

Math with the Grateful Dead

OVERVIEW

ESSENTIAL QUESTION

How can math be used to better understand the Grateful Dead's success?

OVERVIEW

In this lesson, students look at the accomplishments of the Grateful Dead through a mathematical lens by calculating the efforts the band put forth to become a success.

The Grateful Dead was an American Rock band formed in 1965 in the San Francisco Bay Area. Known for its eclectic style which fused elements of Rock, Folk, Country, Jazz, Bluegrass, Blues, Gospel, and Psychedelic Rock, the band is also famous for its many lengthy live performances and devoted fan base. Though the Grateful Dead achieved only a moderate level of commercial success, they consistently filled arenas and are considered by some to be one of the greatest bands of all time.

The Grateful Dead played to an estimated 25 million people over their career—more than any other band in history. In 1998, *The Guinness Book of World Records* certified that the band had played the “most rock concerts ever performed” at the time, with 2,318. The Grateful Dead played to one of the biggest audiences ever recorded for a live event at Summer Jam at Watkins Glen in 1973, to an estimated 600,000 people. In the 1990's, the Grateful Dead made a total revenue of \$285 million from touring, making them the highest-grossing American band of the decade, and the second-highest grossing band in the world, only behind The Rolling Stones. What makes that statistic even more remarkable is lead guitarist Jerry Garcia died in 1995, meaning they achieved this feat in the first half of the decade alone.

The Grateful Dead achieved success through hard work. They toured relentlessly, performed extended and always-changing concerts, and connected directly with fans in creative ways. In so doing, the band accomplished something beyond economic success: they became a cultural force.

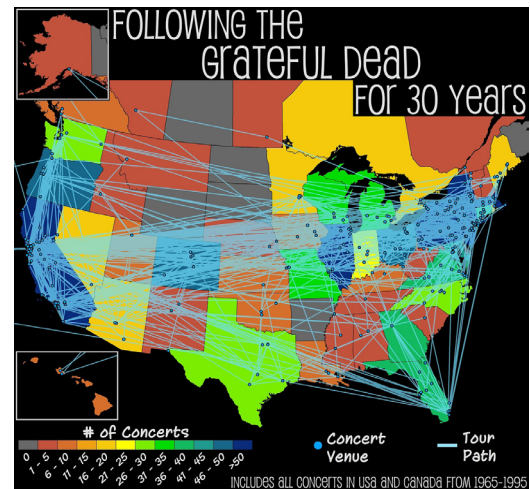


Illustration by Seth Kadish

OBJECTIVES

Upon completion of this lesson, students will:

1. KNOW (KNOWLEDGE):

- About the Grateful Dead and their popularity
- The ways the Grateful Dead maintained and supported a large and growing fanbase
- How to formulate equations that relate to numeric information regarding the Grateful Dead

2. MASTERY OBJECTIVE:

- Students will be able to apply mathematical knowledge to create and solve equations that calculate the musical journey and cultural impact of the Grateful Dead

ACTIVITIES

MOTIVATIONAL ACTIVITY

1. Display **Image 1, Partner Discussion Questions**. Tell students to partner up and ask each other the questions displayed in the image.
2. Ask students to share their partner's responses to the discussion questions. Write a list of the ways students suggest their favorite musical artists gained popularity.

PROCEDURE

1. Show **Image 2, Grateful Dead Live**. Tell students that they will be investigating the band the Grateful Dead, and using math to calculate how they were able to gain the enormous following represented in this picture.
 - In the chart, what do the different color records denote?
 - Based on the chart, how would you compare the Grateful Dead to the other bands listed?
2. Show **Image 3, Billboard Album Charts**. Ask students:
 - What is this chart showing? (*Record sales, by category, for selected Rock bands.*)
 - What might you conclude from this chart about the Grateful Dead?
 - What are some other ways the Grateful Dead might have achieved success, outside of selling their music?
3. Show **Image 4, Following the Grateful Dead for 30 Years**. Ask students:
 - What is being shown in this image?

- Approximately how many concerts did the Grateful Dead perform in the state you live in?
 - Do you have relatives or friends in another state? How many concerts did the Grateful Dead perform in that state?
 - What might be the result of all this touring? How might doing so many concerts have contributed to the Grateful Dead's success?
4. Play **Clip 1, "Not the Band, But the Deadheads."** Ask students:
- Who are "The Deadheads"?
 - Why might these Grateful Dead fans go to concerts?
 - What kinds of things might the Grateful Dead do to attract people to come to their concerts?
5. Play **Clip 2, "The Fan Mandala."** Ask students:
- What were some of the different groups of fans the clip mentions?
 - What does the presence of these various groups say about a Grateful Dead concert? (*If needed, provide the follow-up question: do you think the band welcomed different types of people?*)
 - Deadheads are known for following the band on tour, to see many Grateful Dead concerts in the same year. How might the Grateful Dead keep their concerts interesting for fans who want to see them multiple times?
6. Pass out **Handout 1 – Grateful Dead Setlists.** Individually or in groups, have students complete the handout questions. Go through the answers together as a class, then ask students:
- Based on your calculations, can you make any conclusions about how the Grateful Dead approached their live concerts? How did they keep their concerts interesting for their most devoted fans?
7. Tell students that they will be looking at some other numbers that demonstrate the success of The Grateful Dead. Pair students together and give each pair **Handout 2 – Grateful Dead by The Numbers.**
8. Ask students to turn to a partner and read Handout 2 together. Then ask the class:
- Which number in the handout is the smallest, and which is the largest?
 - Do any of the numbers surprise you, or seem too large or too small? Which ones, and why?
9. Point out the first number on the handout. Tell students that the Grateful Dead's longest concert was 6 hours long. It was a New Year's Eve concert in 1978 that went on until 1979. Tell students that as a class they will be calculating a word problem from this fact. Ask students:
- How long, in minutes, was the Grateful Dead's longest concert?
10. Model for students: 6 hours played x 60 minutes in an hour = 360 minutes played. Ask students to return to their pairs and now calculate how many seconds this concert lasted.
11. Ask student pairs to share their answers with the class, then model the problem: 360 minutes x 60 seconds in each minute = 21,600 seconds.

12. Ask student pairs to turn to the second page of the handout, and work together to solve each of the three problems. If there is time, have students also solve the other word problems, or illustrate the word problem they solved. (*The teacher answer key is available at the **Handout 2 - Grateful Dead by the Numbers (Answer Key)**.*)
13. Ask students to compare their calculations with a classmate or team across the room. Next, ask for volunteers to solve one of the problems for the class (*be sure to check their answer first to ensure that they will solve correctly.*)
14. Using the information on the first page of Handout 2, ask student pairs to write their own math word problems on page 3 of the handout.
15. When students have finished creating their word problems, have them share their problems with a friend and check each other's work. Students may "become the teacher" to help their classmates and model their mathematical thinking.

SUMMARY ACTIVITY

1. Ask students:
 - After doing these calculations, what conclusions can you make about how the Grateful Dead developed such a strong following?
 - If you are a musician or band seeking to become better known, what lessons might you draw from the Grateful Dead?
 - The Grateful Dead became popular largely before the internet. Today, do you think the Grateful Dead's model would be just as successful? Why or why not?
2. Using a scratch piece of paper or the **My Grateful Dead Infographic** handout ask students to create an infographic using some of the numbers in this lesson to tell the story of The Grateful Dead.

EXTENSION ACTIVITIES

1. Design your own Grateful Dead T-shirt using some of the numbers in this lesson. Use the shirt at <https://edeadshop.com/products/grateful-dead-countdown> as inspiration.
2. Read this brief article from U.S. News and World Report (<https://www.usnews.com/news/best-states/new-hampshire/articles/2019-10-05/scholars-gather-to-explore-culture-impact-of-grateful-dead>.)

STANDARDS

COMMON CORE STATE STANDARDS

Math Standards

Operations and Algebraic Thinking 4.OA.A.1: Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

Operations and Algebraic Thinking 4.OA.A.2: Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison

Operations and Algebraic Thinking 4.OA.A.3: Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Number & Operations in Base 10 4.NBT.B.4: Fluently add and subtract multi-digit whole numbers using the standard algorithm.

Numbers and Operations in Base 10 4.NBT.B.5: Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

College and Career Readiness Anchor Standards for Reading (K-12)

Reading 1: Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

Craft and Structure 4: Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

Integration of Knowledge and Ideas 7: Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

College and Career Readiness Anchor Standards for Writing (K-12)

Text Types and Purposes 2: Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

College and Career Readiness Anchor Standards for Language (K-12)

Language 1: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

Language 2: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

Language 3: Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

College and Career Readiness Anchor Standards for Speaking and Listening (K-12)

Comprehension & Collaboration 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.

Comprehension & Collaboration 2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

Presentation of Knowledge 4: Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

SOCIAL STUDIES – NATIONAL COUNCIL FOR THE SOCIAL STUDIES (NCSS)

Theme 1: Culture

Theme 2: Time, Continuity, and Change

Theme 3: People, Place, and Environments

Theme 4: Individual Development and Identity



RESOURCES

VIDEOS

- *Long Strange Trip* - "Not the Band, But Deadheads"
- *Long Strange Trip* - The Fan Mandala

HANDOUTS

- Handout 1 - Grateful Dead Setlists
- Handout 2 - Grateful Dead by the Numbers
- Grateful Dead by the Numbers (Answer Key)
- My Grateful Dead Infographic

Lesson Materials



Image 1, Partner Discussion Questions

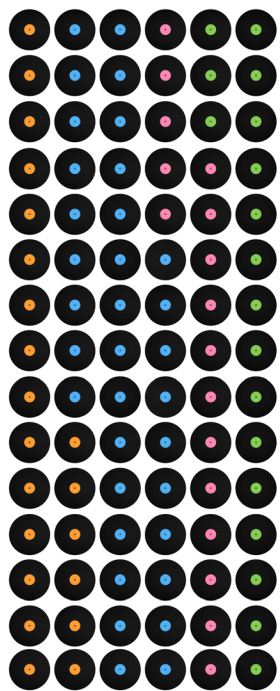
Discuss with a partner:

- 1) Do you have a favorite musical artist or band? Who are they?**
- 2) Would you consider this artist or group “popular”? Do a lot of people know about them?**
- 3) What kind of work might have these musicians done to achieve their popularity? What kind of work would they have to do to become more popular?**

Image 2, Grateful Dead Live



Image 3, Billboard Album Charts



**THE
BEATLES**

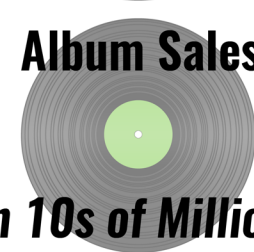
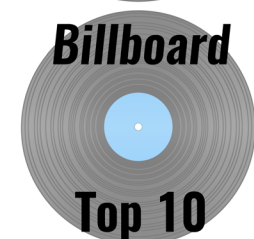
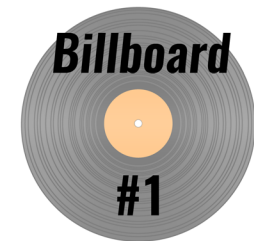
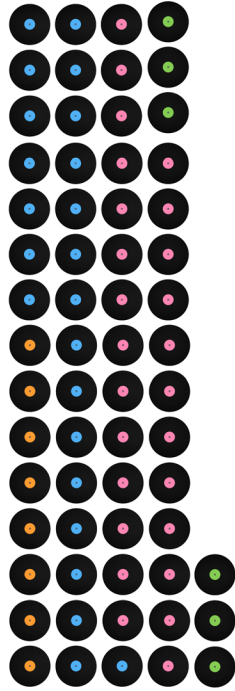
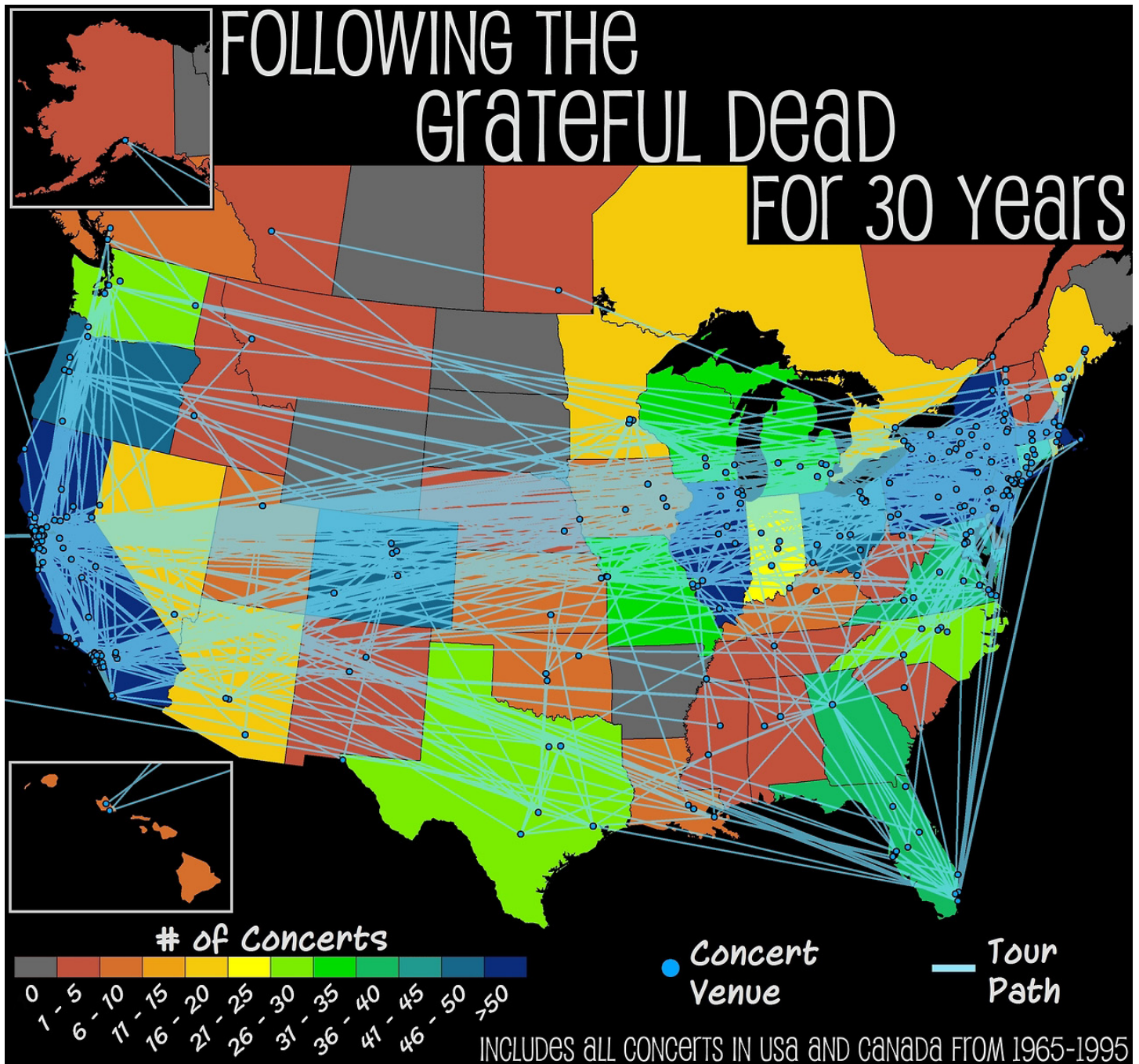


Image 4, Following the Grateful Dead for 30 Years



Handout 1 - Grateful Dead Setlist

Below are the setlists of songs performed by the Grateful Dead during four consecutive shows in 1970. Using the information here, answer the questions on the following page.

01/02/70, Early Show Fillmore East (NYC) Mason's Children Casey Jones Black Peter Mama Tried Hard To Handle Cumberland Blues Cryptical Envelopment Drums The Other One Cryptical Envelopment Cosmic Charlie	01/02/70, Late Show Fillmore East (NYC) Uncle John's Band High Time Dire Wolf Easy Wind China Cat Sunflower I Know You Rider Good Lovin' Me And My Uncle Monkey And The Engineer Dark Star St. Stephen The Eleven Turn On Your Love Light	01/03/70, Early Show Fillmore East (NYC) Morning Dew Me And My Uncle Hard To Handle Cumberland Blues Cold Rain And Snow Alligator Drums Jam And We Bid You Goodnight Jam Jam Alligator Reprise Caution (Do Not Stop On Tracks) Jam Feedback	01/03/70, Late Show Fillmore East (NYC) Casey Jones Mama Tried Big Boss Man China Cat Sunflower I Know You Rider Cryptical Envelopment Drums The Other One Cryptical Envelopment Cosmic Charlie Uncle John's Band Mason's Children Black Peter Dire Wolf Good Lovin' Drums Good Lovin' Dancin' In The Streets St. Stephen Midnight Hour
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Questions

1. How many songs in total did the Grateful Dead perform over these four concerts?
2. What is the average number of songs the Grateful Dead performed each night? (*Hint: average= total number of songs performed/number of concerts.*)
3. How many unique songs did the Grateful Dead perform during these four concerts?
4. Which songs were played the most during the four concerts? Which songs were played the least?
5. How did you determine your answer to question 4?

Handout 2 - Grateful Dead by the Numbers (Answer Key)

Using the data on page 1, answer the following questions:

Question #1:

The Grateful Dead played a total of 2,318 concerts. Though each Grateful Dead concert was different, the average length of time for a Grateful Dead concert was 3 hours. Calculate approximately how many hours the Grateful Dead played in all.

$$2318 \text{ concerts} \times 3 \text{ hours each} = 6,954 \text{ hours total}$$

Question #2:

Grateful Dead fans often recorded the band's concerts and traded cassette tapes of those recordings. Imagine that you have a tape of each of the 2,318 concerts that the Grateful Dead ever played, and that you have decided to spend 8 hours a day listening to all the tapes. How many days will it take you to listen to your whole collection? (*Hint: you may want to use your answer from Question #1 to help you in your calculations.*)

$$6965 \text{ hours total} / 8 \text{ hours per day listening time} = 869.25 \text{ days}$$

Question #3:

The original members of The Grateful Dead performed from December 4, 1965 to July 9, 1995. How many months in all did the band perform together during that time? **Bonus Question:** Calculate the number of days that The Grateful Dead had together, and be sure to account for leap years! (Hint: 1968 was a Leap Year). How many minutes?

$$\text{December 1965 to December 1994} = 29 \text{ years}$$

$$29 \text{ years} \times 12 \text{ month per year} = 348 \text{ months}$$

$$\text{January 1995 to July 1995} = 7 \text{ months}$$

$$348 \text{ months} + 7 \text{ months} = 355 \text{ months total}$$

Bonus:

$$365 \text{ days per year} \times 29 \text{ years} = 10,585 \text{ days}$$

$$\text{December 5, 1964 to July 9, 1995} = 216 \text{ days}$$

$$10,585 + 216 = 10,801 \text{ days}$$

$$7 \text{ Leap Years between 1965 and 1995} = 7 \text{ days}$$

$$10,774 \text{ days} + 7 \text{ leap days} = 10,808 \text{ days total}$$

$$10,808 \text{ days} \times 24 \text{ hours} = 259,392 \text{ hours total}$$

$$259,392 \text{ hours} \times 60 \text{ minutes each} = 15,563,520 \text{ minutes}$$



Handout 2 - Grateful Dead by the Numbers

6 hours

The Length of the Grateful Dead's Longest Concert

9 Minutes

The Average Length a Grateful Dead Song

30 Years

The Number of Years the Original Members of the Grateful Dead Performed Together

46 Minutes

The Longest Song Ever Played in a Grateful Dead Concert

200+

The Number of Grateful Dead Albums (Official or Unofficial)

218

The Number of Bands who have Covered Grateful Dead songs

2318

The Total Number of Grateful Dead Concerts

80,000

The Average Size of an Audience at a Grateful Dead Concert

600,000

The Largest Audience The Grateful Dead Ever Played For

25,000,000

The Estimated Number of People who have seen the Grateful Dead in Concert

35,000,000

The Number of Grateful Dead Albums Sold Worldwide



Using the data on page 1, answer the following questions:

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Use page 1 of this handout, create your own Word Problems below:. You will be sharing the questions with another classmate.

Question #1:

Question #2:

Question #3:



My Grateful Dead Infographic