

Twenty Questions: A Lesson Using the Hundreds Chart

A Lesson for Grades 3–5

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Overview of Lesson

This lesson is a math variation of the popular 20 questions game. The teacher chooses a secret number on the 1–100 chart. Students ask 20 questions to try to ascertain the secret number. Students mark their 1–100 charts to keep a visual record of information they have gathered and to see the possibilities narrow down. Formative assessment opportunities abound as students think, explore, hypothesize, ask questions, and discuss the properties of numbers.

Identifying the Mathematical Goals

Students will:

- generate questions in order to guess a secret number,
- use logical thinking to eliminate possible answers,
- apply deductive reasoning to solve a problem,
- connect numbers to real world contexts,
- and use mathematical vocabulary to describe properties of numbers.

References

Adapted from *Minilessons for Math Practice, Grades 3–5*, by Rusty Bresser and Caren Holtzman

Formative assessment ideas and strategies from *INFORMative Assessment: Formative Assessment to Improve Math Achievement* by Jeane M. Joyner and Mari Muri

Materials

- Several 1–100 charts and pencils for students
- Several 1–100 charts for teacher to display at the front of the room

Common Core State Standards for Mathematics

Make sense of problems and persevere in solving them.

Construct viable arguments and critique the reasoning of others.

Vocabulary

odd, even, multiple, factor, prime, digits, sum, difference, divisible, composite



Teaching Directions

Part 1: Focus or Warm-Up

1. Begin the lesson by showing a 1–100 chart. Ask students if they have used 1–100 charts before and what they know about them. Ask students to generate a list of words that describe numbers (odd, even, more than, digit, less than, prime, composite, etc.). Write these words on the board for student access. This warm-up prepares the students for the upcoming task and also gives you a diagnostic assessment of the students' current ideas about 1–100 charts, numbers, and relevant vocabulary.

Part 2: Introduction

2. Play a game with the whole class. Distribute 1–100 charts and pencils to all students. Have a 1–100 chart visible in the front of the room. Tell students you have chosen a secret number on the 1–100 chart. Their job is to guess the secret number. Explain that they need to ask 20 yes/no questions to help them narrow down the possibilities. They are not allowed to guess the secret number until all 20 questions have been asked.

Part 3: Exploration

3. Have students talk in pairs or small groups to brainstorm questions. This is an opportunity to eavesdrop and get a sense of what types of questions students are asking and which vocabulary words they're comfortable using independently. Collect some formative data by jotting down notes about which students are asking questions and what types of questions surface.
4. Have a volunteer ask a question. Answer the question and tell students to discuss what they now know about the secret number. Have them mark their 1–100 charts accordingly. For example, if the volunteer asks, "Is your secret number odd?" and the answer is no, students now know the secret number is even. They can cross out all the odd numbers on their 1–100 charts. You might model this on the 1–100 chart in the front of the room. You might also keep a written chart with information about the secret number. For example, after the first question is answered, you can write, "The secret number is even" on a class chart. This class chart serves as a reference for the students and also offers further formative assessment information about what types of questions and which number concepts and vocabulary they use.

Teaching Tip: Using a Word Bank and Sentence Frames

If students have not had much experience talking about numbers, this can be a challenging activity. Having a word bank and prompting students for different ways to ask questions provide helpful supports for the less experienced math conversationalists.

For students who need more language support, sentence frames might be helpful as well. Some useful sentence frames are:

Is your number greater than _____?
Is your number between _____ and _____?
Is your number a multiple of _____?
Does your number tell how many _____?

5. Students continue to ask yes/no questions and mark their charts accordingly. Give students frequent opportunities to check in with a partner to clarify what they know about the secret number, what possibilities are left, and what questions they might ask next. These small-group talks provide formative assessment opportunities to briefly interview students about their ideas.



Teaching Tip: Formulating Questions

Another chance for formative assessment arises when students are prompted to apply different number concepts in formulating their questions. Challenge students to ask a question that involves multiplication (e.g., Is the secret number a multiple of 3?) or considers the relationship of the digits (e.g., Is the sum of the digits less than 10?). See if students can generate more than one question related to the same concept. You might say to students, “Can you come up with three more questions that are connected to multiplication?” Also, find out if students are using the appropriate math vocabulary to formulate their questions.

Teaching Tip: Asking 20 Questions

Typically students home in on the number within 10–15 guesses. However, the challenge is to ask 20 questions, so they must stretch their thinking about numbers and operations in order to create questions that test their hypotheses about the secret number. If students think they know the secret number but still haven’t asked all 20 questions, prompt them to think about ways the secret number might be used in the real world outside of math class. For example, students might connect the number to dates, ages, quantities of common objects, sports, or food.

Summary

6. After students guess the number, have them process the experience and do some self-assessment. This processing can be done in small groups, through a whole-class discussion, or as a writing task for individuals. Effective questions include:

How did it go?

What was tricky about this game?

What strategies did you use? How did they work?

Do you have any advice for students who are going to play this game for the first time?

What question would you ask first? Why?

Students’ responses provide insights into their conceptual and metacognitive knowledge.

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