

Ask®

Got Numbers?

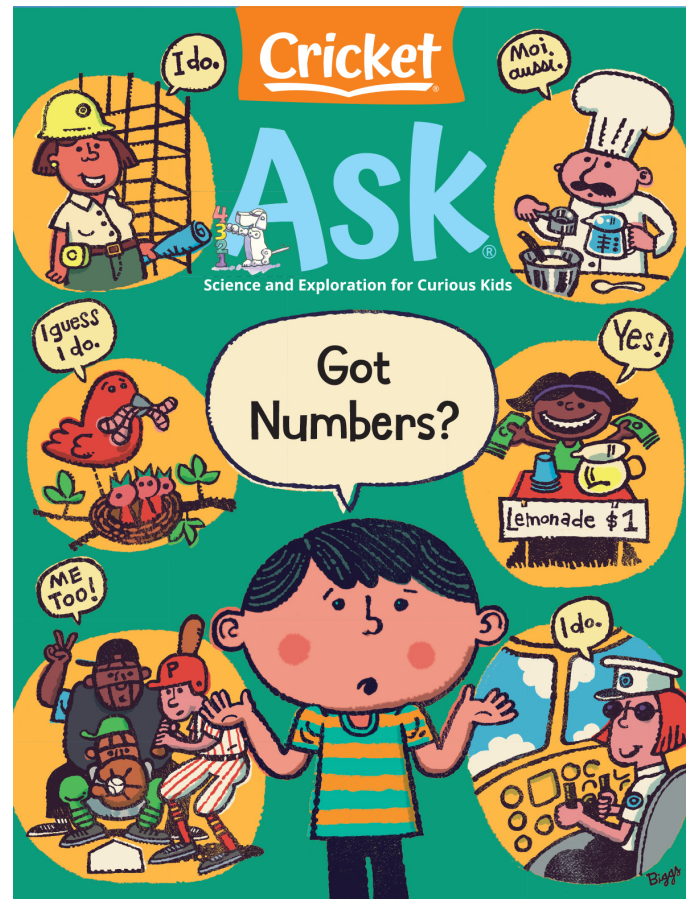
This month's issue of ASK magazine combines science and mathematics to explore number systems and concepts. In addition to learning about a famous mathematician, readers will discover why a strong number sense is beneficial for all creatures living in the natural world.

CONVERSATION QUESTION

How do numbers help us to make sense of the world?

TEACHING OBJECTIVES

- Students will learn about the life of Italian mathematician Leonardo Fibonacci.
- Students will learn how numbers were represented in ancient cultures.
- Students will learn how a number sense is useful for animals in the natural world.
- Students will investigate a series of numbers.
- Students will interpret ancient number systems.
- Students will obtain information from a nonfiction text.
- Students will plot geographical locations on a map of the world.
- Students will calculate totals utilizing number systems studied in the article.
- Students will learn to count to ten in different languages.



In addition to supplemental materials focused on core STEM skills, this flexible teaching tool offers vocabulary-building activities, questions for discussion, and cross-curricular activities.

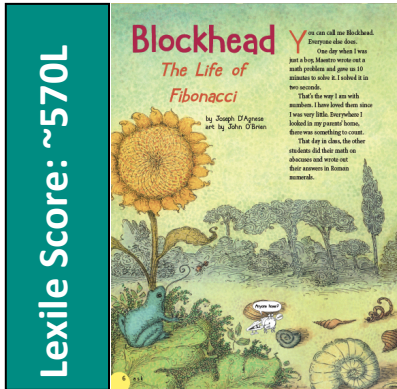
SELECTIONS

- **Blockhead**
Biography, ~570L
- **Who Needs Numbers?**
Expository Nonfiction, ~980L
- **Can Animals Count?**
Expository Nonfiction, ~1070L

Blockhead

pp. 6–13, Biography

This article tells the story of Leonardo Fibonacci, a young Italian daydreamer who eventually became known as the most talented Western mathematician of the Middle Ages.



RESOURCES

Mother Nature's Numbers:
Investigating Patterns

OBJECTIVES

- Students will learn about the life of Italian mathematician Leonardo Fibonacci.
- Students will investigate a series of numbers.
- Students will plot geographical locations on a map of the world.

KEY VOCABULARY

- **time-consuming** (p. 6) using or needing a great deal of time
- **absent-minded** (p. 7) having or showing a lack of attention

ENGAGE

Conversation Question: How do numbers help us to make sense of the world?

Tell students that “Blockhead” is essentially the story of young boy who pursued his true passion and as a result made an important contribution to the field of mathematics. Ask students to share accounts of real people and fictional characters who followed their passions, despite obstacles. Why can it be difficult to follow your dreams?

INTRODUCE VOCABULARY

Post, read aloud, and discuss the key words. Guide students to notice that both terms are hyphenated adjectives. Have students work in pairs to figure out the meaning of each word by thinking about the meaning of its parts. Have students record the word meanings. Then show the definitions and have students compare them to the meanings they came up with.

READ & DISCUSS

After students read the article, pose the following questions to students to prompt meaningful discussion.

1. What strategies were Leonardo Fibonacci’s classmates using to solve math equations in 1178?
2. How did Fibonacci get the nickname Blockhead?
3. Why did Signor Bonaccio take his son to live in Africa?
4. How did Leonardo continue to pursue his passion for numbers even while working for his father?
5. Why was Leonardo in favor of using Hindu-Arabic numerals? Why did people resist?
6. What connection did Leonardo’s number sequence have to the natural world?

SKILL FOCUS: Investigating Patterns

INSTRUCT: Explain that Fibonacci’s curious pattern of numbers later became known as the Fibonacci sequence. Review the pattern—each number in the Fibonacci sequence is the sum of the two previous numbers. Use the first five numbers of the sequence (0, 1, 1, 2, 3) to demonstrate the pattern. Distribute *Mother Nature’s Numbers: Investigating Patterns*. Instruct students to fill in the missing numbers by calculating the next number in the sequence.

ASSESS: Review answers with the class (**A:** 3, 8, 13; **B:** 144, 610, 987; **C:** 4,181, 10,946, 75,025). Evaluate Think Tank responses individually.

EXTEND

Geography Instruct students to reread the article and highlight all of the geographical locations contained in the text. Provide pairs of students with a world map and have them plot and label each location with a brief description of what Fibonacci learned from the region.

Mother Nature's Numbers

Investigating Patterns Calculate the next number in the series by applying the Fibonacci sequence.

A

0; 1; 1; 2; _____; 5; _____; _____; 21; 34

B

55; 89; _____; 233; 377; _____; _____; 1,597

C

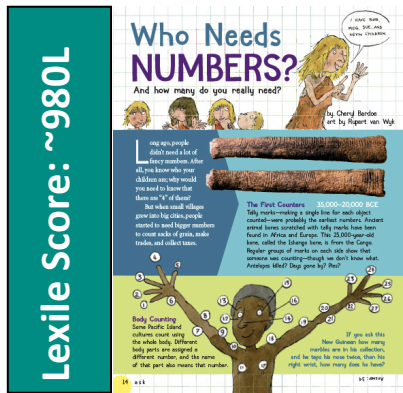
2,584; _____; 6,765; _____; 17,711; 28,657; 46,368; _____

Think Tank: On page 13 of the article, Alfredo comments to Fibonacci, "These are the numbers Mother Nature uses to order the universe." Use the back of this paper to explain the meaning of that comment. Refer to article pages 12–13 to gather evidence to support Alfredo's claim.

Who Needs Numbers?

pp. 14–17, Expository Nonfiction

Students can count on this article to provide them with a detailed history of numbers. From tally marks to the invention of zero, humans have continually used formal number systems to create order in the world.



RESOURCES

Count on It!: Analyze and Interpret

OBJECTIVES

- Students will learn how numbers were represented in ancient cultures.
- Students will interpret ancient number systems.
- Students will calculate totals utilizing number systems studied in the article.

KEY VOCABULARY

- **tally (p. 14)** a way of keeping count by drawing marks
- **hieroglyphs (p. 15)** a system of writing using pictorial characters
- **cuneiform (p. 15)** wedge-shaped characters impressed onto clay tablets used in ancient writing systems

ENGAGE

Conversation Question: How do numbers help us to make sense of the world?

As a prereading activity, begin a brainstorming web with the Conversation Question above in the center. Activate prior knowledge by having the students contribute information to the web. Encourage them to think about real-life experiences with numbers. Post the title of the article and prepare to read.

INTRODUCE VOCABULARY

Post the key terms and discuss the definitions. Tell students they will be creating a word-search puzzle using these three words, in addition to another 17 theme-related words. Suggest that they highlight topical words as they read for use in the word search. Share the puzzles with another class for use as a motivational exercise for this article.

READ & DISCUSS

Reinforce comprehension of the concepts presented in the article by using the following prompts to direct discussion:

1. Why did people begin to need bigger numbers?
2. What solution did traders devise to represent how things were being traded?
3. How is body counting used to calculate a total?
4. Why were Roman numerals inconvenient for calculating sums?
5. Why was the abacus counting board used in many cultures?
6. How did Indian numbers and the invention of zero revolutionize mathematics?

SKILL FOCUS: Analyze and Interpret

INSTRUCT: Have students return to the article to study the information and graphics. Point out that organized number systems are a part of all cultures. Distribute copies of the *Count on It!: Analyze and Interpret* graphic organizer and tell students to interpret the systems and use the correct symbols to represent each number.

ASSESS: Circulate and converse with the students as they are working. Collect and review worksheets to evaluate individual abilities to interpret information.

EXTEND

Mathematics Give students a few minutes to reread their work in the graphic organizer and to revisit the article pages. Have each student choose one of the number systems and create a mathematical worksheet. Students will use the symbols to create equations to be solved. Then have students exchange worksheets with a partner. Partners must interpret the equation, rewrite it using standard numbers, solve it, and then represent the answer in both forms.

Count on It!

Analyze and Interpret Represent each number using the number system listed.

Number System	Number	Symbolic Representation
Tallies	63	
Wedgies	76	
Stick Numbers	444	
Roman Numerals	1,356	
Mayan Math	812	

Match the numerical contribution or system with the correct region.

- | | |
|--------------------------|------------------------|
| _____ 1. Central America | A. invention of zero |
| _____ 2. Sumer | B. hieroglyphs |
| _____ 3. Egypt | C. body counting |
| _____ 4. Rome | D. clay tokens |
| _____ 5. India | E. letters for numbers |
| _____ 6. Pacific Islands | F. quipus |

Can Animals Count?

pp. 20–23, Expository Nonfiction

Students will enjoy learning that humans aren't the only ones who count! Bright photographs accompany this article that details the many ways our animal friends use counting to navigate the world.



RESOURCES

Count Me In: Obtaining Information

OBJECTIVES

- Students will learn how a number sense is useful for animals in the natural world.
- Students will obtain information from a nonfiction text.
- Students will learn to count to ten in different languages.

KEY VOCABULARY

- shoals** (p. 20) large numbers of fish swimming together; schools
- coot** (p. 22) a type of black or gray bird that lives on or near water

ENGAGE

Conversation Question: How do numbers help us to make sense of the world?

Review the less-than and greater-than symbols (< >). Explain to students that we can determine more or less of something without counting or measuring by using our estimating sense. When numbers get bigger, we can calculate the answer using our counting sense. Display the expressions below and insert the correct symbols (< or >). Note that you will be using your ability to both estimate and calculate.

The number of children on a bus ____ the number of children in a school
The weight of 5 cats ____ the weight of 100 ladybugs
$230 + 42$ ____ $157 + 85$
32×7 ____ 28×9

INTRODUCE VOCABULARY

Post and discuss the two vocabulary words and definitions. Have students Think-Pair-Share with a partner. Give them the following brainstorming directives, one at a time:

- Discuss why fish might swim in **shoals**.
- What animals might share the **coot**'s environment?

READ & DISCUSS

Read the article aloud with the class. Have students reread the article in small groups to answer the questions below. Discuss responses.

- What is a basic math talent that many animals share with humans?
- How is a pigeon's counting ability unique?
- Describe methods scientists use to test animals' counting ability.
- Explain difference between estimating sense and counting sense.
- How do scientists know that many animals can add and subtract?

SKILL FOCUS: Obtain Information

INSTRUCT: Guide students to obtain information from the text, captions, and photos in the article. Remind them that the article was written to teach readers how counting is important for animals as well as humans. Introduce the *Count Me In: Obtaining Information* worksheet and instruct students to correctly match the counting behavior on the right with the animal on the left.

ASSESS: Review graphic organizers with the class and discuss.

EXTEND

Languages Use video clips and books to explore how to count to ten in different languages. Challenge students to create flashcards and to teach what they have learned to other classes.

Count Me In

Obtaining Information Match the animal counting behavior on the right with the correct animal on the left. Refer to the article for accuracy.

- | | |
|----------------------------|---|
| 1. _____ salamander | A. can match the same number of different objects |
| 2. _____ honeybee | B. can do simple addition and subtraction |
| 3. _____ robin | C. can learn to peck at groups in numerical order |
| 4. _____ ring-tailed lemur | D. can pick which is “more” up to 3 |
| 5. _____ chimpanzee | E. can count and notice when things are missing |
| 6. _____ jackdaw | F. can use its nose to count on a touchscreen |
| 7. _____ pigeon | G. can be trained to navigate a maze by counting dots |

When do you use estimating during your day and when do you use counting/calculating?
