How to use ratios

By Gale, Cengage Learning, adapted by Newsela staff on 12.22.17
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Image 1. In a Golden Spiral, a spiral gets larger and larger by an amount known as the Golden Ratio. Although the dimensions are not exact, sea shells are often compared to Golden Spirals. Photo from Pxhere.

A ratio is used to compare two quantities. Examining the ratios between two or more values often helps us understand the patterns and behaviors of numbers.

Ratios exist naturally throughout the universe. The ratio of the size of one planet to another nearby planet can affect the movement of both planets. The ratio of owls to mice plays a big role in the survival of both species. The ratio of height to trunk width determines how large a tree can grow.

Humans have used ratios throughout history. For example, a building depends on several ratios involving height, width, angles and the strength of materials to stay up. People around the world use ratios each day to organize time and money. Ratios are fundamental concepts in math.

The Main Math Concepts And Terms

A ratio between two numbers is usually expressed in one of three ways. Let's say you live on a street where there are 12 cars for every three trucks. The ratio of cars to trucks can be written as 12/3, as 12:3, or as "12 to 3." Given this information, it is also true that the ratio of trucks to cars is 3/12, 3:12, or "3 to 12." All of these expressions state that for every 12 cars, there are three trucks.

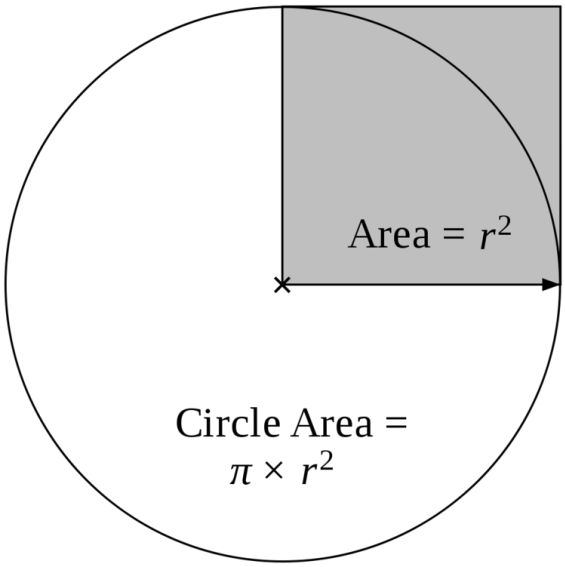
In a ratio, whatever happens to one of the numbers also happens to the other. If six trucks can be seen in driveways around the neighborhood, the ratio says there are 24 cars hidden in garages. The number of trucks was multiplied by 2, so the number of cars doubles as well. Division of ratios works in the same way.

Ratios can be multiplied together to discover new ratios. Money is a good example. There are four quarters to every dollar and five nickels to every quarter. That means there are 20 nickels to every dollar. You can then multiply the five pennies in each nickel by 20 (the number of nickels in a dollar) to get 100 pennies to every dollar.

Ratios are not exactly the same as fractions. For example, if Otis has two dogs and four cats, then the ratio of dogs to cats in his house is two to four, which simplifies to 1:2 or 1/2. This shows that there are half as many dogs as cats. However, the fraction of animals in Otis' house that are dogs is two out of the total number of animals, or 2/6. This simplifies to 1/3, meaning one-third of all of his animals are dogs.

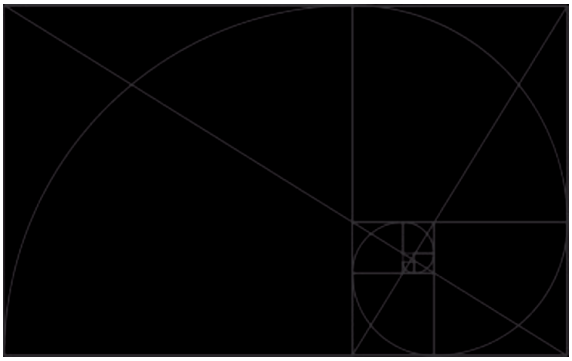
A Brief History

The term ratio is an early 16th-century Latin word meaning reason or computation. However, people have used ratios long before then.



For example, the Greek mathematician Archimedes discovered the exact ratio between a circle's diameter and circumference more than 2,000 years ago. Other people came close thousands of years before that. The circumference of a circle is equal to the diameter multiplied by this ratio, which is about 3.14159. So if a circle is 1 inch wide, it is 3.14159 inches around. This ratio is commonly represented by the Greek letter pi.

Another important ratio studied throughout history is the Golden Ratio. This ratio is also known as the Golden Mean and has many other names. The Golden Ratio is approximately 1.618:1. It is usually shown by the Greek letter phi (φ).



The Golden Ratio is found throughout nature. It is seen in leaves, pinecones, seashells and even the reproductive patterns of certain animals. The Golden Ratio may have been used in the architecture of the ancient Egyptians, Greeks and Romans. Some ancient Egyptian hieroglyphics show signs of the Golden Ratio as well. Later, Leonardo da Vinci, Mozart and Beethoven purposely used this ratio in their works.

Length Of A Trip

Ratios can be used to estimate length. For example, suppose that Tom needs to drive from New York to Miami. His map of the United States has a scale, which is a bar in the corner. The bar represents 100 miles. He uses his ruler and finds that the bar is one inch long, so the ratio of inches to miles on Tom's map is 1:100.

He can estimate the length of his trip based on the inch to mile ratio of 1:100. All he needs to do is find out how many inches separate New York and Miami on the map. The shortest driving route is not a straight line, so he must estimate how long the route is on the map. He uses a ruler to measure it and finds that the route is a little less than 13 inches long.

Tom then wants to find out how many miles are represented by 13 inches. He has to multiply the ratio by 13 to get 13:1,300. This ratio shows that 13 inches on the map stand for 1,300 miles in the real world. So, Tom's trip will be about 1,300 miles long.

Sports

Ratios are often used to judge an athlete or sports team. The relationship between two or more numbers is often more useful than a single number alone.

As an example, basketball players are partly measured by their assist-to-turnover ratio. An assist is any pass that leads right to a basket, and a turnover is anything that causes the ball to go to the other team. Suppose Gary has had 53 assists this year, and has turned the ball over to the other team 44 times. Gary's assist-to-turnover ratio is 53:44.

Every pass he throws could be an assist or a turnover. Assists are good and turnovers are bad. Because of this, the ratio between them is more important than either number alone. For example, someone with a ratio of 18:25 may not have many turnovers, but they have even fewer assists. Therefore, this is a bad ratio to have.

Healthy Living

A person's height-to-weight ratio is the relationship between how tall that person is and how much that person weighs. If a person is 6 feet tall and weighs 180 pounds, then the height-to-weight ratio is 6 feet to 180 pounds. That can be simplified to 1 foot per 30 pounds. This ratio can show how healthy a person is. There are, of course, many other important considerations to find the best weight for someone. All of these factors can be written as ratios.

Quiz

1 Read the conclusion below.

> *Maps use a ratio to create a scale that allows travelers to determine the distance between two locations.*

Which sentence from the section "Length Of A Trip" provides the BEST support for the statement above?

(A) His map of the United States has a scale, which is a bar in the corner.

(B) He can estimate the length of his trip based on the inch to mile ratio of 1:100.

(C) The shortest driving route is not a straight line, so he must estimate how long the route is on the map.

(D) So, Tom's trip will be about 1,300 miles long.

2 Read the section "A Brief History."

Select the detail from the article that suggests that an understanding of the Golden Ratio stretches back thousands of years.

(A) The term ratio is an early 16th-century Latin word meaning reason or computation.

(B) The Golden Ratio is approximately 1.618:1. It is usually shown by the Greek letter phi (φ).

(C) The Golden Ratio may have been used in the architecture of the ancient Egyptians, Greeks and Romans.

(D) Later, Leonardo da Vinci, Mozart and Beethoven purposely used this ratio in their works.

3 Read the paragraph from the section "Sports."

> *Ratios are often used to judge an athlete or sports team. The relationship between two or more numbers is often more useful than a single number alone.*

HOW does this paragraph contribute to the entire article?

(A) It shows one way that ratios can be used in real life.

(B) It shows how ratios can be used to predict the outcome of an event.

(C) It explains the limitations of ratios in the world of sports.

(D) It explains how sports ratios are different than mathematical ratios.

4 Read the section "The Main Math Concepts And Terms."

What does this section explain that other sections do NOT?

(A) the most common uses of ratios

(B) the role of ratios in the history of mathematics

(C) how ratios create mathematical patterns

(D) why ratios and fractions are similar

Answer Key

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