

Made in the Shade:

Musical Mathematics

Educational Guide, Grades K-3



About the Performance

Who knew math could be so much fun?! Dan and Crick demonstrate how the magic of music is made possible through measurement, sets, geometry, addition, subtraction, multiplication, and division, by playing stirring musical snippets and then guiding students in breaking them down into their components. Students learn about note value and meter and collectively try their hands at conducting, and composing a new piece of music using measures, sets, and notes.



About the Artists

Made in the Shade is an acoustic quartet that entertains audiences worldwide with the exuberant spirit of jazz. Its unique blend of New Orleans jazz, swing, ethnic and original music delights listeners and dancers of all ages. This acclaimed ensemble is comprised of bandleader Dan Fox on trombone, Mike Peipman on trumpet, Crick Diefendorf on banjo and John McLellan on drums. The ensemble was formed in 1990 when a group of music school graduates decided to play on the Boston Common in celebration of our nation's birthday. Since then Made in the Shade has performed at numerous festivals, concerts, schools, radio and television shows and many other social functions throughout the United States and Europe.

Program Learning Goals

1. To practice math skills through the medium of music.
2. To demonstrate the mathematical organization of music using terms like measures, beats, and tempo.
3. To explore composition through set theory.

Essential Questions

1. How are math concepts used in music?
2. How is music measured?
3. How can we use music and math to be creative?

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Vocabulary

- **Beat:** the steady pulse of a song or piece of music
- **Measure:** a set group of beats, also known as a “bar”
- **Meter:** the number of beats per measure, also known as a “time signature”
- **Rhythm:** a strong pattern of notes or beats in music
- **Tempo:** the speed of a song or piece of music
- **Pattern:** a piece of visual or audio information that repeats

Key Facts and Context for Students

Music as Counting

The beats of a song can be organized into groups. In a piece of music, these groups are put into boxes, or measures. The meter, or the numbers at the start of the line, shows how to count these groups. The circled number is how many beats to count in each measure.

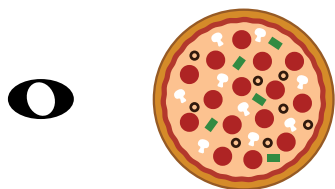


Music as Patterns

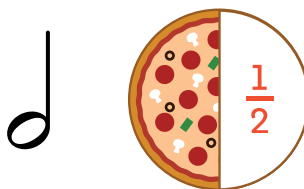
There are many patterns to be found within music. Songs often have repeated rhythms, notes, words, and structures that make it memorable. This can be heard in common children’s songs such as “The Wheels on the Bus,” “Go Tell Aunt Rhody,” “Old MacDonald Had a Farm,” and many more!

Music as Fractions

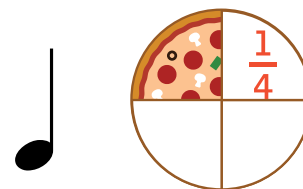
A measure of music can be divided into fractions. Different types of music notes symbolize how many beats, or what fraction of a measure the note takes up.



A **whole note** takes up a whole measure, just a like a whole pizza takes up a whole pan.



A **half note** takes up half of a measure, just a like a half of a pizza takes up half of a pan.



A **quarter note** takes up a quarter of a measure, just a like a quarter of a pizza takes up a quarter of a pan.

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Pre-Performance Discussion Questions

- What do you know about music and rhythm? What would you like to know?
- How can you count along to music?
- Why does music make you want to dance?

Pre-Performance Activity: Moving to a Musical Beat

Learning Goal:

To explore counting and understanding different beat groupings in music.

Materials:

Audio recordings of marches, such as:

- “The Imperial March” from *Star Wars* (by John Williams)
- “Stars and Stripes Forever” by John Philip Sousa
- “March of the Toy Soldiers” by Pyotr Tchaikovsky

Audio recordings of waltzes, such as:

- “Waltz No. 2” by Dimitri Shostakovich
- “Voices of Spring” by Johann Strauss
- “Mississippi Waltz” by Bill Monroe

Speakers/equipment to play audio recordings



Directions:

1. Discuss the beat in music. Explain that there is a steady pulse in all of the musical examples being used in this activity. Play the different examples and practice clapping along to the beat.
2. Talk about marching. Practice marching around the room while calling “left, right, left, right”. Then practice marching while repeatedly counting out loud “1, 2, 3, 4”. Play the march recordings and march while counting to the beat.
3. Talk about music and dancing. Explain that there is a special dance called a waltz where you have to be good at counting to three. Practice the waltz step. First, sway to the left and take three steps, then sway to the right and take three steps. Repeat these steps while calling “boom cha cha” where the “boom” falls with the sway. Then practice the steps while repeatedly counting out loud “1, 2, 3”. Play the waltz examples and waltz while counting to the beat.
4. Once students are confident with both marching and waltzing, play the recordings in a random order and have them decide whether each is a waltz or a march by counting the beats and moving to the music. See how many students can get on their own!

Pre-Performance Activity Extensions

- Ask students to pick their favorite songs. Play them for the class and practice clapping to the beat. Can you figure out how many beats are in each musical grouping? (For most songs, it will either be three or four beats per grouping.)
- Sing common children's songs and search for patterns. Do certain words repeat? Does the melody go up or down several times in a row? Can you make groups of three or four beats in the song?
- Play different kinds of music and practice clapping and dancing to the beat. Discuss how your dancing naturally changes depending on the speed, mood, and rhythmic groupings of each piece of music.



Post-Performance Discussion Questions

- What did you learn about music? What did you learn about math? How do they connect to each other?
- What instruments were used in the performance? How were they played?
- What was your favorite part of the performance? Why?



Post-Performance Activity: Making Rhythms

Learning Goal:

- To explore different rhythmic values
- To create and perform rhythms
- To explore the connection between rhythm and fractions

Materials:

Making Rhythms Worksheet (see page 6), Rhythms for Making Rhythms Worksheet (see page 7), scissors



Directions:

1. Discuss what students learned in the performance about rhythms and counting.
2. Introduce the different rhythms in this activity:
 - **Whole note:** takes up a whole measure, clap once and count 1-2-3-4 for each.
 - **Half note:** takes up half a measure, clap once and count 1-2 for each.
 - **Quarter note:** takes up a quarter of a measure, clap once and count 1 for each.
3. Practice clapping and counting each rhythm with the class.
4. Pass out the worksheets (one set for each student, or one set per small group). Explain to students that each box on worksheet is called a “measure” and can be filled with the rhythms that they practiced clapping.
5. Cut out the rhythms on the “Rhythms for Making Rhythms Worksheet” with scissors.
6. Experiment with placing the rhythms into the measures. Note that only rhythms totaling four beats will fit into one measure (i.e. one whole note, two half notes, four quarter notes, or one half notes and two quarter notes).
7. Practice clapping and counting the rhythms that students make up. How many different combinations can you come up with?

Post-Performance Activity Extensions

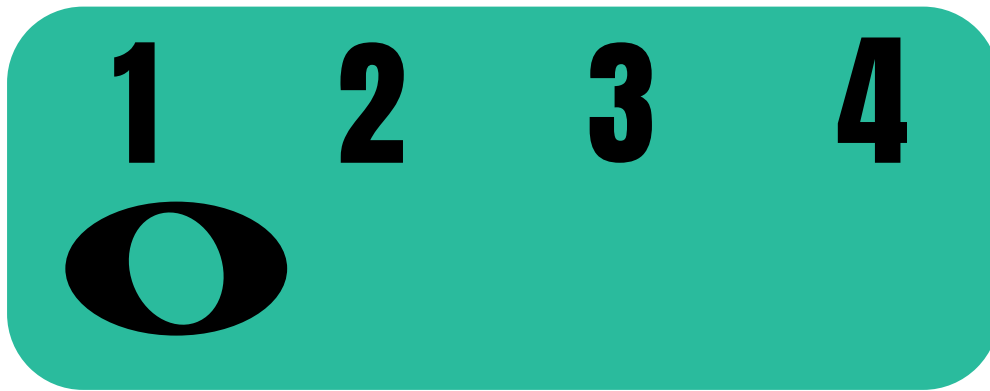
- Split the group in half and give each group a different rhythm to clap/count (i.e. one group claps/counts a whole note and the other group claps/counts half notes). Have each group practice their rhythm alone, and then perform them together at the same time. Switch rhythms to see how it feels the other way. How does it feel to perform a rhythm while hearing a different one at the same time? Does it get easier with practice?
- Write a review of Made in the Shade's performance. What did you enjoy? What did you learn about music, math, and how they are connected?

Making Rhythms Worksheet

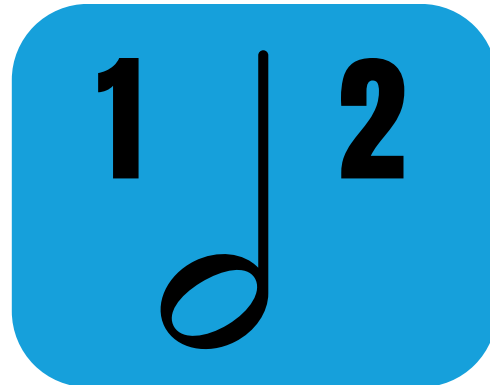
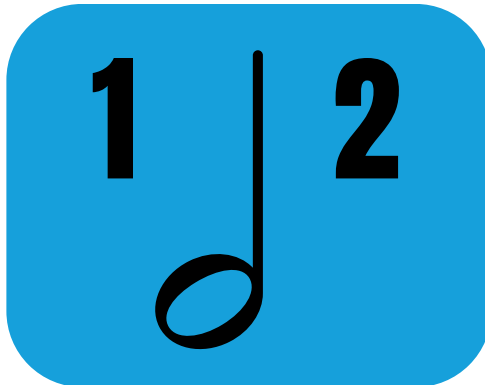
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Rhythms for Making Rhythms Worksheet

Whole note: takes up a whole measure, clap once and count 1-2-3-4 for each.



Half notes: takes up half a measure, clap once and count 1-2 for each.



Quarter notes: takes up a quarter of a measure, clap once and count 1 for each.



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Further Resources

- [Connections: Math & Music, by The Kennedy Center](#)
- [Math + Science + Music, by the Herbie Hancock Institute of Jazz](#)
- [Music and Math Resources, by PBS Learning Media](#)
- Bonilla, Lindsay: *The Note Who Faced the Music*, Page Street Kids (2023)
- Elizabeth, Jordannah: *A Child's Introduction to Hip-Hop: the Beats, Rhymes, and Roots of a Musical Revolution*, Sourcebooks Explore (2008)
- Morland, Charlie: *Music and How it Works: The Complete Guide for Kids*, DK Children (2020)
- Terry, Keith and Linda Akiyama: *Rhythm of Math: Teaching Mathematics with Body Music: a Kinesthetic Approach*, Crosspulse Media (2015)
- Woo, Eddie: *It's a Numberful World: How Math Is Hiding Everywhere—from the Crown of a Tree to the Sound of a Sine Wave*, The Experiment; Illustrated edition (2019)



Curricular Connections

Arts Standards: Music

Creating

- Generate and conceptualize artistic ideas and work. (M.Cr.01)
- Organize and develop artistic ideas and work. (M.Cr.02)

Performing

- Convey meaning through the presentation of artistic work. (M.P.06)

Responding

- Perceive and analyze artistic work. (M.R.07)
- Interpret intent and meaning in artistic work. (M.R.08)
- Apply criteria to evaluate artistic work. (M.R.09)

Connecting

- Synthesize and relate knowledge and personal experiences to make art. (M.Co.10)
- Relate artistic ideas and works to societal, cultural and historical contexts to deepen understanding. (M.Co.11)

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Curricular Connections, continued

English Language Arts and Literacy Anchor Standards

Speaking and Listening

- Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. (SL.PK-12.2)
- Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric. (SL.PK-12.3)

Mathematics

Counting and Cardinality

- Know number names and the count sequence. (K.CC.A)
- Count to tell the number of objects. (K.CC.B)
- Compare numbers. (K.CC.C)

Operations and Algebraic Thinking

- Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from. (K.OA.A)
- Understand and apply properties of operations and the relationship between addition and subtraction. (1.OA.B)
- Work with addition and subtraction equations. (1.OA.D)
- Represent and solve problems involving addition and subtraction. (2.OA.A)
- Work with equal groups of objects to gain foundations for multiplication. (2.OA.C)
- Represent and solve problems involving multiplication and division. (3.OA.A)
- Understand properties of multiplication and the relationship between multiplication and division. (3.OA.B)

Measurement and Data

- Describe and compare measurable attributes. (K.MD.A)
- Classify objects and count the number of objects in each category. (K.MD.B)
- Measure lengths indirectly and by iterating length units. (1.MD.A)
- Represent and interpret data. (1.MD.C)
- Relate addition and subtraction to length. (2.MD.B)

Number and Operations - Fractions

- Develop understanding of fractions as numbers for fractions with denominators 2, 3, 4, 6, and 8. (3.NF.A)