Teacher's Guide

Donald in Mathmagic Land

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Synopsis

In *Donald in Mathmagic Land*, Donald Duck gets a lesson in math appreciation when he is shown the relevance of math in everyday life. The video begins with Donald wandering into a mysterious land filled with numbers, shapes, and peculiar symbols. A narrator who calls himself "The Spirit of Adventure" informs the world's most skeptical duck that he is about to embark on a journey through the wonderland of mathematics.

Donald is whisked back to ancient Greece to meet Pythagoras, the father of math and music, and after eavesdropping on a secret meeting of Pythagoreans and turning their serene musical trio into a riotous quartet, Donald's journey continues. He takes on numerous roles, including art critic, nature observer, billiards player, baseball player, and even Lewis Carroll's Alice. Through these adventures in Mathmagic Land, Donald—and viewers themselves—come to appreciate how measurements, calculations, shapes, and ratios contribute to music, architecture and art, nature, games, and inventions of all kinds, as well as how math will play a limitless role in the scientific achievements of the future.

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Objectives

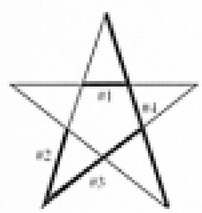
The student will:

- learn how Pythagoras created the mathematical basis for our musical scale of today;
- be introduced to the Golden Section and how it is derived from the pentagram and the Golden Rectangle;
- see how the Golden Rectangle's ideal proportions create pleasing works of art and architecture;
- become aware of the Golden Section's occurrences in nature;
- understand some of the ways in which mathematics is used in games and sports;
- become acquainted with some inventions that have been inspired by imaginative uses of mathematics;
- understand the importance of mathematics in science and technology; and
- see that the usefulness of mathematics is as limitless as our own imaginations.

Background Information

The Pythagoreans

Pythagoreans were students of the mathematical, philosophical, and religious school started by Pythagoras (c. 580 B.C.–c. 500 B.C.). Some historians think that Pythagorean students were expected to listen but not contribute during their first five years at school, and that they were to credit any mathematical discovery to the school or to Pythagoras.

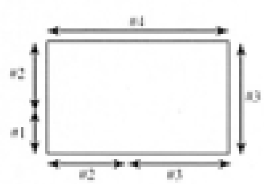


The Golden Section

The lines of a pentagram can be divided into four different lengths. Lines #1 and #2 exactly equal line #3. This partition is a Golden Section. And lines #2 and #3 exactly equal line #4. This partition is also a Golden Section. The ratio of the lengths of the two Golden Sections is $\frac{\sqrt{5}+1}{2}$, approximately 1.618. When this ratio is used to create the length and width of a rectangle, the result is called a Golden Rectangle.

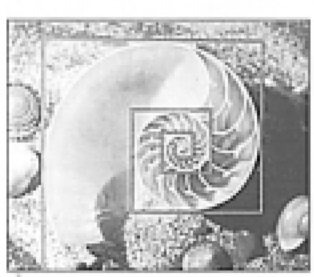
The Golden Rectangle

A Golden Rectangle is a rectangle whose ratio of length to width is approximately 8 to 5, or 1.618. These proportions were greatly admired by the Greeks, and Golden Rectangles are found in classical architecture and art.



The Magic Spiral

A magic spiral isn't magic at all. It is a spiral that repeats the proportions of the Golden Sections of a Golden Rectangle into infinity. Magic spirals can be seen in many of nature's spirals, such as the shell of a sea snail.



The following are examples of art and architecture shown in the video that use the porportions of the Golden Rectangle:

The Parthenon

The Parthenon is an ancient marble temple dedicated to the Greek Goddess Athena. Constructed between 447 B.C. and 432 B.C., this temple is located on the Acropolis in Athens, Greece.

Porch of the Caryatids

The Caryatids are six female statues supporting the south porch roof of the Erechtheum temple. The temple, located on the Acropolis in Athens, Greece, was built between 420 B.C. to 406 B.C. The Caryatids that adorn the temple today are copies, but four of the six originals are housed in the Acropolis Museum.

Venus de Milo

This famous ancient Greek sculpture depicts the goddess Venus. The sculpture was named for the Greek island of Melos where it was discovered in 1820 as it was about to be crushed into mortar. The sculpture was restored, but its broken arms were lost and never replaced. The sculpture is now housed in the Louvre Museum in Paris, France.

Cathedral of Notre Dame of Paris

The Cathedral of Notre Dame in Paris, France, is regarded as the greatest masterpiece of Gothic architecture. It was constructed between 1163 and 1250 and was dedicated to Mary, the Mother of Jesus ("Notre Dame" means "Our Lady" in French). It was restored after the French Revolution ended in 1799.

Mona Lisa

This portrait of a Florentine woman was painted between the years 1503 and 1506 by Leonardo da Vinci (1452–1519). The painting was stolen from France's Louvre Museum in 1911, but was found in a Florence hotel room two years later and returned to the Louvre.

United Nations Secretariat Building

This 39-story building is one of several United Nations (U.N.) buildings located on the 18-acre U.N. complex in New York City. John D. Rockefeller Jr. donated the land and design began in 1947. The Secretariat building was completed in 1950. The U.N. Secretary General's offices are located on the 38th floor.

Who's Who in Mathematics

If you have access to the Internet and want to read full biographies of these mathematicians or choose from over a thousand others, visit <http://www-groups.dcs.st-andrews.ac.uk/%7Ehistory/BiogIndex.html>.

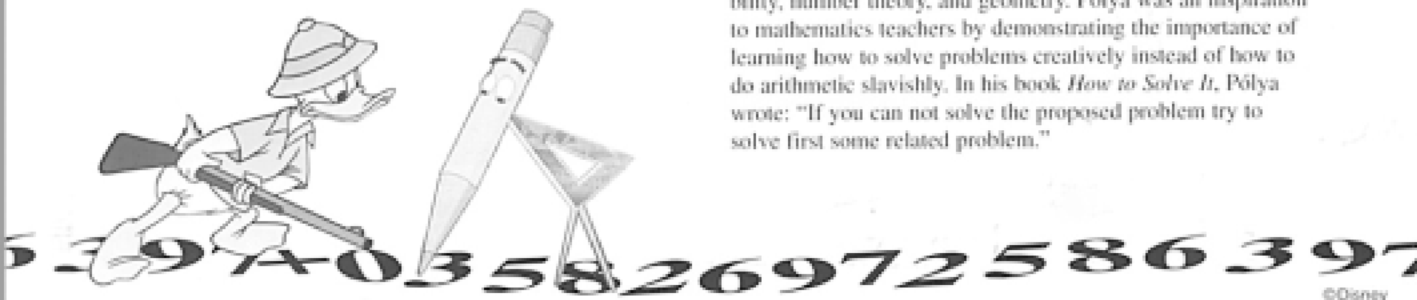
Pythagoras of Samos (c. 580 B.C.–c. 500 B.C.)
Pythagoras was a Greek philosopher and mathematician who left Samos in 532 B.C. and founded a school of philosophy and religion in Italy. The school made significant contributions to music theory, astronomy, and mathematics. The Pythagorean Theorem, $a^2 + b^2 = c^2$, relates the three sides of a right triangle.

Archimedes of Syracuse (c. 287 B.C.–212 B.C.)
Archimedes was a Greek mathematician, scientist, and inventor. He formulated the principles of buoyancy after he stepped into his bath one day and noticed the displacement of water. According to Plutarch, Archimedes was killed during a Roman invasion of Syracuse. Archimedes was studying a math problem and told a Roman soldier he wouldn't leave his home until he had finished it. The angry soldier replied by drawing his sword and killing him.

Hypatia of Alexandria (c. 370–415)
Hypatia was the first known female mathematician. Home-schooled by her father, Hypatia herself became an acclaimed math, philosophy, and astronomy teacher in Alexandria, Egypt. Hypatia edited *On the Comics of Apollonius*, a work that later developed into concepts of hyperbolas, parabolas, and ellipses. At age 45, Hypatia was killed by a mob during a period of religious and civil unrest.

Leonardo Fibonacci of Pisa (c. 1170–c. 1240)
Fibonacci was an Italian mathematician. He was so interested in the mathematical systems he saw while traveling in foreign countries that in 1202, Fibonacci published *Liber Abaci*, Latin for "The Book of the Abacus." This book introduced Arabic numerals and the Hindu-Arabic decimal system into Europe. He discovered the curious sequence: 1, 1, 2, 3, 5, 8, 13, and so forth, in which each number is the sum of the two previous numbers, and the ratio of any term to its predecessor gets closer to the Golden Ratio the further out you go.

Blaise Pascal (1623–1662)
Blaise Pascal was a French mathematician, inventor, physicist, and theologian. He invented the barometer and the hydraulic press, and in correspondence with fellow mathematician Pierre de Fermat, he set the stage for the theory of probability. Pascal died at age 39 of what was probably stomach cancer.



Isaac Newton (1642–1727)
Isaac Newton was an English mathematician and scientist. While homebound during the Bubonic Plague, Newton invented calculus. He later developed influential theories about light, laws of motion, and gravity, although it is doubtful he discovered the principle of gravity after watching an apple fall. During his lifetime he was a Cambridge professor, a Member of Parliament, Master of the Mint, and was knighted in 1705.

Leonhard Euler (1707–1783)
Leonhard Euler was perhaps the most prolific mathematics writer of all time. Euler was born in Switzerland but lived most of his life in St. Petersburg, Russia. He wrote more than 800 books and papers on math, astronomy, and physics, almost half of them after he had gone blind. Many of his notations, such as e and π, are still used today.

Charles Lutwidge Dodgson (Lewis Carroll) (1832–1898)
Charles Lutwidge Dodgson, better known by his pseudonym Lewis Carroll, was born in England and was a mathematics lecturer at Oxford and a deacon in the Anglican Church. He wrote several mathematics books, but is famous for his books *Alice's Adventures in Wonderland* and *Through the Looking Glass*.

Albert Einstein (1879–1955)
Albert Einstein was born in Germany. His teachers doubted he would ever learn mathematics because he had so much trouble calculating sums. Einstein became a lecturer and professor, and won the Nobel Prize for Physics in 1921. Einstein moved to the United States in 1933 after the Nazis forced him from his home and his teaching job in Berlin. He became a professor at Princeton University. His equation $E = MC^2$ led to the evolution of nuclear fission and the atomic bomb. In 1952 Einstein declined an offer to serve as Israel's president.

George Pólya (1887–1985)
George Pólya was a Hungarian mathematician who later moved to the United States. He made contributions to probability, number theory, and geometry. Pólya was an inspiration to mathematics teachers by demonstrating the importance of learning how to solve problems creatively instead of how to do arithmetic slavishly. In his book *How to Solve It*, Pólya wrote: "If you can not solve the proposed problem try to solve first some related problem."

Math Timeline

The timeline below contains some significant events that have occurred throughout the history of math. If you have access to the Internet and want to learn more about these or other events in math history, visit < http://www-groups.dcs.st-and.ac.uk/~history/index.html >.

c. 20000 B.C.

Fossilized Ishango bone marked with counting notches dating back more than twenty millennia is unearthed in Zaire.

3000 B.C.–1000 B.C.

Egyptians, Chinese, and Babylonians record symbolic number systems.

Egyptians and Babylonians use simple fractions.

1000 B.C.–0 B.C.

Pythagoras (c. 580 B.C.–c. 500 B.C.) develops Pythagorean theorem, discovers the octave, & develops a musical scale.

Babylonians create a symbol for 0 around 300 B.C. They develop the first place-value number system around 250 B.C.

Archimedes (c. 287 B.C.–212 B.C.) calculates *pi* to two decimal places around 260 B.C.

Hindu-Arabic numerals (1–9) written on pillars in India date back to around 250 B.C.

0 B.C.–1000 A.D.

Mayans use dot and line system to represent numbers. A blank space is used to represent zero.

Tsu Ch'ung-Chi (430–501) and his son calculate *pi* to six decimal places around 450.

The Hindu-Arabic decimal place-value number system is developed in or near India and zero is given a numeric representation.

The abacus, a manual calculator, is invented between 900 and 1000.

1000–1600

Fibonacci (c. 1170–c. 1240) introduces Hindu-Arabic numerals and the decimal point to Europe in his book *Liber Abaci* in 1202.

Robert Recorde (c. 1510–1558) creates the equals sign around 1557.

1600–1900

William Oughtred (1574–1660) invents the slide rule in 1632.

Wilhelm Schickard (1592–1635) invents a six-digit calculator that adds and subtracts.

Isaac Newton (1642–1727) invents calculus and develops his theories about light, laws of motion, and gravity.

August Möbius (1790–1868) invents the Möbius strip in 1858.

1900–1950

Albert Einstein (1879–1955) completes his theory of general relativity in 1915.

ENIAC, the first computer made almost entirely of electronics, is introduced in 1946.

Pi is calculated to 2,037 decimal places using ENIAC computer in 1949.

1950–Present

UNIVAC I, the first mass-produced electronic computer, is completed in 1951.

Pi is calculated to 100,000 decimal places in 1961.

Texas Instruments introduces a portable electronic calculator in 1971.

Apple Computer introduces the Apple II personal computer in 1977.

Pi is calculated to 134 million decimal places in 1987.

Preview Questions

1. What is your first thought when you hear the word "math"? Do you think math is fun? Did you ever see anything in math that surprised you?

2. Do you ever use math to solve everyday problems? How?

3. Who was Pythagoras? Who do you suppose the Pythagoreans were? Can you name any other mathematicians?

4. Can you name some ways that math is present in nature? In architecture or art? In sports or games?

Postviewing Questions

1. Pythagoras was a Greek mathematician. What are some of the mathematical contributions he made?

2. What is a Golden Rectangle? Why is it important in architecture and art? Look around you right now. Do you see anything that looks like a Golden Rectangle in your classroom?

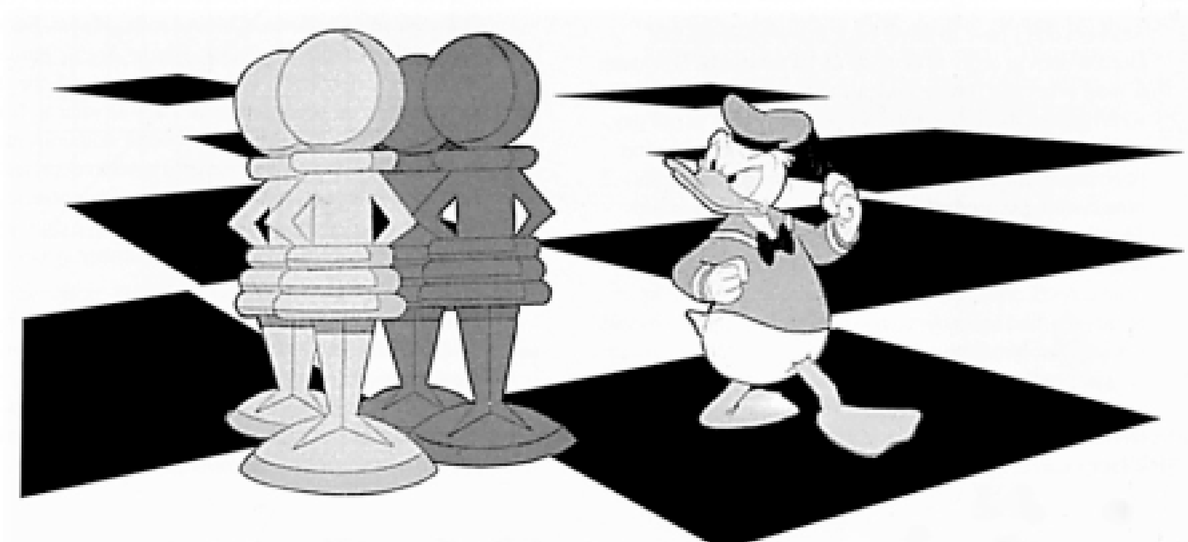
3. Pythagoras wrote, "Everything is arranged according to number and mathematical shape." What do you think he meant by this? Do you agree with him? Why or why not?

4. What are some ways that math is a part of your daily life? What about the lives of the people in your community? The government?

5. Can you suggest some ways that math is present in nature?

6. The video refers to a number of games that rely on geometric or other math principles in order to be played. What were some of these games and how is math used in them? What other games do you know of that use math principles in some way?

7. The video spans three millennia and shows mathematical achievements from ancient to modern times. What are some inventions that exist today that weren't shown in the video? Name some ways that math is used in these achievements.



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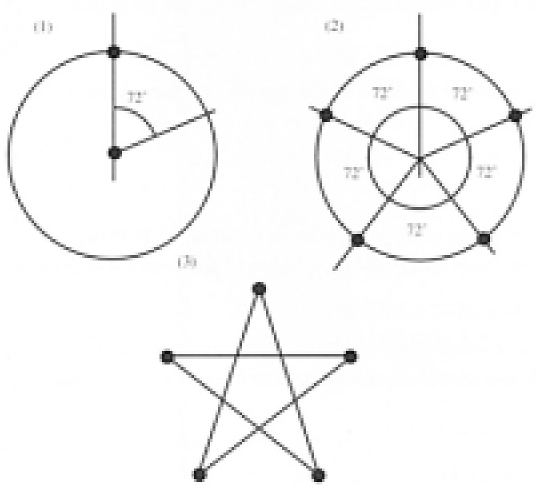
Suggested Activities

Here are some activities you might want to do with your class. Note that many of the activities listed for one grade level can be easily adapted for use at another grade level.

Grades 4-6

1. The equal-sided pentagram was the Pythagoreans' emblem. Provide protractors and pencils and allow students to experiment with the shape's construction, or share these steps: (1) Use a pencil to draw a circle with a lid or similar object on a piece of paper and mark the center of the circle. (2) Locate five equally spaced points (one for each tip of the pentagram) around the circle using a protractor. *(Hint: A complete circle is 360°. If the five points are equally spaced around the circle, then each arc of the circle is 360° ÷ 5 = 72°. Draw a point at the top of the circle and use the protractor to mark 72° around the circle until you come back to the point at the top.)* (3) Erase the circle and its center and all the construction lines, and then join the five points as shown.



2. Students don't have to travel back three millennia like Donald does in order to develop an awareness of how math is used every day. Invite students to look around their school with mathematical eyes for a set period of time (a full day, an hour, a recess or lunch break). Reproduce the chart on page 11 for students to list ways math is used during this time period. Let students share their lists in small groups. Then have each group vote for their most interesting or unusual findings and share them with the entire class.

3. Some jobs like accounting and bank telling require obvious math skills, but math is an important part in performing all jobs, even if it used in less obvious ways. Lead the class in brainstorming careers that require math skills. Divide students into groups and allow each group to select a career or assign one of the following:

airline pilot	grocery store manager
police officer	stay-at-home parent
school principal	zookeeper
heart surgeon	auto mechanic
film producer	building contractor

   Have students discuss and record how people with that job might use mathematics while they work. Ask students to share their results with the class and encourage other students to add their own ideas.

4. The video showed many examples of how mathematical logic is present in nature. Have students go on a scavenger hunt at school, at home, or in the community with meter sticks and collect objects in nature or pictures from magazines that contain the shape of the pentagram, the magic spiral, the Golden Ratio (a ratio of length to width of approximately 8 to 5), or interesting patterns. Provide a large bulletin board on which students can create a giant collage with their pictures. Display their objects by category.

5. Have students learn about a mathematician who shares their birthday. If you have access to the Internet, students can quickly find the names of more than one by visiting <http://www-groups.dcs.st-and.ac.uk/~history/Day_files/Year.html>. Have students learn some interesting facts about the mathematicians they choose and share those facts with the class—perhaps on their birthday!

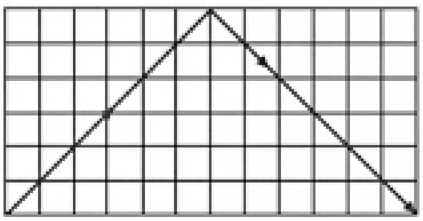
6. In the video, Donald travels back to Pythagoras's time—about 530 B.C. Math and numbers existed in many other ancient societies, too. Assign groups of students one of the following numeral systems: Egyptian hieroglyphs; Babylonian cuneiform; Chinese rods; Mayan bars and dots; ancient Greek alphabet; Hindu-Arabic numerals; and Roman numerals. Have groups research the numeral system they've been assigned. They'll want to find out what symbols were used to represent numerals and learn to draw them, how each numeral system depicted numbers higher than 9, how they added and subtracted, and whether the system continues today. Have each group teach their classmates about their number system.

7. Ask students to select their favorite sport or hobby and think of the ways that math is used in it (scoring, measuring, distance and time, averaging, etc.). Provide time for students to share their sport or hobby and the mathematical principles in it through demonstrations, pictures, props, or multimedia presentations.

Grades 7-8

1. Provide students with graph paper (an 8.5 by 11 sheet of 1/4 or 1/2 inch grid paper will do) to play math billiards, a variation on the billiards game in the video. Explain how a ball that is hit at a 45° angle from any corner of the table will bounce off the opposite side at the same angle of 45°. On their grid have students draw a rectangle 12 spaces long and 6 spaces high and trace the path of a ball hit from the lower left corner at a 45° angle (illustration a). Have them continue the path after the ball hits the opposite side, and explain that the path ends in the lower right corner (because the ball stops when it hits a corner).

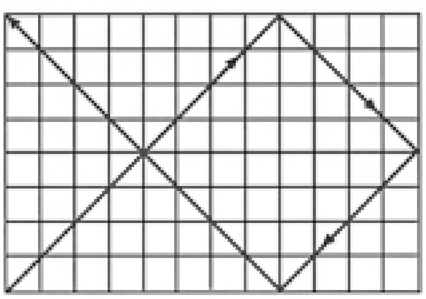
(a)



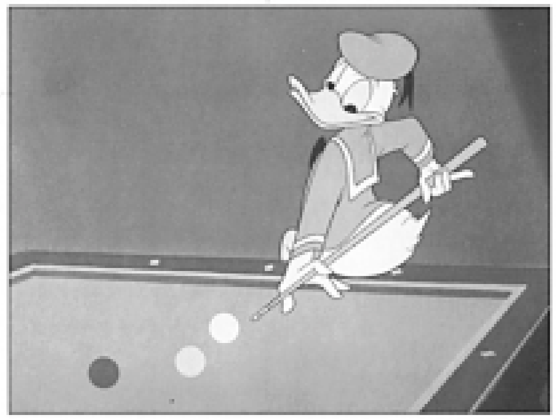
12 x 6 rectangle

Have students experiment to find different sized rectangles where the ball follows the same pathway. Ask them to find the smallest one possible with the same pathway. This is called the "reduced" rectangle. Then divide the class into small groups. Have the students in each group draw the path of the ball hit from the lower left corner at a 45° angle on rectangles 12 spaces long and 3, 5, 8, and 10 spaces high, assuming a different height for each group (illustration b). Have each group experiment to find the "reduced" rectangle with the same path for its rectangle. Have the groups share their results with the others and help them see the similarity with the problem of reducing fractions.

(b)



2. In the video, Donald learns that sometimes math is all fun and games. Invite students to demonstrate a card trick, magic trick, or mind teaser that uses math in some way. Students may want to look through books to get ideas, or if they have access to the Internet they can visit <http://www.cut-the-knot.com/games.html> or <http://www.scri.fsu.edu/~dennisl/CMS/activity/math_magic.html>.



Have students try to guess the math principle(s) involved in each trick and let the demonstrator explain if no one guesses correctly.

3. Donald goes back in time and learns that Pythagoras and his followers shared their ideas in secret. Divide students into small groups and ask each group to choose a location in the world (Egypt, Greece, Persia, China, Europe, etc.) to research from a mathematical perspective. Ask each group to become experts on the place, time, and mathematicians who lived there. Why was math important to them and what was their contribution to mathematics? How did society react to these mathematicians and their ideas? Each group should present their findings through playacting, posters, multimedia presentations, or other creative visual ways.

4. If your school has access to musical instruments, let students experiment carefully with a stringed instrument like an acoustic guitar. Tune two of the strings to make the same note. In the middle of one string place your finger lightly and allow students to plink the two strings. Do the notes harmonize (sound good to their ears)? Then place your finger at a point that is 1/3 the length of the string; 1/4; 1/5; 2/5; 3/5; and 4/5. How do the notes sound together?

5. The video shows how the concept of the Golden Rectangle influenced architecture through the ages. Explain to students that people around the world design homes and buildings with shapes they find visually pleasing and practical for their needs. Have students design houses or buildings that are visually pleasing to them and make a model of them out of empty boxes, heavy paper, and other materials. You might want to provide pictures of a variety of structures, such as a conical tipi, the Pentagon in Washington, D.C., a Kenyan round house, a medieval European castle, and an Egyptian pyramid to

generate ideas. Display the models in your classroom and provide time for students to explain the mathematical principles behind their designs.

6. Have students interview a professional to find out how he or she uses math on the job. Students may choose family members, friends, neighbors, or other members of the local community. Ideally, students will visit their subject's place of employment to see for themselves how math is used, but home or telephone interviews are acceptable as well. Students should ask questions such as, "How do you use math in your job?" "How often do you use math?" Provide time for students to share what they learned in small groups, and ask each group to summarize their findings and share them with the entire class.

7. Bring in a weekend edition of your local newspaper and give groups of students a section, such as World News, Local News, Weather, Sports, Business, Travel, Classifieds, and so on. If your local paper is too small to divide among all of the groups, provide a larger metropolitan paper instead. Instruct each group to analyze their section of the newspaper and circle anything in the layout or articles they find that pertains to math.

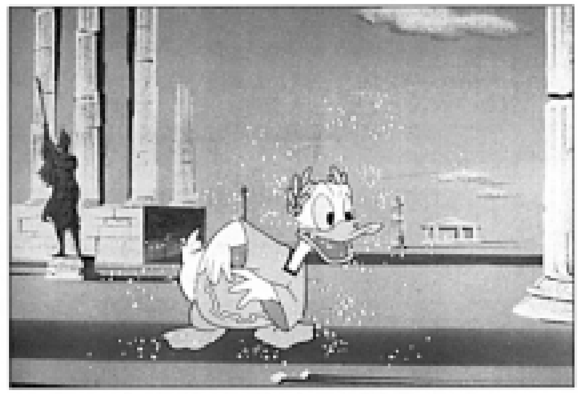
8. Mathematical thinking has opened many doors to the exciting adventures of science and invention. Have students choose a scientific invention such as the telescope, and find out the math that was involved as a basis for the invention's discovery.

Grades 9-12

1. Enlarge and reproduce the pentagram on page 2 and give each student a copy with a metric ruler. Use a calculator to compute the ratios of the lengths of lines #1 and #2 (divide the longer length by the shorter), the lengths of lines #2 and #3, and the lengths of lines #3 and #4. If students are careful in measuring they will get the same ratio (lines #1 and #2 exactly equal line # 3, and lines #2 and #3 exactly equal line #4.) Challenge students to figure out the Golden Ratio accurately using algebra. *(Let the length of line #1 be one unit and the length of line #2 be x. The Golden Ratio is the ratio of the length of #2 divided by the length of #1, which is x ÷ 1. But since the Golden Ratio is the length of #3 divided by the length of #2, and since the length of #3 is x + 1, we see that the Golden Ratio is also (x + 1) ÷ x, so it must be that:*

$$\frac{\#2}{\#1} = \frac{\#3}{\#2} = \frac{\#2 + \#1}{\#2} \quad or$$

$$\frac{x}{1} = \frac{x+1}{x}$$



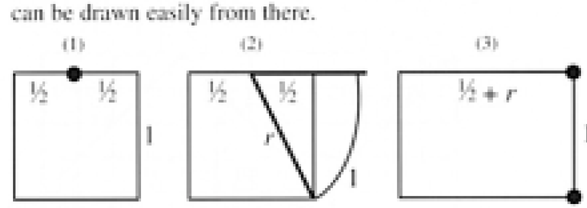
That equation is equivalent to the following:

$$x^2 = x + 1$$

$$or \quad x^2 - x - 1 = 0$$

The positive solution to that equation is $x = \frac{1+\sqrt{5}}{2}$, *which is approximately 1.618034.)*

2. It is possible to construct a Golden Section with just a ruler and a compass. (1) Start with a square that is the width of the Golden Section. Find the midpoint of the top side of the square and set the compass points on the midpoint and one of the opposite corners of the square. (2) Strike the arc of a circle with its center at the midpoint and mark where the top side of the circle meets the arc. (3) That point is the corner of the Golden Section, which can be drawn easily from there.



Let the side of the square be 1 and let r be the radius of the circle. Then use the Pythagorean Formula ($c^2 = a^2 + b^2$) to show that $r = \frac{\sqrt{5}}{2}$

Then the length of the Golden Section is $\frac{1}{2} + \frac{\sqrt{5}}{2}$, the same equation that can be found algebraically.

3. The Golden Rectangle is any rectangle whose ratio of length to width is approximately 8 to 5. Ancient Greeks thought these proportions were attractive and used them in their architecture and art. Many people still do to this day. Have students go on a Golden Ratio hunt around school and at home with a meter stick. Have students measure things carefully and bring in a few items that come the closest to having the Golden Ratio. Remind students that as the video demonstrated, the Golden Ratio can be found in nature as well as in man-made things. As an extension of this activity, you can ask students to design something that uses the Golden Ratio. Students with Internet access might want to visit the Rectangles All Around site and do some online activities connected with Golden Rectangles: <http://math.rice.edu/~lanius/Geom/golden.html>.

4. Have students attend a game at school or in their neighborhood, or view one on television, and observe the event from a mathematical perspective. Some aspects of the game you might encourage students to analyze include the geometric makeup of where the game is played; the skill required to play the game such as logic, power, or finesse; how the game is measured or scored; and how statistics are calculated. Invite students to share their results with the class.

5. Invite students to create a Web page or book that is a collection of situations that teenagers typically find themselves in with descriptions of how math is useful in each. Have students submit their scenario ideas to you first in order to ensure that each student contributes an original topic. Scenarios can be creative and humorous as long as the math connections make logical sense. Students with access to the Internet can visit the "What Good is Math?" site at <http://www.richmond.edu/~ed344/96/math/> if they need ideas to get started, or you can write these ideas on the blackboard:

shopping at the mall	planning a party
buying a car	being treasurer of a club
eating lunch	playing in the school band

6. Because *Donald in Mathmagic Land* was produced before the advent of personal computers, there is no mention of their important contribution to society. Have students research and make a book, video, or multimedia presentation in the style of *Donald in Mathmagic Land* that shows the history of computers. Have students start with the earliest computers and the inventors responsible for their creation and move forward to the personal computers, modems, and other computer technology available today. Students will also want to record some of the things people are able to do now because of this technology that couldn't be done fifty years ago.

7. The tangram puzzle is an excellent example of a game that applies math logic. In this ancient Chinese game, seven geometric pieces are used to create designs. Find reproducible tangram puzzle pieces in a book or at the Strong Museum Internet site at <http://www.strongmuseum.org/kids/tangram.html>. Reproduce the pieces onto brightly colored paper and have students try to use all seven pieces (a square, a rhomboid, and five triangles) to create their tangram designs. You might suggest they try to make a chair, a shirt, a rooster, or a sailboat. Answers to these tangram puzzles and additional ideas can also be found at the Strong Museum Internet site.

8. Donald learns that there are no limits to what the imagination can come up with. A great number of the world's inventions are the result of a person solving a problem in an imaginative way. Place a variety of items on a table somewhere in your classroom. Provide both practical and seemingly impractical things like duct tape, ball bearings, popsicle sticks, rubber bands, a pencil, marshmallows, and so on. Tell students who are interested that they can invent anything they want using at least one of those items, from the serious to the whimsical, but the invention should be functional. Display finished inventions and have students discuss what their inventions are and some of the challenges they encountered while making them.

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Bibliography

If you liked the topics in *Donald in Mathmagic Land*, here are some books about math appreciation, the history of math, and using math in fun and creative ways that you might also enjoy:

The Billiard Congress of America. *Billiards: The Official Rules and Records Book.* New York: Lyons & Burford, 1992.

Cole, K.C. *The Universe and the Teacup: The Mathematics of Truth and Beauty.* New York: Harcourt Brace & Company, 1998.

Jacobs, Harold R. *Mathematics: A Human Endeavor.* New York: W. H. Freeman & Company, 1970.

Katz, Victor. *A History of Mathematics: An Introduction.* New York: HarperCollins College Publishers, 1993.

Muschla, Judith A., and Gary Robert Muschla. *The Math Teacher's Book of Lists.* Englewood Cliffs, New Jersey: Prentice Hall, 1995.

Ohanian, Susan. *Garbage Pizza, Patchwork Quilts, and Math Magic.* New York: W. H. Freeman, 1993.

Stewart, Ian. *The Magical Maze: Seeing the World Through Mathematical Eyes.* New York: John Wiley & Sons, Inc., 1997.

Thiessen, Diane, and Margaret Matthias. *The Wonderful World of Mathematics: A Critically Annotated List of Children's Books in Mathematics.* Reston, Virginia: National Council of Teachers of Mathematics, 1992.

Wakeling, Edward. *Lewis Carroll's Games and Puzzles.* New York: Dover Publications, 1992.

Internet Resources

If you have access to the Internet, here are some math Web sites you might find helpful:

Ask Dr. Math
http://forum.swarthmore.edu/dr.math/index.html
The good doctors at Swarthmore College are on call to answer any math-related questions you or your students might have. The Ask Dr. Math archives, indexed by subject, are loaded with answers to previous mind-bogglers pertaining to math history, mathematicians, and hundreds of other math topics.

The Cornell Theory Center
http://www.tc.cornell.edu/Edu/MathSciGateway/
This site includes links to math-related topics such as astronomy, biology, computers, and health and medicine. Intended primarily for high school students and their teachers, the site also has links to research articles, history connections, college information, and more. The site was developed by the Cornell Department of Education.

Ivars Peterson's MathLand Archives
http://www.maa.org/mathland/mathland_archives.html
This archive site contains Ivars Peterson's entertaining weekly column on real-world math written for the Mathematical Association of America (MAA). Past columns include "Math and a Music Education," "Pythagoras Plays Ball," and "Billiards in the Round." Find current columns on MAA's homepage: <http://www.maa.org/Welcome.html>.

MacTutor History of Mathematics Archive
http://www-groups.dcs.st-and.ac.uk/~history/index.html
This site includes an enormous amount of information, including biographies of more than 1,100 male and female mathematicians, birthplace maps and a birthday calendar, articles on mathematical history topics, chronologies, and more. The University of St. Andrews' School of Mathematical and Computational Sciences maintains this site.

The Math Forum Internet Resource Collection: Math History
http://forum.swarthmore.edu/~steve/steve/mathhistory.html
This site includes over 200 math history links arranged in alphabetical order and provides optional annotations for each link. This site is maintained by Swarthmore College.

The Math Forum: Teachers' Place
http://forum.swarthmore.edu/teachers/
This site provides activities and projects, teacher-developed lesson plans, links to fun sites for kids, and information on a variety of topics tailored for grades K-2, grades 3-5, middle school, and high school. This site is brought to you by Swarthmore College and is funded by the National Science Foundation.

Mega Math
http://www.cs.uidaho.edu/~casey931/mega-math/menu.html
This site provides a fine collection of math-related activities as well as math vocabulary and links to other sites. This site is a project of the Computer Research and Applications Group at Los Alamos National Laboratory.

National Council of Teachers of Mathematics (NCTM)
http://www.nctm.org/
NCTM's homepage includes organization and membership information, NCTM publication listings, job classifieds, news and notable items, and links to other math sites.

Topics for More Information

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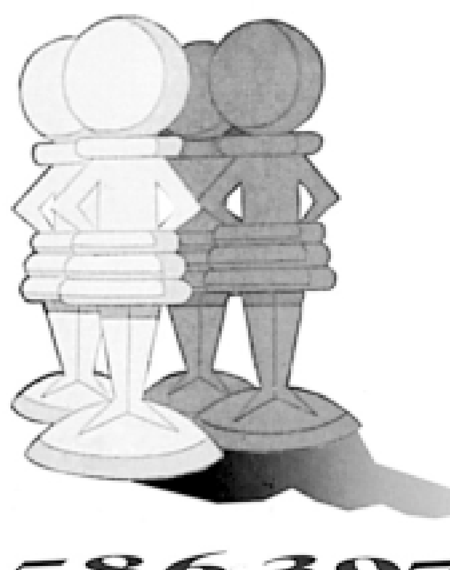

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Math Around Us

Mathematics is everywhere—just take a look around.
List some things you see. Try to find more than one thing for every category.

Numbers and Counting

Measurement

Geometry

Probability and Statistics

Fractions

Patterns

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