**Lesson:** The Mathematics and Meaning Behind Music

**Learning Objectives:**

Students will be able to:

(*Rhythm Section)*

* Discover the application of fractions in popular music
* Count songs that are in 4/4 (common) time signature
* Comprehend rhythmic subdivisions and understand them as fractions of fractions
* Perform basic addition, subtraction, multiplication, and division with fractions in the context of musical rhythm
* Connect the concepts of speed and tempo

**Materials:**

[Presentation](https://docs.google.com/presentation/d/1RjyRxWXmmbe8NY7-7r2D3qolkWVrlCzQCnEUpeuTI6Y/edit?usp=sharing)(Includes Supplemental Video Materials)

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| **Basic Definitions and Counting**  **Concept:** Music can be broken down into parts. Numbers can also be broken down into parts  **Materials:** Slides 1-8 of the [presentation](https://docs.google.com/presentation/d/1RjyRxWXmmbe8NY7-7r2D3qolkWVrlCzQCnEUpeuTI6Y/edit?usp=sharing). (This includes [Video 1](https://www.youtube.com/watch?v=z9JPi5Fhjlk))  **Location:** Classroom |

*The following instructions are given as a guideline on how to utilize the slides during the lesson*

**Slide 2:** Most of the songs heard today can be broken down into smaller and smaller parts. This is similar to how numbers can be broken down to parts, or fractions, as well!

**Slide 3:** Let’s take a general look at how songs can be broken down. Each part of the song usually represents an idea.

* The chorus (or the hook as it is sometimes called) is usually the main idea of the song.
* The verses tell the story. The first verse may introduce some concepts and following verses may add to them
* The bridge is typical near the end of the song and usually adds some new concepts and variation
* The intro sets the mood and tone for the song and draws the listener into what comes next
* The outro wraps up the song

Some songs have short transitions between the sections, others do not. This is really up to the artist

**Slide 4:** In music, the melodies and rhythms can be defined by notes. These notes have names that tell us exactly what they are.

These solid ovals with a thin line connected to them are notes. These ones specifically are called quarter notes.

*Point to notes on the slide*

**Slide 5:** In most popular music nowadays, music is written in 4/4 (pronounced four four), which means that a measure is made up of four beats, or quarter notes. We can see here that there are two measures

*Slide 5 adds a red circle around the 4/4 and adds lines that indicate measures in the graphic*

**Slide 6:** Each of these quarter notes are beats numbered 1-4. Each of the two measures contains 4 quarter notes, or beats!

**Slide 7:** *Play the video*

**Slide 8:** Group Time!

*Read the instructions present on the slide*

*Allow the students to get into groups of 3-4. If the size of the class requires different sized groupings, proceed with what makes sense. However, try to keep groups towards the small side. While students are in groups, make your way around the groups. If students are struggling, suggest that they try a different song. Encourage students who are having fun with the activity.*

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| **Subdivisions**  **Concepts:** Rhythms are a way to divide time into parts. Rhythmic values can be divided and this is known as subdivision  **Materials:** Slides 9-17 of the [presentation](https://docs.google.com/presentation/d/1RjyRxWXmmbe8NY7-7r2D3qolkWVrlCzQCnEUpeuTI6Y/edit?usp=sharing). (This also includes [Video 2](https://www.youtube.com/watch?v=ZRbn47Nv51Y))  **Locations:** Classroom |

*The following instructions are given as a guideline on how to utilize the slides during the lesson.*

**Slide 9:** The word subdivision literally means to break something down into smaller parts. In music, rhythms can be subdivided!

**Slide 10:** Here’s what some common rhythmic values look like. Whole notes are a hollow oval. Half notes are a hollow oval with a stem. A quarter note is a solid oval with a stem. An eighth note is a quarter note with a flag. Sometimes flags can be connected if multiple eighth notes are written

**Slide 11:** Subdivisions can be pictured through a tree diagram. Two half notes make up one whole note. Two quarter notes make up one half note. Two eighth notes make up one quarter note.

*This is an excellent opportunity to ask questions of the students. For example:*

* *How many eighth notes can go into 3 quarter notes?*
  + *Answer: 6*
* *How many quarter notes can go into 2 whole notes?*
  + *Answer: 8*
* *How many eighth notes can go into 3 half notes?*
  + *Answer 12*

**Slide 12:** If we think of a whole note as the value 1, then other types of notes can be assigned values relative to the whole note, or 1. The names of these notes makes the values quite easy. Half notes can be thought of as 1/2, quarter notes as 1/4, and eighth notes as 1/8.

*If any of the students had a lot of difficulty conceptualizing subdivisions without numerical values during* ***Slide 11****, ask them if it makes more sense now that fractions have been assigned.*

**Slide 13:** Since a whole note takes up an entire measure, one measure can be thought of as one as well. One measure can be filled by one whole note, two half notes, four quarter notes, or eight eighth notes.

*Note values can extend to sixteenth notes, 32nd notes, 64th, etc. but for the sake of simplicity are not included. If any student asks if an eighth note can be divided, let them know that two sixteenth notes make up one eighth note.*

**Slide 14:** There’s more than one way to make a measure! It doesn’t always have to be the same note value in each measure. Most songs mix and match rhythmic values. If they didn’t, music would sound boring!

**Slide 15:** Here’s the notes with numeric values above them! Each measure sums to 1. Since music is written left to right, the order DOES matter.

*This is an addition with fractions. If students have questions about how to add them, teach them how to find a common denominator.*

**Slide 16:** Using this graphic, try making at least two examples of one measure. If it helps, write out the fraction value above each note!

*Ask students to take out a piece of paper and draw notes left to right to make one measure. Go around the room and look at each of the students' examples. Alternatively, students could try to grade each other.*

**Slide 17:** *Round up the students and play the video*

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| **Triplets**  **Concepts:** Rhythms don’t have to be divided into twos all the time. They can be divided into threes and this is called triplets.  **Materials:** Slides 18-22 of the [presentation](https://docs.google.com/presentation/d/1RjyRxWXmmbe8NY7-7r2D3qolkWVrlCzQCnEUpeuTI6Y/edit?usp=sharing). (This also includes [Video 3](https://www.youtube.com/watch?v=ftOfNjIeSzo&feature=emb_logo))  **Locations:** Classroom |

*The following instructions are given as a guideline on how to utilize the slides during the lesson.*

**Slide 18:** So far, we’ve talked about how to divide notes by twos or multiples of two. What if we could divide notes in ways other than twos?

**Slide 19:** Notes can be divided into thirds! The type that we’re going to be talking about are eighth note triplets. Three of these will fit into one quarter note!

**Slide 20:** Here’s a question. A quarter note is one fourth of a measure. If an eighth note triplet is one third of a quarter note, what fraction of the measure is one eighth note triplet?

*Let students offer up any answers.*

**Slide 21:** The answer is 1/12th! Think about it this way. One third of one fourth can be calculated by multiplying 1/3 by 1/4.

*If students have questions about multiplying fractions, guide them through it! After explaining this question, other example questions could be asked.*

* *What fraction of a measure would 9 eighth note triplets be?*
  + *Answer: 3/4 (9 \* 1/12)*
* *What fraction of a measure would 5 eighth note triplets be?*
  + *Answer: 5/12 (5 \* 1/12)*

**Slide 22:** Here’s what triplets sound like in music! *Play the video*

*After the video, try the triplet counting exercise with the students! Additionally, ask students if they can think of any songs with triplets in them. This is a tricky concept to think about and to understand. If the students don’t fully understand this the first time through, then that’s okay. Repeating portions of the lesson might be necessary!*

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| **Tempo**  **Concepts:** Musical tempo is how fast or how slow it is. It can be compared to speed  **Materials:** Slides 23-27 of the [presentation](https://docs.google.com/presentation/d/1RjyRxWXmmbe8NY7-7r2D3qolkWVrlCzQCnEUpeuTI6Y/edit?usp=sharing). This also includes [Video 4](https://www.youtube.com/watch?v=xQ9IfBkmC0c&feature=emb_logo)  **Locations:** Classroom |

*The following instructions are given as a guideline on how to utilize the slides during the lesson.*

**Slide 23:** All of this talk about rhythms and fractions is great! However, how do we know how fast or how slow a song is going to be overall? This is dictated by the tempo!

**Slide 24:** Think of tempo as the speed limit of music. Just as a speed limit dictates how fast cars should drive, the tempo dictates how fast the music should be. Picture a road that has a speed limit of 35 miles per hour. If a car is driving at this speed limit for two hours, how many total miles have been traveled?

*Allow the students to offer up answers*

**Slide 25:** The answer is 70 miles! Think about it this way, if the car is traveling at a speed of 35 miles per hour, then this means in one hour it will travel 35 miles. Therefore, in two hours, it will travel 70 miles!

**Slide 26:** Instead of miles per hour, which is given as distance over time, the tempo of music is given as beats per minute. If the tempo is constant, then the length of one beat, or one quarter note, is going to be consistent. At 120 beats per minute, a song can fit 12 beats into one minute. Higher BPMs feel faster because more beats are being fit into the same amount of time.

**Slide 27:** This video explores what different tempos feel like and also gives examples of songs that have tempo changes!

*Spend some time with the students talking about what tempo changes represent. If the song gets faster, what does this mean? What is the artist trying to communicate? Along the same lines, if the song suddenly has a slow section, what might this mean? The interpretation of these tempos is quite subjective. There really isn’t an exact answer. It may depend on the chords, the lyrics, or more. Encourage students for simply presenting ideas!*

*Additionally, much like the triplets section, ask the students if they know any other songs with tempo changes. This may be a fun way to share each others’ music!*

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| **Tuplets**  **Concepts:** Rhythms can be divided into complicated fractions!  **Materials:** Slides 28-36 of the [presentation](https://docs.google.com/presentation/d/1RjyRxWXmmbe8NY7-7r2D3qolkWVrlCzQCnEUpeuTI6Y/edit?usp=sharing).  **Locations:** Classroom |

*The following instructions are given as a guideline on how to utilize the slides during the lesson.*

**Slide 28:** So far, we’ve learned that things can be divided into twos and threes. What if we could divide rhythms in more complicated ways?

**Slide 29:** If triplets split something into 3 parts, how many parts would result from quintuplets? *It may be helpful to explain what the stem quin- means if students are stuck.*

**Slide 30:** Five parts!

**Slide 31:** If a quarter note is split into 5 parts, what fraction of the measure is one of these quintuplets?

**Slide 32:** 1/20! We can get to this answer much like one of the previous questions. Since a quarter note is one fourth, one fifth of one fourth is one twentieth.

**Slide 33:** This brings us to the topic of tuplets. This term includes the subdivisions that we’ve talked about already. Additionally, it includes pretty much any subdivision possible! We’re really only limited by our imaginations. Complicated tuplets can be hard to play but with enough dedication they are possible.

**Slide 34:** Here’s a list of advanced tuplets! Trying to perform these rhythms can be really hard. However, the math side of things may be a little easier.

**Slide 35:** Here’s what quintuplets, sextuplets, septuplets, and nonuplets would look like if each bunch was equivalent to one quarter note!

**Slide 36:** Each group of tuplets adds up to 1/4th.

*If possible, walk the students through calculating the fractions for individual tuplets. For example, if 1/4 is divided into 6 parts, what fraction of the measure would one of these sextuplets be? The answer is 1/24! Exercises like this would help students improve their multiplication skills.*

*If students have access to a computer at home and they are interested more in music theory, here’s some resources that can be shared. These will go much further beyond rhythms and talk about melodic elements as well.*

* Online music theory lessons<https://www.musictheory.net/lessons>
* Adam Neely on YouTube (<https://www.youtube.com/user/havic5>)
  + Bass player who studied jazz and makes advanced theory content
  + <https://www.youtube.com/watch?v=9MzKx0fKg5o> (video specifically about tuplets)
* Andrew Huang’s Music Theory Video (<https://www.youtube.com/watch?v=rgaTLrZGlk0>)
  + Worked in commercial sound design