Overview

Read *One Hundred Hungry Ants* to the class and model the problems in the book with students' help. Students investigate constructing arrangements of different numbers of manipulatives into equal groups. Their findings are represented on grid paper.

Grade Levels: 1–3

Concepts

- Multiplication
- Commutative property
- Algebra

Materials

- TI-10 calculators
  Note: the TI-15 Explorer™ can be used in place of the TI-10 for this activity.
- *One Hundred Hungry Ants*
  Pinczes, Elinor J., (New York, NY: Houghton Mifflin, 1993)
- Grid paper
- Scissors
- Glue
- Crayons
- Up to 10 manipulatives (tiles, connecting cubes, plastic ants) for each pair of students
- Paper
- Pencils
- Student activity sheet

Calculator Connections

- Problem solving key
- Manual Mode Auto
- Scrolling

Modified from Marching Columns, from Math at Your Finger Tips with the TI-10

Assessment

Assessment should be done through student work samples and teacher observation. The following items should be considered.

Does the student:

- Use the manipulatives to form groups?
- Work cooperatively with his or her partner?
- Count the manipulatives correctly?
- Count the manipulatives each time, or does the student use the previous information to form the next one, moving only some of the manipulatives?
- Identify patterns with numbers?
- Recognize the Commutative property (understand that 3 x 4 is the same as 4 x 3)?
- Use mathematical language: *equal groups, rows, columns, horizontal, vertical, multiply*?
- Transfer the arrangement made with manipulatives to the grid paper correctly?
- Describe his or her strategy of finding all the combinations for a number?

Vocabulary

columns: an arrangement of figures one above the other

equal: exactly the same amount or value

horizontal: an arrangement of objects or numbers, to the left or right of each other

representation: an object or number taking the place of another object or number

rows: objects arranged side by side

vertical: an arrangement of objects or numbers, one above the other

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Activity 1

Connecting Literature and Mathematics

Read *One Hundred Hungry Ants* to the entire class. Have the students sit in a circle on the floor. Count 100 manipulatives to represent the 100 ants. If using connecting cubes, the cubes could be snapped together in groups of 10 to facilitate the activity.

1. While children are still sitting in a circle on the floor, encourage them to retell the story and help to arrange the manipulatives to reflect the actions in the story.

   Actions in the Story: The story shows 1 long line of 100, 2 lines of 50, 4 lines of 25, 5 lines of 20, and 10 lines of 10.

2. If children want to test the number of lines by following a pattern, let them arrange the manipulatives and discover the outcome. This will present an opportunity for students to see that there will not be equal groups with each number. There will be some leftovers.

   Note: If students extend the pattern of testing numbers far enough, they will experience the commutative property.

Questions for Students:

- *Why did the ants in the story only make columns of 1, 2, 4, 5, and 10?*
- *How are rows different from columns?* (Stress that rows are horizontal and columns are vertical.)
- *What is a row?*
- *What is a column?*

3. Model how the design of rows and columns can be represented using grid paper. Stress the meaning of rows being horizontal and columns being vertical.
4. For each example you model for students, count the squares horizontally (rows) and the squares vertically (columns). Rotate the paper a quarter turn to represent a new number of rows and columns. For example: 5 rows of 20 become 20 rows of 5.
5. The final example you should model for students is 10 columns of 10. Ask the students why it is still 10 columns of 10 after rotating the paper.

Teacher Tip

While designing rows and columns on grid paper, you may want to place a small manipulative in each square to help students make the connection between the manipulatives and the grid paper.

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Activity 2

Exploring the Commutative Property

1. Explain to students that they will now work with partners for the next activity.
2. Assign pairs of students a number of manipulatives to use for this activity. They will use the number to arrange their manipulatives in rows and columns.
3. Challenge each pair of students to find as many solutions as they can.

Number of Solutions	Number of Manipulatives
12	60, 72, 84, 90, 96
10	48, 80
9	36
8	24, 30, 40, 42, 54, 56, 66, 68, 70, 78, 88
7	64
6	28, 32, 45, 50, 52, 63, 75, 76, 92, 98, 99
5	81

Teacher Tip

You may wish to give each pair of students different numbers or use only three or four different numbers for the entire class.

Teacher Tip

The table to the left shows the number of solutions for a given number of manipulatives. For example, a student who is given 24 manipulatives will have the following eight solutions:

1 by 24	24 by 1
2 by 12	12 by 2
3 by 8	8 by 3
4 by 6	6 by 4

4. For each solution that has an equal number of manipulatives in each row and an equal number in each column, children should represent that solution on grid paper.

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Activity 3

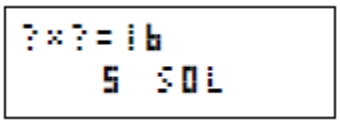
Commutative Property with the TI-10 (or TI-15)

To find and check the number of possible solutions for a product, use the problem solving button on the TI-10.

1. Press ON to begin.
2. Press AC to clear anything previously stored in the memory.
3. Press Clear. The screen is blank (except for the cursor), the memory is clear, and you are ready to get started.
4. Press the problem solving key ◆ and Auto until the Auto text is not on the screen. The TI-10 displays:

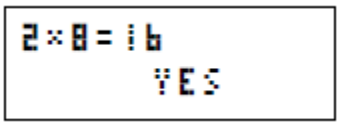
5. Decide what number to use for modeling. It is usually best to simplify, so use 16 as the product.
6. Press ? × ? = 1 6 Enter.

   The TI displays:

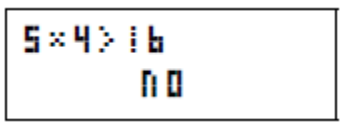


7. Press 2 Enter. The 2 replaces the first **?** in the number sentence. Next, choose the number to replace the second **?.**
8. Press 8 Enter.

   The TI-10 displays:



If numbers are entered that do not produce 16 as their produce, the TI-10 displays an inequality such as:



Teacher Tip

In the manual mode, the TI-10 will not offer correct solutions. However it will show when the number sentence is correct by displaying YES and will provide clues in finding the correct answers by using < less than and/or > greater than.

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After following this model, provide time for students to use this tool to explore the factor pairs for a chosen number from the table in Activity 2.

Teacher Tip

Student should record the number sentences when correct. The and keys may be used to scroll through completed number sentences.

Conclusion

- Provide opportunities for students to share their findings and explain how they found their solutions.
- Challenge the class by asking if all the possible solutions with equal groups are pictured. *How do you know? How could you find out? Do you see any patterns?*
- You may wish to leave the student's work displayed to encourage them to find any arrangements still missing, or as an invitation to explore additional numbers.

Extension

Students may question when numbers do not produce equal groups. They may go through the same process as described in the above activity and then repeat their finding and show the "leftovers" at the side. Point out that the extra manipulatives that don't fit must be accounted for; they cannot simply be tossed out.

This unit can serve as an introduction to remainders in division. The TI-10 can also be used as a tool in division with remainders. Experiences such as this can also serve as a foundation for building an understanding of prime numbers.

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SOLUTIONS

Student Activity

Name _____

Date _____

Focus: Use equal groups to show multiplication.

Vocabulary

Write the meaning of the words.

Columns *an arrangement of figures one above the other*

_____

Rows *objects arranged side by side*

_____

1 Arrange 12 connecting cubes in a row.

Write as may solutions as you can for the 12 cubes.

_____

Answer: 1 x 12; 12 x 1; 2 x 6; 6 x 2; 3 x 4; 4 x 3

_____

_____

_____

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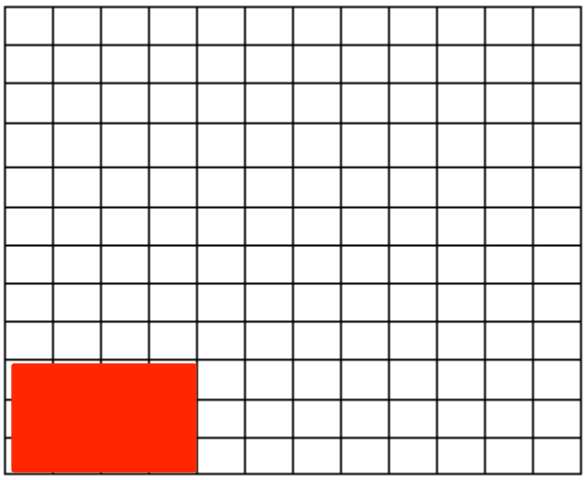
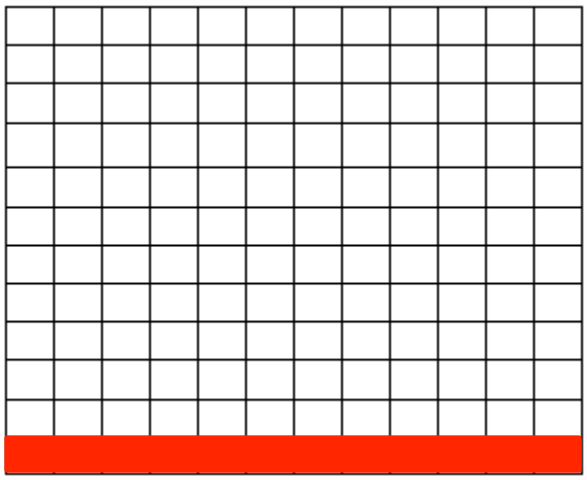
2 Select two solutions and represent them on the grids below.

Answers will vary. Possible answers: 3 rows of 4; 1 row of 12.





Using the Calculator

3 Write the keys you need to press to find a possible solution for 12.

Answer: ? x ? = 12 Enter

4 What numbers can you use to replace the ?'s on the screen?

Answers will vary. Possible answers: 1, 2, 3, 4, 6, 12

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