# Notes for the Teacher

Students pick a number from 1-36 to see all its factors "dance" around it in a circle. With each new number, students watch the "dance partners" change, giving them a dynamic context for posing and exploring mathematical questions about factors. Such questions include: "What is true about numbers that have just two dance partners?" and "Is there a number that dances with everyone?"

***Objectives:***

- Students will form and test conjectures about relationships between numbers and their factors.
- Students will explore multiplicative relationships between a chosen number and its factors.
- Students will correctly predict which numbers are factors of any chosen number from 1 to 36.

***Common Core Mathematical Practices:*** (1) Make sense of problems and persevere in solving them; (2) Reason abstractly and quantitatively; (3) Construct viable arguments and critique the reasoning of others; (5) Use appropriate tools strategically; (7) Look for and make use of structure.

***Common Core State Standards:*** 3.OA7, 9; 4.OA4, 5

***Grade Range:*** Grades 3–4

***Introduce:***

Open **Dancing Factors--Find Factors of a Number.gsp** and distribute the worksheet. Use a projector to show the sketch page "Dancing Factors." The numbers 1 to 36 are in the upper-left corner of the sketch. The number 8 sits inside the big green circle.

Say, "I wonder what will happen when I press the *Dance* button?" Press the *Dance* button. Ask students to describe what happens. (The numbers 1, 2, 4, and 8 "dance" around the green 8.)

Ask, "Why do you think only the numbers 1, 2, 4, and 8 are dancing around the number 8 in the large green circle? Why aren't the other numbers dancing, too?" Write students' conjectures on the board.

Students may guess correctly that the numbers are factors of 8. (If students aren't yet familiar with the term *factor,* don't introduce the word just yet; wait until students have

 

had time to clarify their conjectures and argue for and against them.) Other students may think the numbers form a multiplication statement ($1 \times 2 \times 4 = 8$). Write down all students' ideas, but don't discuss them at this time.

Say, "Let's try a number other than 8 and see which numbers dance with it." Have students pick a different number from 1–36 and ask them to predict what will happen. Then demonstrate how to highlight 8 in the *number* edit box and enter a new number using the computer keyboard. Click anywhere outside the edit box and watch what happens.

Depending on the number students chose, some of the numbers that were dancing around the 8 will stop moving and other numbers will join the dance party!

Drag the green circle around the screen, showing that the dancing numbers always follow the number in the green circle.

Ask, "How would you describe the numbers that are dancing around the number in the green circle?" If the term *factor* is unfamiliar to students, this is a good time to introduce it. Be sure to introduce both "factor" and "factor of": a *factor* is any number used in multiplication, and a *factor of* a given number is a number that can be multiplied by some other number to produce the given number.)

Tell students that they will work in pairs to explore questions they may have about numbers and their factors. Brainstorm a few questions with the class and write them on the board. Be sure students understand they can pick a question from the list or think of a different one with their partner. Here are some possible questions:

- *Do any two numbers share the exact same dance partners?*
- *Which number from 1–36 has the most dance partners?*
- *Which number has the fewest dance partners?*
- *Does any number dance with everyone?*
- *Does every number have itself as a dance partner?*
- *What is true about numbers that have just two dance partners?*
- *Which two numbers share the most dance partners?*
- *What is true about all numbers that have the number 2 as a dance partner?*
- *Notice that 1, 2, and 3 dance with 6. What does that tell us about the numbers that dance with 30?*

 

- *Which numbers have an odd number of dance partners?*

### *Explore:*

Assign students to partners and send them in pairs to the computers. Have students open **Dancing Factors--Find Factors of a Number.gsp** and go to page "Dancing Factors." Ask partners to think of one or more questions they would like to explore. To make sure that a variety of questions are covered, you may want to assign one question to each pair and let them choose the other questions.

Encourage students to make a conjecture about each question first before they use the Sketchpad model. Show students where to write their questions, conjectures, and findings on the worksheet. Tell students that they can record the dancing factors on the second page of the worksheet.

As students enter new values into the *number* edit box, their sketch will soon become crowded with a jumble of dance partners, some of which are moving, some of which are static. Suggest to students that they press *Reset* from time to time to refresh their sketch. Students can also drag the number in the green circle around the screen so that its current dance partners are separated from its prior dance partners that are no longer moving.

### *Discuss:*

Call students together to discuss and summarize what they have learned. Talk about the questions students explored and their findings. Here are some possible comments:

- *Our question was, 'What is true about numbers that have just two dancing partners?' We thought that all odd numbers would have just two factors, but the number 9 had three factors. Then we realized that numbers with only two factors are primes.*

- *Our question was, 'Which two numbers share the most dancing partners?' We thought that if one number was a factor of the other, like 6 and 12, they would share a lot of partners. We investigated pairs like that and found that 12 and 24 shared six factors. We decided that if 48 had been on the list, then 24 and 48 would share the most factors, eight in all.*

- *We wanted to see if numbers with only three factors had anything in common. We found that 4, 9, and 25 were the only numbers in the list with three factors. These are square numbers. We looked at the other three square numbers—1, 16, and 36—and discovered something interesting. All square numbers on our list have an odd number of factors. We'd like to know why—or if—that is true for all square numbers, not just those on the list.*

 

Discuss as many questions as possible.

### *Related Activities:*

- *Factors in Blue and Gold—Explore Patterns of Factors*
- *Boxed Counters—Find Factors with an Array Model*
- *Dynamic Number Grids—Multiples and Patterns*
- *Dynamic Number Grids—Clues You Can Use*

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