



CLASSROOM ACTIVITY

Rhythm and Ratios

LESSON OBJECTIVES

Students will be able to:

- Examine how ratios translate into musical expressions
- Create musical patterns using different ratios
- Layer patterns to build rhythms using a digital sequencing program like GarageBand

GRADE RANGE

3–8

DURATION

1 class period of 45–60 minutes

LESSON OVERVIEW

CMA's "Anatomy of a Hit Song" Video Topic Series examines all the elements that make a song popular and memorable. The rhythm and beat of a song are often the driving forces behind a song's success, and they can be broken down into simple mathematical relationships. This activity gives students the opportunity to create their own digital rhythms using ratios as building blocks. They will layer patterns of sound in a digital audio mixing program to produce a unique rhythm.

Take this activity further by having students experiment with the audio mixing software. They can manipulate their rhythm tracks by balancing and equalizing the different levels of sound.

DRIVING QUESTION:

How do musicians use ratios and repetition to create interesting and catchy rhythms?

NATIONAL STANDARDS

Common Core State Standards: Mathematics

- Ratios and Proportional Relationships
- 6.RP.A.1—Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

National Association for Music Education

Music Technology: Creating

- MU:Cr1.1.T.1a Generate melodic, rhythmic, and harmonic ideas for compositions or improvisations using digital tools.

KEY VOCABULARY

- ratio
- rhythm
- beat
- pulse
- note
- measure
- tempo
- time signature

MATERIALS

- Laptop or device with recording capabilities and audio software like GarageBand or Audacity—external microphone is optional, but helpful

BACKGROUND INFORMATION

Rhythm and Ratios

Music is a fascinating blend of art, science, and mathematics. In the “Anatomy of a Hit Song” lesson “[Remakes and Remixes](#),” students examine the lyrics and melodies of hit songs. In the [Family Activity](#), they explore sound waves and how different frequencies create different notes. But the basic building block of music is the rhythm, just like the backbone of every band is the rhythm section. Rhythms unfold through an interplay of beats and patterns.

At the heart of every piece of music lies the **beat**, a consistent and steady pulse that keeps everything in sync. It's the rhythmic foundation that musicians and listeners alike tap their feet to. **Rhythm** is the organization of sounds and silences over time. It's the unique pattern created by arranging beats and pauses, giving music its dynamic and expressive qualities.

These rhythms are expressed as simple mathematical **ratios**. Musicians use these ratios to divide time, creating complex and engaging patterns. The relationships between different durations of notes contribute to the richness of musical expression. These ratios denote how long a musical note is played and how quickly it is played in comparison to the rest of the notes. Some rhythms are simple and common, so you will hear them repeated often in many styles of music. Some rhythms are complex and specific to certain songs. This is why you can sometimes tell what song someone is “playing” when they simply clap out the rhythm, even without any different notes or melody. Probably the most widely recognized example of this is the “stomp, stomp, clap, rest” rhythm Queen used in their world-famous and timeless song, “We Will Rock You.” Anyone who hears that iconic rhythm would automatically associate that with their song.

THE MUSICIAN

While there are many roles involved in writing, creating, and producing music, at the heart of the process are the musicians and vocalists. Through their creativity and skill, they breathe life into compositions, transforming notes on a page into a beautiful musical experience. Musicians employ a vast array of instruments, from guitars and drums to keyboards and violins, each contributing its unique timbre and character to the overall sound.

During this Video Topic Series episode, students will hear from Hubert Payne, the touring and recording drummer for the world-famous Country Music group Little Big Town. The rhythm section of any band plays a central role in providing the foundation for the entire composition. Usually made up of bass and drums, this section is responsible for keeping the band on beat, maintaining the tempo, and crafting the rhythmic patterns that give a piece its unique feel. The bass, with its deep resonance, adds a fundamental and grounding quality, while the drums contribute the pulse and dynamic energy that propels the music forward.

In the realm of Country Music, the evolution of the rhythm section offers a fascinating glimpse into the genre's historical roots. Traditionally, Country Music, originating in rural areas as a form of folk expression, leaned towards the use of homemade string instruments. In the early stages, drums were notably absent from the Country Music scene. The rhythm was often carried by the steady strumming of guitars, the twang of banjos, and the heartfelt resonance of fiddles.

TEACHER PREPARATION

- Ensure students have a device with access to the internet, recording capabilities, and audio editing software.
- Print copies of the "Notes and Rests" chart, "Music Basics Vocabulary" capture sheet, and "Notes and Rests" cards. Cut out the cards and have enough on hand to provide a set to each group.

SESSION FLOW

ENGAGE

- After watching "Anatomy of a Hit Song: The Musician" with drummer Hubert Payne, introduce the idea of time signatures and rhythm. Play excerpts from two or three different songs that use the 4/4 time signature and ask students to listen for similarities.
- The 4/4 time signature is so universal to all genres of music throughout history that it's actually called the "common" time. Many of the most famous songs in popular music use this time signature as their base, including those in the Country Music genre. A few examples are included below. **Educator Note:** *As with any material shared with students, be sure to preview the songs and select those that are appropriate and would resonate with your students prior to playing them in class. You could also find instrumental versions of these recordings to remove lyrics from the equation if you want to guide students to focus solely on the beat and rhythms.*

Country Music

- "Jolene" by Dolly Parton
- "Hey Brother" by Avicii (a techno/pop/bluegrass crossover)
- "Have You Ever Seen the Rain" by Creedence Clearwater Revival
- "Achy Breaky Heart" by Billy Ray Cyrus
- "Love Story" by Taylor Swift

- "The House that Built Me" by Miranda Lambert
- "Boot Scootin' Boogie" by Brooks and Dunn
- "Independence Day" by Martina McBride
- "Live Like You Were Dying" by Tim McGraw

Other genres

- "All About that Bass" by Meghan Trainor
 - "Call Me Maybe" by Carly Rae Jepsen
 - "Firework" by Katy Perry
 - "You Belong with Me" by Taylor Swift
 - "Ride" by 21 Pilots
 - "Zombie" by The Cranberries
 - "Hey Jude" by the Beatles
 - "Otherside" by Red Hot Chili Peppers
 - "Stand by Me" by Ben E. King
 - "Hit the Road Jack" by Ray Charles
 - "One Love" by Bob Marley
- After playing the songs, have students "Think, Pair, Share" their thoughts about the songs and what they have in common. For this strategy, students think on their own and may write notes if they wish, pair up with a partner to compare ideas, and then share with the whole group. Direct students to notice that each of the songs, whether fast or slow, has a basic four-count beat. Play the songs again and have students count and clap on beats 2 and 4 to help them hear it.
 - Explain that many songs use this basic 4 beats as the backbone of the song. Notes of different lengths are layered in on top of those four beat counts to create different rhythms. When comparing the difference between a beat and a rhythm, a good pair of songs is "We Will Rock You" by Queen and "Any Man of Mine" by Shania Twain. They both contain the "stomp-stomp-clap-rest" rhythm made famous by Queen.

EXPLORE

- Students will explore the basic music theory vocabulary that relates to rhythm by using the "Jigsaw" strategy. With the "Jigsaw" strategy, instructional content is divided up among the students. They become experts at the topic and then teach the information to the class as a whole. Thus, each student or group has a piece of the puzzle that all comes together as they teach the class.
- Distribute the "Music Basics Vocabulary" capture sheet. Divide students into small groups and assign each group a vocabulary term from the sheet to explore. They will use any resources they have available to find the definitions and examples of the words. Give students 5–10 minutes to learn about their word. Then direct students to teach their words to the class.

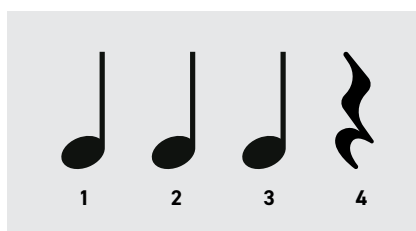
- Encourage students to find audio or visual examples if possible or to act out or demonstrate the terms. As the different groups teach the class, students should fill in the rest of their vocabulary capture sheets.

INVESTIGATE

- Now that students have a basic understanding of the terms used to describe rhythm, they will investigate how beat and rhythm relate to mathematics. Distribute the “Notes and Rests” chart and cards to each group.
- Using the chart as a reference, explain the concept of notes and how whole, half, quarter, sixteenth, and thirty-second notes and rests are really just ratios. Direct students to experiment with their notes and rests to “build” different rhythms. Start with the famous “We Will Rock You” rhythm that is comprised of three-quarter notes and one quarter rest per measure:

4/4 TIME

4 Beats per Measure



Quarter Notes/Rests each get 1 Beat

- Have students experiment with the different notes and rests to create different rhythms with their cards. They can hear the rhythms by clapping them out as they investigate the concept. Students should consider the following:
 - How many different rhythms can be made using just one repeating measure?
 - What happens if the rhythms continue over two or three measures before repeating?
 - Which rhythms are easier to clap out?
 - Which rhythms are more interesting or appealing to the ear?
 - What happens if one person in the group claps out one rhythm and another person in the group claps out another at the same time, to the same beat?

CREATE

- Students will use what they've learned to create their own rhythms using audio recording and editing software like GarageBand or Audacity. Direct students to experiment with the software and create multiple tracks of beats and rhythms that they can layer on top of each other.
- Students can record sounds like singing notes, hand claps, stomps, or dings with the software and use those to build their rhythms, or they can use the software to create the sounds.
- Audacity and GarageBand both have pre-recorded sounds, like drums, guitar, piano, and many others that students can include in their tracks. Have students take screenshots of their displays on the software to show the different layers of tracks and the rhythms they've created.

REFLECTION

- Have students share their recordings with the class. If possible, they should display the screenshots they took of the rhythms or project their screens while playing the songs for their classmates.
- You might also consider publishing their music for the wider school audience or parents by uploading them to a class website or hanging QR codes linked to the music around school. Students should reflect on the process on an exit card prior to leaving for the day. Have students answer the following questions:
 - How does math relate to music?
 - Which of the class's recordings did you like the most and why?

Notes and Rests Chart

Whole note



1 + 2 + 3 + 4 +

Whole rest



4 beats

Half note



1 + 2 + 3 + 4 +

Half rest



2 beats

Quarter note



1 + 2 + 3 + 4 +

Quarter rest



1 beat

Eighth Note (singles or doubles)



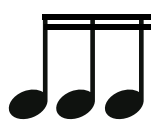
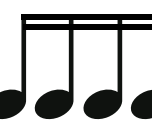
1 + 2 + 3 + 4 +

Eighth rest



1/2 beat

Sixteenth Note (singles or doubles)



1 e + a 2 e + a 3 e + a 4 e + a

Sixteenth rest



1/4 beat

Music Basics Vocabulary

Directions: Complete the following vocabulary chart to explore different terms in basic music theory. Give a definition and an example. Search online for an audio or visual demonstration or describe a good way to remember or explain the topic. Be sure to cite your sources.

Music Theory Term	Definition	Example	Link or Description of Demonstration (include citation if necessary)
Time Signature			
Rhythm			
Beat			
Pulse			
Tempo			
Measure			
Rest			
Note			

Notes and Rests Cards



whole note

1

4 beats each, with 4 beats in a measure for 4/4 time



half note

1/2

2 beats each, with 4 beats in a measure for 4/4 time



half note

1/2

2 beats each, with 4 beats in a measure for 4/4 time



quarter note

1/4

1 beat each, with 4 beats in a measure for 4/4 time



quarter note

1/4

1 beat each, with 4 beats in a measure for 4/4 time



quarter note

1/4

1 beat each, with 4 beats in a measure for 4/4 time



quarter note

1/4

1 beat each, with 4 beats in a measure for 4/4 time



eighth note

1/8

half a beat each, with 4 beats in a measure for 4/4 time



eighth note

1/8

half a beat each, with 4 beats in a measure for 4/4 time

Notes and Rests Cards



sixteenth note
1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



sixteenth note
1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



sixteenth note
1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



sixteenth note
1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



sixteenth note
1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



sixteenth note
1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



quarter note
1/4

1 beat each, with 4 beats in a
measure for 4/4 time



eighth note
1/8

half a beat each, with 4 beats in
a measure for 4/4 time



eighth note
1/8

half a beat each, with 4 beats in
a measure for 4/4 time

Notes and Rests Cards



eighth note
1/8

half a beat each, with 4 beats in a measure for 4/4 time



eighth note
1/8

half a beat each, with 4 beats in a measure for 4/4 time



eighth note
1/8

half a beat each, with 4 beats in a measure for 4/4 time



eighth note
1/8

half a beat each, with 4 beats in a measure for 4/4 time



eighth note
1/8

half a beat each, with 4 beats in a measure for 4/4 time



eighth note
1/8

half a beat each, with 4 beats in a measure for 4/4 time



sixteenth note
1/16

a fourth of a beat, with 4 beats in a measure for 4/4 time



sixteenth note
1/16

a fourth of a beat, with 4 beats in a measure for 4/4 time



sixteenth note
1/16

a fourth of a beat, with 4 beats in a measure for 4/4 time

Notes and Rests Cards



sixteenth note

1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



sixteenth note

1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



vsixteenth note

1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



sixteenth note

1/16

a fourth of a beat, with 4 beats
in a measure for 4/4 time



whole rest

1

4 beats each, with 4 beats in a
measure for 4/4 time



half rest

1/2

2 beats each, with 4 beats in a
measure for 4/4 time



half rest

1/2

2 beats each, with 4 beats in a
measure for 4/4 time



quarter rest

1/4

1 beat each, with 4 beats in a
measure for 4/4 time



quarter rest

1/4

1 beat each, with 4 beats in a
measure for 4/4 time

Notes and Rests Cards



eighth rest

1/8

half a beat each, with 4 beats in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats in a measure for 4/4 time

Notes and Rests Cards



sixteenth rest

1/16

1/4 of a beat each, with 4 beats
in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats
in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats
in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats
in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats
in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats
in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats
in a measure for 4/4 time



sixteenth rest

1/16

1/4 of a beat each, with 4 beats
in a measure for 4/4 time

TEACHER GUIDE

Understanding some basic musical theory and terminology is helpful when understanding how rhythms are combinations of ratios. Here are a few important pieces.

- **Pulse:** The pulse is the recurring emphasis on the beat, creating a sense of regularity. It's the heartbeat of the music that guides performers and listeners through the rhythmic journey.
- **Tempo:** Tempo is the speed at which the beats unfold. It's the pace of the musical journey, ranging from slow and contemplative to fast and energetic. Musicians use terms like *allegro* or *adagio* to convey specific tempos.
- **Note:** Notes are the building blocks of rhythm. They come in various durations, each contributing to the intricate tapestry of musical time. Each duration denotes a ratio. There are whole notes, half notes, quarter notes, sixteenth notes, and even thirty-second notes. The term "note" can also refer to the pitch or tone of the sound: a "C" or "G" note, for example. But in reference to rhythm, only the duration of the sound is considered.
- **Rest:** A rest is a duration of time where a sound is not made. Like notes, a rest can be whole, half, quarter, sixteenth, or thirty-second. Together, notes and rests create the patterns that are rhythm.
- **Time Signature:** In the world of music notation, the time signature is like a musical clock, indicating how beats are grouped. The most common time signature is 4/4, often referred to as "four-four" time or "common" time. In 4/4 time, there are four beats in each measure, with the quarter note receiving one beat. Another very popular time signature is 3/4 time, where there are three beats in each measure, with the quarter note receiving one beat. Songs written in 3/4 time have a waltzy or lilty quality to them.
- **Measure:** A measure is a segment of music defined by the time signature. In 4/4 time, each measure contains four beats. This organization helps musicians navigate the rhythmic landscape and provides a sense of structure.

Value in common time (4/4)

Notes



Whole

4 beats

Half

2 beats

Quarter

1 beat

Eighth

1/2 beat

Sixteenth

1/4 beat

Thirty-second

1/8 beat

Rests

