.
  - (Sixth Grade Challenge)** - Of the eight notes on the students’ papers, there are three quarter rests, one quarter note, two eighth notes, and two sixteenth notes. Count and record the number of times that Sally turns over a quarter rest if she does so at the beginning of every phrase (a phrase is a set of eight beats). Count and record the number of times she turns over a set of sixteenth notes, etc. if she does so at the beginning of every phrase.
  - (Seventh Grade Challenge)** - Of the eight notes on the students’ papers, there are three quarter rests, one quarter note, two eighth notes, and two sixteenth notes. If Sally had the notes on the chairs and she was going to flip one of the notes over to change the pattern, what is the probability that she was going to turn over a quarter rest?
    - Have the students create organized lists, tables, or tree diagrams to organize their results.
  - (Eighth Grade Challenge)** - Of the eight notes on the students’ papers, there are three quarter rests, one quarter note, two eighth notes, and two sixteenth notes. If Sally had the notes on the chairs and she was going to flip one of the notes over to change the pattern, what is the probability that she was going to turn over a quarter rest?
    - Have two groups of five work together to compare their results and construct scatter plots of comparing their outcomes. Have the students share their plots with the class and discuss any noticeable patterns.

### Assessment

The students will share results their respective charts with the class. As an extension, the students can perform the piece with one of the students being responsible for counting the number of times a quarter note or a quarter rest has been turned over. This will work more easily if the student can only turn over each paper one time, and the only the first eight phrases of the music are used.

## Common Core Georgia Performance Standards

### MATHEMATICS

#### GRADE 6

**MCC6.SP.1:** Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question because one anticipates variability in students’ ages*

**MCC6.SP.5:** Summarize numerical data sets in relation to their context, such as by:

a. reporting the number of observations.

b. describing the nature of the attribute under investigation, including how it was measured and its units of measurement

#### GRADE 7

**MCC7.SP.7:** Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy

**MCC7.SP.7a:** Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected*

**MCC7.SP.7b:** Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*

**MCC7.SP.8:** Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation

**MCC7.SP.8a:** Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs

**MCC7.SP.8b:** Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event

#### GRADE 8

**MCC8.SP.1:** Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association

## Georgia Performance Standards

### MUSIC

#### GRADE 6

**M6GM.2:** Performing on instruments, alone and with others, a varied repertoire of music

**M6GM.3:** Reading and notating music

**M6GM.5:** Composing and arranging music within specified guidelines

**M6GM.8:** Understanding relationships between music, the other arts, and disciplines outside the arts

#### GRADE 7

**M7GM.2:** Performing on instruments, alone and with others, a varied repertoire of music

**M7GM.3:** Reading and notating music

**M7GM.5:** Composing and arranging music within specified guidelines

**M7GM.8:** Understanding relationships between music, the other arts, and disciplines outside the arts

#### GRADE 8

**M8GM.2:** Performing on instruments, alone and with others, a varied repertoire of music

**M8GM.3:** Reading and notating music

**M8GM.5:** Composing and arranging music within specified guidelines

**M8GM.8:** Understanding relationships between music, the other arts, and disciplines outside the arts