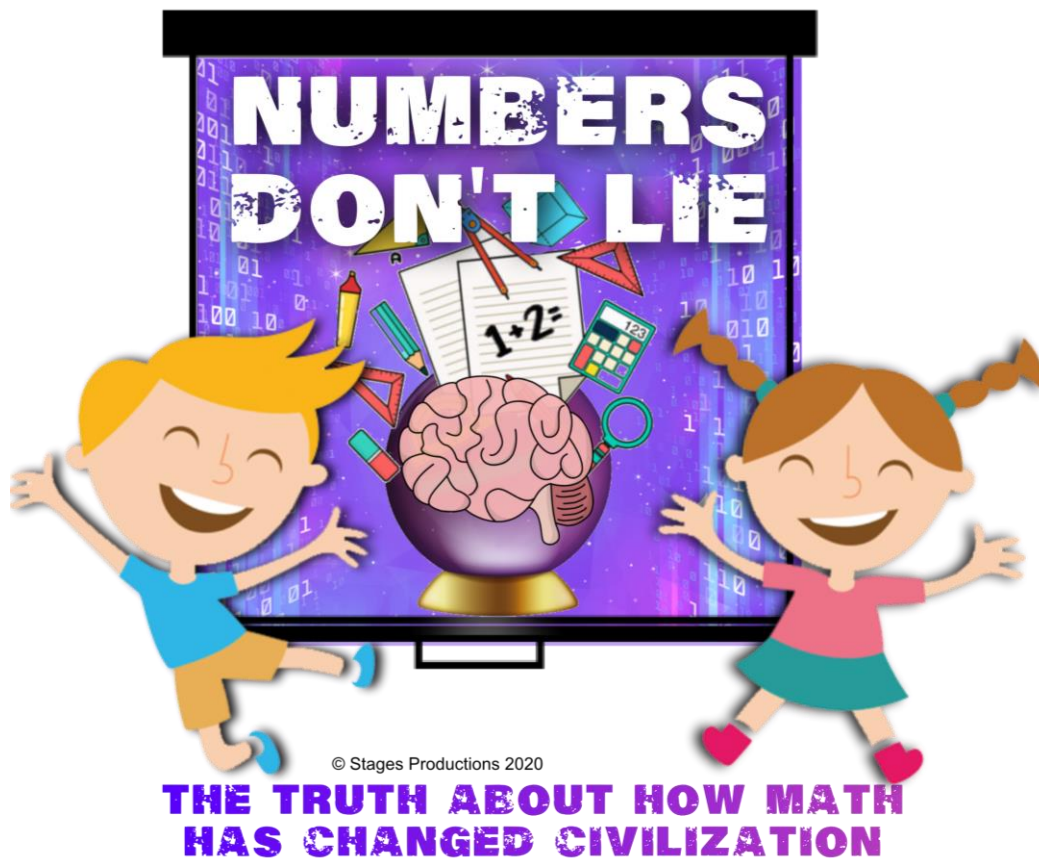


STUDY GUIDE

ELEMENTARY • 4th & 5th GRADE



Stages Productions

This study guide has been developed specifically to align to Florida State Standards for the grade(s) listed above. Please modify accordingly for other grade levels if necessary.

Plot Summary

When two failing math students, Algie & Bray take a trip to an enchanted museum, anything can happen. After falling behind their tour group, the kids stumble upon an old broken-down exhibit called “The Brain.” The premise is that you can ask the Brain any question in the world and it will answer the question using Math. Curious about the exhibit, they try and get it to work, but to no avail so they start to leave. Suddenly, in a whiz bang flash, the brain comes to life and the excitement begins!

Weaving in the 5 basic strands of elementary mathematics, this multi-media musical proves how throughout civilizations, math has led the way in every facet of our history. Filled with fun audience participation songs like “pollution Solution” and “The Tap Measure”, Algie & Bray can’t wait to get back to the classroom and share their new-found knowledge. In the rousing finale, “Math Rules”, the students learn that from sports to science, medicine to music, math is necessary in every part of our lives.

Theatre Etiquette

(Before the Show)

It is often helpful to remind students of appropriate audience etiquette by explaining and discussing **why** these rules of behavior are important.

Audience members should:

- *listen carefully to the ushers, your teachers – this gets everyone to their seats quickly and ensures a pleasant experience*
- *walk single-file and hold hand-rails as you use steps – this also keeps everyone safe*
- *listen carefully to the performers – they are working hard to entertain and inform you with lots of clues about the story*
- *refrain from talking – this allows everyone to enjoy the performance without being distracted*
- *laugh if something is funny, but not too loudly – you don't want to miss any dialogue*
- *pay attention to the lighting, scenery, costumes, and music – all of these elements help provide more details to tell the story in an interesting way*
- *applaud at the end – this shows the performers that you respect and appreciate their work*

Teacher Instructions (After the Show) – Choose from the activities listed on the following pages to extend student learning.

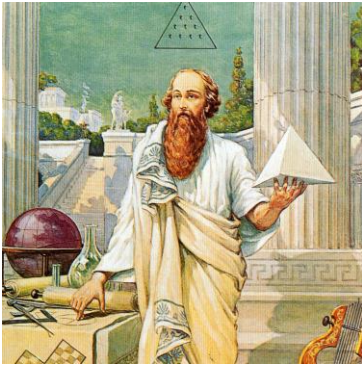
Famous Mathematicians

(LAFS.4.RI.1.1, LAFS.5.RI.1.1)

NAME: _____

Read the following biographies of famous mathematicians. Then answer the question “Why is this person historically important?” and support your answer using details from the text.

Pythagoras



Pythagoras (c. 571- c. 497 BCE) was a Greek philosopher whose teachings emphasized the immortality and transmigration of the soul (reincarnation), virtuous, humane behavior toward all living things, and the concept of “number” as truth in that mathematics not only cleared the mind but allowed for an objective comprehension of reality.

He is best known in the modern day for the Pythagorean Theorem, a mathematical formula which states that the square of the hypotenuse of a right triangle is equal to the sum of the squares on the other two sides. This formula has been applied to measuring distance and space as, for example, in planning and executing the construction of a building.

Pythagoras’ influence on later philosophers, and the development of Greek philosophy generally, was enormous. Plato references Pythagoras in a number of his works and Pythagorean thought, as understood and relayed by other ancient writers, is the underlying form of Plato’s philosophy. Plato’s famous student Aristotle also incorporated Pythagorean teachings into his own thought and Aristotle’s works would influence philosophers, poets, and theologians (among many others) from his time through the Middle Ages (c. 476-1500 CE) and into the modern day. Although Pythagoras remains a mysterious figure in antiquity, therefore, he also stands as one of the most significant in the development of philosophical and religious thought.

Source: <https://www.ancient.eu/Pythagoras/>

Why is Pythagoras historically important?

Famous Mathematicians

(LAFS.4.RI.1.1, LAFS.5.RI.1.1)

NAME: _____

Euclid



The Greek mathematician Euclid lived and flourished in Alexandria in Egypt around 300 BCE. Almost nothing is known of his life, and no likeness or first-hand description of his physical appearance has survived antiquity, and so depictions of him (with a long flowing beard and cloth cap) in works of art are necessarily the products of the artist's imagination.

Euclid is often referred to as the “Father of Geometry”, and he wrote perhaps the most important and successful mathematical textbook of all time, “Elements”, which represents the culmination of the mathematical revolution which had taken place in Greece up to that time. He also wrote works on the division of geometrical figures into parts in given ratios, on catoptrics (the mathematical theory of mirrors and reflection), and on spherical astronomy (the determination of the location of objects on the “celestial sphere”), as well as important texts on optics and music.

The “Elements” was a lucid and comprehensive compilation and explanation of all the known mathematics of his time, including the work of Pythagoras, Hippocrates, Theudius, Theaetetus and Eudoxus. In all, it contains 465 theorems and proofs, described in a clear, logical and elegant style, and using only a compass and a straight edge. Euclid reworked the mathematical concepts of his predecessors into a consistent whole, later to become known as Euclidean geometry, which is still as valid today as it was 2,300 years ago, even in higher mathematics dealing with higher dimensional spaces.

Source: https://www.storyofmathematics.com/hellenistic_euclid.html

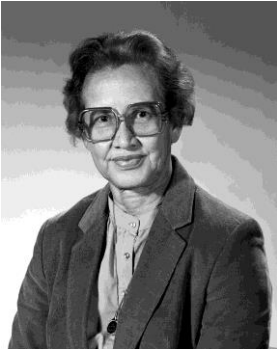
Why is Euclid historically important?

Famous Mathematicians

(LAFS.4.RI.1.1, LAFS.5.RI.1.1)

NAME: _____

Katherine Johnson



Katherine Johnson (1918 –2020) was an American mathematician whose calculations of orbital mechanics as a NASA employee were critical to the success of the first and subsequent U.S. crewed spaceflights. During her 35-year career at NASA and its predecessor, she earned a reputation for mastering complex manual calculations and helped pioneer the use of computers to perform the tasks. The space agency noted her "historical role as one of the first African-American women to work as a NASA scientist".

Johnson's work included calculating trajectories, launch windows, and emergency return paths for Project Mercury spaceflights, including those for astronauts Alan Shepard, the first American in space, and John Glenn, the first American in orbit, and rendezvous paths for the Apollo Lunar Module and command module on flights to the Moon. Her calculations were also essential to the beginning of the Space Shuttle program, and she worked on plans for a mission to Mars.

She helped to calculate the trajectory for the 1969 Apollo 11 flight to the Moon and, in 1970, Johnson worked on the Apollo 13 Moon mission. When the mission was aborted, her work on backup procedures and charts helped set a safe path for the crew's return to Earth, creating a one-star observation system that would allow astronauts to determine their location with accuracy.

In 2015, President Barack Obama awarded Johnson the Presidential Medal of Freedom. In 2016, she was presented the Silver Snoopy Award by NASA astronaut Leland D. Melvin and a NASA Group Achievement Award. She was portrayed by Taraji P. Henson as a lead character in the 2016 film *Hidden Figures*. In 2019, Johnson was awarded the Congressional Gold Medal. Johnson spent her later years encouraging students to enter the fields of science, technology, engineering, and mathematics (STEM).

Source: https://en.wikipedia.org/wiki/Katherine_Johnson

Why is Katherine Johnson historically important?

Famous Mathematicians

(LAFS.4.RI.1.1, LAFS.5.RI.1.1)

NAME: _____

Diophantus of Alexandria



Diophantus was a Hellenistic Greek (or possibly Egyptian, Jewish or even Chaldean) mathematician who lived in Alexandria during the 3rd Century CE. He is sometimes called “the father of algebra” and wrote an influential series of books called the “Arithmetica”, a collection of algebraic problems which greatly influenced the subsequent development of number theory.

He also made important advances in mathematical notation; and was one of the first mathematicians to introduce symbolism into algebra, using an abridged notation for frequently occurring operations, and an abbreviation

for the unknown and for the powers of the unknown. He was perhaps the first to recognize fractions as numbers in their own right; allowing positive rational numbers for the coefficients and solutions of his equations. Diophantus applied himself to some quite complex algebraic problems, particularly what has since become known as Diophantine Analysis, which deals with finding integer solutions to kinds of problems that lead to equations in several unknowns.

Diophantus’ major work (and the most prominent work on algebra in all Greek mathematics) was his “Arithmetica”, a collection of problems giving numerical solutions of both determinate and indeterminate equations. Of the original thirteen books of the “Arithmetica”, only six have survived, although some Diophantine problems from “Arithmetica” have also been found in later Arabic sources. His problems exercised the minds of many of the world’s best mathematicians for much of the next two millennia.

Source: <https://www.storyofmathematics.com/hellenistic-diophantus.html>

Why is historically important?

Math Connections

(MAFS.4.MD.1.1, MAFS.5.MD.1.1)

Name: _____

The measurement marks on a ruler are known as ticks. In the song “Tap Measure,” the characters learn to engage their brains by using fractions to measure items. Now it’s your turn! Using a ruler, measure everyday items around you. Using the chart below, indicate the item’s length to the nearest foot. Then convert the measurement to inches.

ITEM	MEASUREMENT (FEET)	MEASUREMENT (INCHES)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		

If you are ready for an extra challenge, try the same activity using the metric side of your ruler!

Math in Everyday Life

Name: _____

In the first scene of the play, Ms. Hatcher asks the students who can name one thing that, in some way, does not involve math? They quickly realize that from football to eating lunch to video games, all things somehow involve math. Use the chart below to brainstorm ten everyday things that involve math and explain how.

What is an everyday thing that involves math?	Explain how:
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

(LAFS.4.RL.1.3, LAFS.4.W.1.1, LAFS.5.W.1.1)

Name: _____

Complete the directions in the chart below.

[illegible]

Arts Integration

Creation / Improvisation (TH.4.C.1.1, TH.5.C.1.1)

In pairs, improvise a scene based on two friends who have a misunderstanding where one action leads to a bad situation. Try two different ways to respond to the situation and then talk about the best result possible and what could have prevented the situation in the first place. Remember to speak clearly and express your characterizations through your tone, facial expression, and movements.

Reflection (TH.4.S.1.3, TH.5.S.1.3)

Have a class discussion about the performance. Encourage students to address specific elements that worked well and those that could use improvement including using theater vocabulary such as characterization, choreography, and production elements. 5th Graders should also be encouraged to describe what they think and feel about the characters and the story.

Creation (MU.4.S.1.1, MU.5.S.1.1, MAFS.4.NF.1, MAFS.5.NF.1)

Musical notes provide a fantastic lesson in fractions. Without math, time signatures would not exist in music. The most common time signature in music is 4/4 time, thus it is known as common time. The top number tells us how many beats are in each measure. The bottom number tells us the type of beat, and those beats are fractions. Explore this concept with your students, and then encourage them to improvise musical phrases based on characters and themes from the play using a variety of rhythms.

Academic Vocabulary

- **Binary** – something that has two parts or components
- **Calculate** – to find out or determine something using math
- **Decagon** – a figure with ten sides and ten angles
- **Ellipse** – a shape that looks like a flattened circle; oval
- **Fractions** – a part of a whole
- **Hexagon** – a flat, closed figure with six straight sides
- **Hypotenuse** – the side opposite the right angle in a triangle; the longest side of a right triangle
- **Infinity** – something beyond measure; an indefinitely large amount or number
- **Measurement** – the specific size of something
- **Museum** – a building where collections of objects that are important to history, art, or science are kept and shown to the public
- **Nonagon** – a two-dimensional geometric figure with nine sides and nine angles
- **Octagon** – a flat, closed figure with eight straight sides
- **Parallelogram** – a flat, closed figure with four straight sides; the opposite sides are parallel and equal to each other
- **Query** – a question

Arts Vocabulary

- **Adaptation** – alter a text to make it appropriate for the stage
- **Characterization** – use body, voice, and movement to create a representation of a person or animal
- **Choreography** – movements that are combined into a dance
- **Production Elements** – costumes, lighting, props, scenery, and sound that contribute to a production

Standards Alignment: The activities in this study guide are aligned with the standards listed below. When teachers incorporate the arts, they increase student engagement, offer multiple points for students to access the curriculum, and provide alternative means for students to demonstrate what they know.

Language Arts Florida Standards	
Grades 4 & 5	
Reading Literature	
LAFS.4.RL.1.3	Describe in depth a character, setting, or event in a story or drama, drawing on specific details in the text (e.g., a character's thoughts, words, or actions).
Reading Standards for Informational Text	
LAFS.4.RI.1.1	Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
LAFS.5.RI.1.1	Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
Writing Standards	
LAFS.4.W.1.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
LAFS.5.W.1.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

Florida Math Standards	
Grades 4 & 5	
Measurement and Data	
MAFS.4.MD.1.1	Know relative sizes of measurement units within one system of units. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.
MAFS.5.MD.1.1	Convert among different-sized standard measurement units within a given measurement system.

Florida Music Standards	
Grades 4 & 5	
Skills, Techniques, and Processes	
MU.4.S.1.1	Improvise phrases, using familiar songs.
MU.5.S.1.1	Improvise rhythmic and melodic phrases to create simple variations on familiar melodies.

Florida Theater Standards	
Grades 4 & 5	
Critical Thinking and Reflection	
TH.4.C.1.1	Devise a story about an age-appropriate issue and explore different endings.
TH.5.C.1.1	Devise an original performance piece based on an age-appropriate theme or social issue relevant to the school climate and explore different solutions and endings.
Skills, Techniques, and Processes	
TH.4.S.1.3	Use theatre terms to evaluate a live performance and discuss the qualities that directly impacted the audience's response to the production.
TH.5.S.1.3	Evaluate a performance, using theatre terminology, and articulate emotional responses to the whole and parts of dramatic performances.