

Problem-Solving: Math, Episode 1

Teacher's Guide

Grade Level: K–2

Curriculum Focus: Math

Lesson Duration: One class period

Program Description

Got Your Number? (5:00) – Discover the many ways we use numbers in our everyday life.

You Count! (5:30) – Investigate the difference between cardinal and ordinal numbers.

Less or More (5:25) – Count herds of animals to determine which groups have more and which groups have fewer animals than the others.

Fair Shares (3:23) – Learn how to divide whole objects such as pizza pies and apples into equal parts.

Onscreen Questions

- When do you use numbers?
 - Give an example of an ordinal number.
 - What is a number that is greater than 11?
 - What does it mean to split something in half?
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Lesson Plan

Student Objectives

- Learn why numbers are an important part of everyday life.
- Provide examples of daily uses of numbers.

Materials

- *Problem-Solving: Math, Episode 1* program
- Writing paper
- Pencils and erasers
- Computer with Internet access (optional)

Procedures

1. Talk about the different ways we use numbers in our everyday lives. What are some uses of numbers? Why are numbers important? A good way to introduce this topic is to watch *Problem-Solving: Math, Episode 1* with the class.
2. Have students walk around the classroom for 5 to 10 minutes and ask them to point out examples of numbers they find in the room. Direct them to some less obvious ways numbers are used, such as on a clock or the number of paintbrushes in a jar or the number of cubbies and windows in the classroom.
3. Have students return to their desks and ask them these questions: Where do you see numbers? What are the numbers doing there? Are they measuring something, telling time, or representing a group?
4. After sharing what they found, ask students to imagine a world without numbers. What would it be like? How would things be different? How would school and their classroom be different? Give students a few minutes to think and share their thoughts with the class. Talk about the things that students do in a day. What things would be harder to do without numbers? How do numbers help students know when to go to school? How do numbers help them know how many plates to put on the dinner table? How do numbers help them know where to stand in a line? Help students come up with examples of ways they rely on numbers everyday.
5. Have students draw a picture showing an example of a time they have used numbers. Give them some examples: standing first or last in line, dividing candy among friends, or having a doctor measure their height. All of these represent important uses of numbers in everyday life. More advanced students could write words or a sentence or two explaining their drawing.
6. When the drawings are completed, ask volunteers to share their work with the class. Display the drawings in the classroom so that students are reminded of the importance of numbers in their everyday lives.

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students were highly engaged in class discussions; were well behaved and on task while searching for examples of numbers in the classroom; drew unique and colorful pictures that clearly identified an example of a way they use numbers in their everyday lives.
- **2 points:** Students participated in class discussions; were reasonably well behaved and generally on task while searching for examples of numbers in the classroom; drew somewhat unique and colorful pictures that generally identified an example of a way they use numbers in their everyday lives.
- **1 point:** Students participated minimally in class discussions; were unable to stay on task while searching for examples of numbers in the classroom; drew incomplete or inaccurate pictures that did not identify an example of a way they use numbers in their everyday lives.

Vocabulary

cardinal number

Definition: A number such as 3, 11, or 412 used in counting to indicate quantity but not order

Context: "One, two three..." These are cardinal numbers: You just give a number to each person, and count how many.

count

Definition: To name or list the units of a group or collection one by one in order to determine a total

Context: Let's count the elephants in these two groups.

measure

Definition: To determine the dimensions, quantity, or capacity of something

Context: Numbers help us measure the right amount of time to bake bread.

numeral

Definition: A symbol or mark used to represent a number

Context: Numbers and the numerals representing them help us make sense of things in the world.

ordinal number

Definition: A number indicating position in a series or order

Context: "First" and "second" are ordinal numbers, which you use when you want to talk about the order of people or things.

unit

Definition: An individual, group, structure, or other entity regarded as a whole

Context: An apple, a cantaloupe, a pizza, a tomato...you can think of any of these as a unit because each is one whole, single thing.

Academic Standards

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit

<http://www.mcrel.org/compendium/browse.asp>

This lesson plan addresses the following national standards:

- Mathematics: Understands and applies basic and advanced properties of the concepts of numbers; Understands and applies basic and advanced properties of the concepts of measurement; Understands the general nature and uses of mathematics

National Council of Teachers of Mathematics

The National Council of Teachers of Mathematics (NCTM) has developed national standards to provide guidelines for teaching mathematics. To view the standards online, go to <http://standards.nctm.org/>

This lesson plan addresses the following math standards:

- Number and Operations: Understands numbers, ways of representing numbers, relationships among numbers, and number systems
 - Measurement: Understand measurable attributes of objects and the units, systems, and processes of measurement
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How To Use the DVD

The DVD starting screen has the following options:

Play Video – This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

Video Index – Here the video is divided into four parts (see below), indicated by video thumbnail icons. Watching all parts in sequence is similar to watching the video from start to finish. Brief descriptions and total running times are noted for each part. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

Curriculum Units – These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. Total running times for these segments are noted. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.



Standards Link—Selecting this option displays a single screen that lists the national academic standards the video addresses.

Teacher Resources—This screen gives the technical support number and Web site address.

Video Index

I. Got Your Number? (5 min.)

From building walls to keeping track of orangutans to baking bread, explore the many ways people use whole numbers and their numerals.

II. You Count! (6 min.)

Consider the uses of ordinal numbers by waiting in line at Chicago's O'Hare airport, crossing the finish line with race cars, and counting down a space shuttle launch.

III. Less or More (5 min.)

Which weighs more, a baby elephant or a human infant? Why are one-digit numbers always less than two-digit ones? Evaluate numbers, lesser and greater.

IV. Fair Shares (3 min.)

Examine how a whole unit can be divided into equal parts by splitting a sandwich and sharing eight slices of pizza with your friends.

Curriculum Units

1. Numbers of Objects

Pre-viewing question

Q: What are some things you keep track of?

A: Answers will vary.

Post-viewing question

Q: What is the difference between a number and a numeral?

A: A number is the total of objects or units—for example, four birds or four horses. A numeral is the symbol that represents a number; the same numeral—"4"—is used to represent both the birds and the horses.

2. Numbers for Length

Pre-viewing question

Q: What measurements do we use for length?

A: Answers will vary.

Post-viewing question

Q: In inches, how long is a one-foot board?

A: It is 12 inches.

3. Numbers for Time

Pre-viewing question

Q: How often do you check your watch or the clock?

A: Answers will vary.

Post-viewing question

Q: Besides baking, what are some activities where watching the clock is important?

A: Answers will vary.

4. Being First

Pre-viewing question

Q: Have you ever been the first or last person in a long line?

A: Answers will vary.

Post-viewing question

Q: When are ordinal numbers used?

A: Ordinal numbers are used when you want to talk about the order or position of people or things – for example, the first car to cross the finish line.

5. Cardinal vs. Ordinal

Pre-viewing question

Q: Have you ever seen birds or other animals migrating?

A: Answers will vary.

Post-viewing question

Q: What did the cardinal and ordinal numbers show about the wildebeests?

A: Counting with cardinal numbers showed how many wildebeests were in the migrating group. Using ordinal numbers showed each wildebeest's order as it crossed the river – which one was first and which one was 53rd in line.

6. 3, 2, 1 ... Liftoff!

Pre-viewing question

Q: How much harder is it to do things backwards?

A: Answers will vary.

Post-viewing question

Q: What type of numbers do launch teams use and why?

A: Mission control uses cardinal numbers to count backward so the team knows how much time is left before launch. It is important to know how many minutes remain, not their order – which is a given.

7. Which Is Greater?

Pre-viewing question

Q: What do you think weighs more, an elephant or a car?

A: As students will hear in the program, one elephant can have the same weight as five medium-sized cars.

Post-viewing question

Q: How do numbers help us compare things?

A: We use numbers to measure and weigh things and to keep score and mark prices. By knowing what two objects weigh or cost, for example, we can compare them.

8. One- vs. Two-Digit Numerals

Pre-viewing question

Q: What does it mean to count by tens?

A: Students should give examples similar to "10, 20, 30, 40...."

Post-viewing question

Q: In the numeral 25, what digit is in the tens place?

A: The digit 2 is in the tens place; 5 is in the ones place.

9. Comparing Two-Digit Numbers

Pre-viewing question

Q: How many digits are in your age?

A: Answers will vary.

Post-viewing question

Q: Which number is greater, 22 or 32, and why?

A: The greater number is 32 because it has a larger number in the tens place.

10. Dividing Into Halves

Pre-viewing question

Q: What food do you share with friends?

A: Answers will vary.

Post-viewing question

Q: What does it mean to halve something?

A: Halving an object or unit is dividing it into two equal parts.

11. Sharing Pizza

Pre-viewing question

Q: How often do you eat pizza?

A: Answers will vary.

Post-viewing question

Q: How could you divide a square pizza into four equal pieces?

A: Possible answers include slicing from corner to corner to create four triangles and cutting the pizza down the middle and then halving each piece.

Problem-Solving: Math, Episode 2

Teacher's Guide

Grade Level: K–2

Curriculum Focus: Math

Lesson Duration: 1–2 class periods

Program Description

Picture This (5:09) – See how diagrams help solve problems before buildings, bridges, and other structures have even been built.

That's Discussing (5:22) – Find out why the best way to solve a problem or difficult situation might be to discuss it with a friend or knowledgeable person.

Make Sense (5:21) – Solving a problem is only half the battle. It is also important that people are able to comprehend the solution. Learn why good explanations help young scientists win a yearly science competition.

Get It Together (3:37) – See how making lists can help you organize information and prepare for situations.

Onscreen Questions

- How are pictures useful in creating buildings?
 - How does discussing a problem help you find a solution?
 - Why do you think it's important to give clear answers?
 - Why is a list helpful when you prepare for a trip?
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Lesson Plan

Student Objectives

- Explore different ways to find solutions to problems or situations.
- Draw a picture that represents a problem-solving strategy.

Materials

- *Problem-Solving: Math, Episode 2* program
- Drawing paper

- Crayons
- Pencils and crayons

Procedures

1. Discuss problems students have had and the ways they solved them. Ask students these kinds of questions:
 - Have you ever forgotten your lunch? What did you do?
 - Have you ever been unable to do your homework because you didn't understand it? What did you do?
 - Have you ever been in a fight with somebody? How did you work it out?

Talk about the strategies scientists, engineers, and mathematicians use when solving problems. How are their strategies similar to those of the students? A good way to introduce the topic of problem solving is to watch *Problem-Solving: Math, Episode 2*.

2. After watching the program, discuss the strategies featured. When does diagramming or drawing pictures come in handy? When do students or their parents make lists to help them solve problems? How does discussing a problem or situation help solve it? Why is it important to think clearly and be organized when solving a problem?
3. Brainstorm some school-based problems with the class, such as trash on the playground, noise in the hallways, limited handicapped access in some areas, too few bathrooms or dirty bathrooms, incorporating healthier foods in the cafeteria, the need for more computers. Choosing one, discuss with students how they might go about solving it. What are some possible solutions to this problem? How would you test the solutions? Who would you talk with to discuss possible solutions? Would a diagram or drawing help you solve this problem? Do you need math to solve this problem? What would you say to make people understand your solution?
4. Ask volunteers to share some small problems they have encountered and as a class, discuss ways to go about solving them. Once you are confident that students understand problem-solving techniques and the importance of delivering a clear explanation of problems and solutions, tell them that they are going to draw pictures of a problem and how they solved it.
5. Demonstrate drawing a line down the center of a piece of paper. Draw an example of a problem on one side of the paper, such as a forgotten lunch or difficulty building a model airplane. On the other side of the divided paper, draw a solution to the problem, perhaps asking a friend to share their lunch, or a child drawing a diagram of the model airplane.
6. Make sure students understand what you are asking them to do. Then distribute the drawing paper and allow time to draw pictures. More advanced students can write a sentence or two describing their problem and solution.
7. Once students have completed their drawings, have volunteers share them with the class. Talk about the different problems and solutions.

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students were highly engaged in class discussions; demonstrated a clear understanding of different problem-solving strategies; drew colorful, unique pictures that clearly identified a problem and a solution.
- **2 points:** Students participated in class discussions; demonstrated a general understanding of different problem-solving strategies; drew somewhat colorful and unique pictures that mostly identified a problem and a possible solution.
- **1 point:** Students participated minimally in class discussions; were unable to demonstrate a basic understanding of different problem-solving strategies; drew incomplete or inaccurate pictures that did not clearly identify a problem or drew a solution that did not fit the problem.

Vocabulary

diagram

Definition: A plan, sketch, drawing, or outline designed to demonstrate or explain how something works or to clarify the relationship between the parts of a whole

Context: Diagrams can be used to plan new structures and to find out how a damaged building looked originally.

explanation

Definition: The act or process of defining something or making it understood to others

Context: A good explanation of a solution can help us understand and solve similar problems.

problem

Definition: A question to be considered, solved, or answered

Context: Making a list is a way of organizing information to solve a problem.

strategy

Definition: To determine the dimensions, quantity, or capacity of something

Context: Discussing a problem is a good strategy to make sure a science team understands what each individual needs to solve the problem.

Academic Standards

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This lesson plan addresses the following national standards:

- Life Skills – Thinking and Reasoning: Understands and applies basic principles of logic and reasoning; Applies basic trouble-shooting and problem-solving techniques
- Mathematics – Uses a variety of strategies in the problem-solving process

National Council of Teachers of Mathematics

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<http://standards.nctm.org/>

This lesson plan addresses the following math standards:

- Problem Solving: Solve problems that arise in mathematics and other contexts; Apply and adapt a variety of appropriate strategies to solve problems

Support Materials

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Video Index

I. Picture This (5 min.)

Diagrams help architects and engineers see – and solve – many problems before structures are built. Take a detailed look at the benefits of this problem-solving strategy.

II. That's Discussing (5 min.)

From understanding the challenge to making sure each team member knows what to do, discover the crucial role discussion plays for these young scientists.

III. Make Sense (5 min.)

A good explanation of a solution can help us understand and solve similar problems. It also helped these students win a science contest!

IV. Get It Together (4 min.)

Gathering and organizing information is a good way to tackle a task like getting ready for a trip. It can also make important information easy to use and share.

Curriculum Units

1. Drawing the Colosseum

Pre-viewing question

Q: Have you ever tried to rebuild something?

A: Answers will vary.

Post-viewing question

Q: How did the scientists use the computer to rebuild the Colosseum?

A: By drawing a computer diagram of what remains of the Colosseum, scientists were able to “rebuild” the structure by drawing views of what it looked like when it was originally built.

2. Drawing Bridges

Pre-viewing question

Q: What's the longest bridge you've ever crossed?

A: Answers will vary.

Post-viewing question

Q: What is a suspension bridge?

A: This type of bridge is built with nothing underneath to keep it up. Cables suspended, or hung, from towers are all that hold the bridge in place.

3. Drawing Skyscrapers

Pre-viewing question

Q: Have you ever been in a skyscraper?

A: Answers will vary.

Post-viewing question

Q: What do diagrams tell architects and engineers about a skyscraper?

A: These plans show what building materials will work best, as well as what the finished skyscraper will look like.

4. Discussing Lasers

Pre-viewing question

Q: What's the most difficult obstacle course you've faced?

A: Answers will vary.

Post-viewing question

Q: How did discussing the problem help the team?

A: The team's discussion helped the members understand the problem well enough to solve it.

5. Discussing Music

Pre-viewing question

Q: Do you know what Beethoven's Fifth Symphony sounds like?

A: Answers will vary.

Post-viewing question

Q: What did the kids use to get their musical timing right?

A: Math

6. Discussing Force

Pre-viewing question

Q: What does it feel like to ride a skateboard?

A: Answers will vary.

Post-viewing question

Q: How did talking to the skateboarders help the team?

A: Their discussions helped the young scientists understand what the forces felt like and allowed them to make predictions about where the force was stronger and weaker.

7. Slippery When Wet

Pre-viewing question

Q: How does rain make it difficult to travel?

A: As students will hear in the program, one elephant can have the same weight as five medium-sized cars.

Post-viewing question

Q: What did Shannon discover with her experiment?

A: She found that although silica sand was more cost effective, garnet worked better to increase traction.

8. A Winning Explanation

Pre-viewing question

Q: Have you ever been stung by a fire ant?

A: Answers will vary.

Post-viewing question

Q: Was it important that Blake could clearly explain his experiment?

A: Yes, it helped him win second place in the Discovery Young Scientist Challenge.

9. Let Me Explain

Pre-viewing question

Q: What problems have you had when trying to explain something?

A: Answers will vary.

Post-viewing question

Q: Why are clear explanations important?

A: A clear explanation of a problem can help solve it, and a clear explanation of a solution can help solve similar problems.

10. Packing List

Pre-viewing question

Q: What do you do before you go on a trip?

A: Answers will vary.

Post-viewing question

Q: How did Anita's list help her pack for the trip?

A: The list helped Anita plan what she needed for the trip and make sure she didn't forget to pack anything important.

11. Airline Schedule

Pre-viewing question

Q: Have you ever flown on an airplane?

A: Answers will vary.

Post-viewing question

Q: What information is shown on an airline schedule?

A: Among other information, the flight schedule board lists flight numbers, boarding gates, and departure times.