Notable Numbers

⚓ ANCHOR ACTIVITY PLANNING PAGE

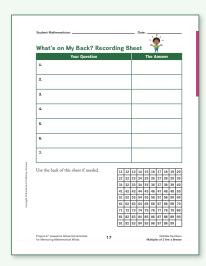## What's on My Back?

Description

In this game, each player in the group hides a two-digit number from the deck of cards in a lanyard or taped on the back of the player to his or her left. Players in the group then ask each other questions, one at a time, in order to determine the value of the number on their back. They are using their knowledge of properties of numbers to figure this out. To make this more challenging and focus on properties, the following rules apply.

- Only questions requiring a "yes" or "no" answer are allowed.
- Questions involving "greater than," "less than," or "in between" are not allowed.

To begin, players take "think time" to write down three questions they would like to ask on their recording sheet (*SMJ* p. 5), keeping in mind that the object is to guess the number using the fewest number of questions. This allows students to individually use mathematical reasoning to consider properties of numbers, rather than just repeat questions they hear as the game is played.

To start the activity, introduce the game and play a round or two with the students. Students have found it helpful to use the chart at the bottom of the recording page to cross off numbers during the elimination process. Players ask each other questions until they think they have figured out their number. They write down each question and the answer on their recording sheet. Once they determine their number and confirm it is correct, they can continue to answer other players' questions until all players have correctly guessed their numbers.

Students should strive to ask the fewest questions and try to improve on this each time they play the game. To make this a competitive game, you can declare the winner to be the player who asked the fewest questions.

What's on My Back? Recording Sheet
(*SMJ* **p. 5, 7, and 9**)

Mathematics Standards

Content

- Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. (Be able to use multiples of a number to determine an unknown number.)
- Understand and use the place value system. (Be able to use the place value of the digits to help determine an unknown number.)

Practices

- Students are encouraged to use the mathematical habits of mind that mathematicians practice found in **Thinking Like a Mathematician** on p. 1 of their *Student Mathematician's Journal*.

THINKING LIKE A MATHEMATICIAN*

Here is a list of skills mathematicians use every day. See how many you can use in your *Student Mathematician's Journal*.

1. Make sense of problems and keep trying until you solve them.
2. Understand quantities, their relationships, and how to represent them.
3. Build logical reasons to defend your thinking. Consider the reasoning of others and ask useful questions to help make sense of the reasoning. Explain why you agree or disagree with another's reasoning.
4. Use the math you know to help solve problems in everyday life. Use physical models, drawings, tables, graphs, and/or equations to help you.
5. Choose and use the appropriate math tools to help solve each problem.
6. Communicate explanations clearly using correct math vocabulary and symbols.
7. Look closely and use patterns to help solve problems.
8. Notice if you are using the same math again and again and look for short cuts.
9. Solve a problem in a new way. Ask new questions to investigate.**

Thinking Like a Mathematician (*SMJ* p. 1)

Materials

- 1 deck of *What's on My Back?* Game Cards (*SMJ* pp. 11–18; copied on cardstock and cut out)
- 1 lanyard per student or tape
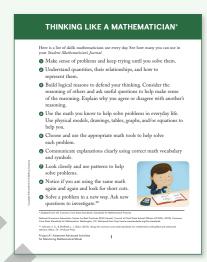- *SMJ* pp. 4–11

Length

- One class period (approximately 60 minutes)

Differentiating Instruction

This game can be modified to make it easier in the following ways:

- Allow questions that focus on order: greater than, less than, and in between.
- Modify the deck of cards to contain only multiples of 2, 3, 5, and 10.
- Assign specific numbers to students based on their math knowledge level.

If you are teaching a heterogeneously grouped class of students, you might consider playing the game with the entire class using one or both of these modifications. Playing with a small group of students rather than in pairs offers the opportunity for greater interaction among the students and enhanced learning. Note that if students only use ordering type of questions (greater than, less than, in between), this will not encourage critical thinking questions about the properties of numbers.

Let's Talk!
(*SMJ* p. 2)

! Teaching Tips !

✓ Before starting this activity we recommend familiarizing your students with and discussing the **Thinking Like a Mathematician** list (*SMJ* p. 1) and the talk prompts **Let's Talk!** (*SMJ* p. 2). We feel these are very important in developing mathematical thinking and discourse and are in fact the processes and skills that mathematicians use to accomplish their work.

✓ You may want to review the term "multiple" with students as it is very helpful in asking questions such as "Is the number a multiple of 5?" A multiple is a number that is the product of a given number and a whole number. For example, 6 is a multiple of 3 since $3 \times 2 = 6$.

✓ If they are having difficulty thinking of questions you might present the following:
Zach asked "Is the tens digit even?" If the answer he gets is NO, what numbers can he eliminate?

✓ Sometimes students may answer a question incorrectly. For example, they might say "no" if asked if 57 is a multiple of 3. Tell students they can consult with another student or you to help figure out the answer if they are unsure.

✓ For the Wrap It Up question, if your students have not had much experience with writing in math class, we suggest you work on a written response together after the discussion. Scribe the discussion by recording bullet points first. Then together create a response that can serve as a model for future writing.

What's on My Back?

SMJ p. 4

In this game, a two-digit number is placed on each player's back without the player seeing the number. The object is for each player to guess his or her number using as few questions as possible.

What's on My Back? Directions

- Place the deck of number cards face down in the center of a table.

- Players place a lanyard on their back. Then each one chooses a number from the deck and puts it inside the lanyard of the person to his/her left. You can tape the card on the player's back if you are not using lanyards. No peeking by the person with the lanyard!

- Think about questions to ask that follow these rules:

  o Only questions requiring a "yes" or "no" answer are allowed.

  o Questions involving "greater than," "less than," or "in between" are not allowed.

  o Write down three good questions to ask on your recording sheet.

- Show your number to another player and ask your first question. Record the answer on the Recording Sheet. You may want to cross off any numbers you eliminate on the chart at the bottom of the sheet.

- Then show your number to another player and ask your second question. Record the answer. Continue until you think you know your number. Tell a player your guess and then have the player check it on your back.

- Once you figure out your number, continue helping other players by answering their questions until everyone figures out their numbers.

- Count up the number of questions you asked. Next time, try to use fewer questions!

- First play the game once with your teacher. Then play at least two more times before doing the Wrap It Up.

Thinking About What's on My Back?
ANSWER SHEET *SMJ* p. 11

Wrap It Up

- What do you think is the best first question to ask? Why?
- What are other good questions? Explain why they are good.

Talk About It!

See how many mathematician skills you can use from **Thinking Like a Mathematician** on p. 1. Talk to your partner/group/teacher about the above questions.

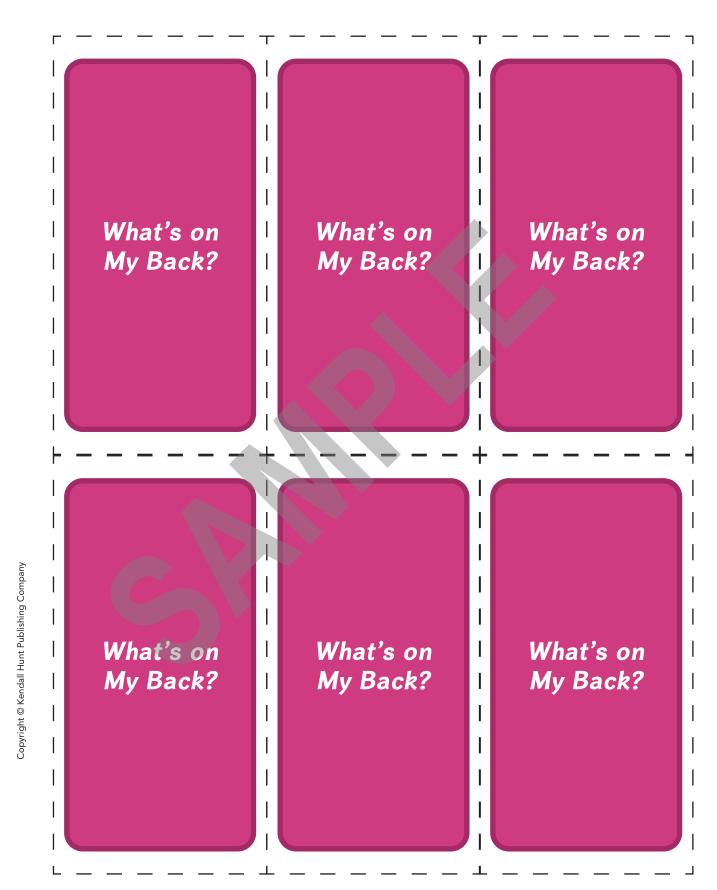Remember to use our talk prompts on **Let's Talk**, p. 2.

Write About It!

Write your responses below.

The best first question to ask is whether the number is odd or even because this will eliminate half the numbers. The next best question to ask is if the tens digit is even or odd as this will eliminate half of the remaining numbers. Students could also ask if the number is a multiple of another number such as 3, 4, 5, 7, 8, 9, or 11.
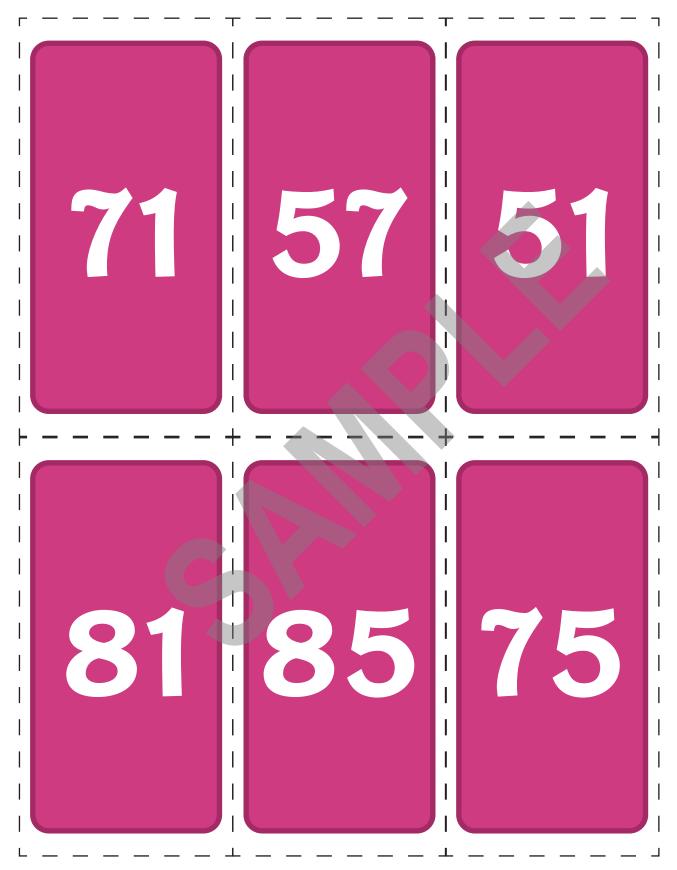
! Teaching Tip !

✓ We encourage you to come back to these questions with students after they have explored the other activities in this section. Depending on what other activities they investigated, they can ask if the number is prime, composite, abundant, deficient, or perfect. After exploring *Multiples of 3 Are a Breeze,* students should know that if they ask if a number is a multiple of 6, the two-digit number is also a multiple of 3 so that question would be redundant.
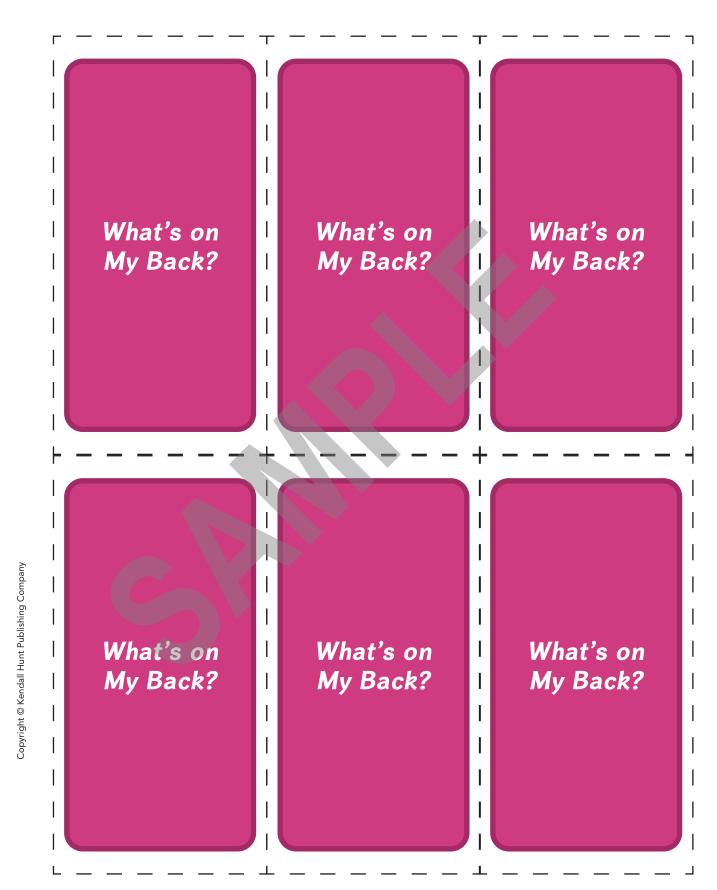
Game Cards for *What's on My Back?*

What's on My Back?	*What's on My Back?*	*What's on My Back?*
What's on My Back?	*What's on My Back?*	*What's on My Back?*

Game Cards for *What's on My Back?*

71	**57**	**51**
81	**85**	**75**

Notable Numbers
What's on My Back?

Project A³: Awesome Advanced Activities
for Mentoring Mathematical Minds

Game Cards for *What's on My Back?*

What's on My Back?	*What's on My Back?*	*What's on My Back?*
What's on My Back?	*What's on My Back?*	*What's on My Back?*

Game Cards for *What's on My Back?*

49	**56**	**48**
17	**63**	**24**

Game Cards for *What's on My Back?*

What's on My Back?

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What's on My Back?

What's on My Back?

Game Cards for *What's on My Back?*

99

77

80

25

64

31

Game Cards for *What's on My Back?*

What's on My Back?

What's on My Back?

What's on My Back?

What's on My Back?

What's on My Back?

What's on My Back?

Game Cards for *What's on My Back?*

18	**30**	**44**
72	**36**	**28**

Student Work Page