



# Investigations

in Number, Data, and Space®

## Unit Guide for Grade 5, Unit 1: *Number Puzzles and Multiple Towers* Multiplication and Division 1

This document applies to the 2nd edition of *Investigations* (2008, 2012). See <http://investigations.terc.edu/CCSS/> for changes when implementing *Investigations and the Common Core Standards*.



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## Unit Guide for Grade 5, Unit 1

### *Number Puzzles and Multiple Towers*

### Multiplication and Division 1

#### Unit Summary:

Students refine and gain fluency in solving two-digit by two-digit multiplication problems, develop strategies for division problems with one- and two-digit divisors, and increase their knowledge of multiplication relationships by learning about prime factorization (e.g.,  $36 = 4 \times 9 = (2 \times 2) \times 9 = 2 \times 2 \times 3 \times 3$ ).

#### Materials:

*Number Puzzles and Multiples Towers* (1 copy per person)  
Resource Master M15, Centimeter Grid Paper (2-3 per person)  
Student Activity Book pp. 1-2, Number Puzzles: 1 Clue. (1 per person)  
Color tiles (1 set available)  
12" x 18" Construction paper (1 per person)  
Student Activity Book p. 35, Multiplication Cluster Problems (1 per person)  
Student Activity Book pp. 49-50, Problems about Multiples of 21 (1 per person)

### Do the following activities from *Number Puzzles and Multiple Towers*:

#### 1. Identify the mathematics in the unit

To get an overview of the mathematics students will be doing in this unit, refer to these sections in the unit front matter. As you look at these sections, begin thinking about the main mathematical ideas students work on in this unit.

- Turn to pp. 8-9, *Overview of This Unit*. Look at the title of each Investigation and read the summary for each Investigation.
- Review the *Mathematics in This Unit* essay, pp. 10-13. Look at the Mathematical Emphases and Math Focus Points. (The emphases are numbered, and can be found above bulleted lists of Math Focus Points.)
- Read the “Benchmarks in This Unit” in the table on p. 15, *Assessing the Benchmarks*.

**Discuss**

- What mathematical ideas and skills are students working on in this unit?
- What mathematics are students expected to know at the beginning of the unit? At the end?

## 2. Building and Using Arrays (Session 1.1)

In this Investigation, students use arrays and number puzzles to learn about properties of numbers. In this session, students build rectangular arrays of 2-digit numbers and identify factors and multiples of these numbers.

- Read and do the Activity, *Building Arrays*, p. 31-33. Members of your group should work on different numbers, choosing from 24, 28, 36 or 42.

### Discuss

- How did you find arrays for 24 (28, 36 or 42)?
- What relationships do you notice among the arrays for (24)? Did you use the dimensions of one array to help you find the dimensions of another?
- Do you think you found all the arrays for your number? How do you know?

- Read the Activity, *Number Puzzles: 1 Clue*, pp. 34-35. Complete Student Activity Book pp. 1-2, *Number Puzzles: 1 Clue*. Read the Algebra Note, “Models,” p. 34.

### Discuss

- How do arrays show different properties (e.g. odd, even, prime, square, etc.) of numbers?
- How does the work of finding arrays and solving number puzzles help students better understand the operations of multiplication and division?

## 3. Solving $35 \times 28$ (Session 2.1)

In this Investigation, students continue to develop strategies for solving 2-digit by 2-digit multiplication problems. In this session, students solve a two-digit multiplication problem and represent their solution.

- Working by yourself:
  - Create a story problem for  $35 \times 28$ .
  - Solve the problem, showing your solution clearly.
  - Draw a quick representation for the problem, using cubes, arrays, groups, etc.
- With a partner:
  - Create a poster that shows one (or both) of your strategies, including the representation.
  - Share posters with the group.
- Read the Activity, *Solving  $35 \times 28$* , pp. 71-74.
- Read the Teaching Notes, “Story Contexts” p. 71, and the Math Note, “Clear and Concise Notation”, p. 73.

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**Discuss**

- How are the strategies and representations your group used the same and different from those shown in the session?
- How do the story context and the representation help students answer the following questions about each strategy: What part of the problem has been solved with each step? What remains to be solved? Where is the 35 in your solution? Where is the 28? Where is the answer?
- How do the questions above help students achieve computational fluency in multiplication?

#### 4. Multiplication Cluster Problems (Session 2.4)

Students are introduced to *Cluster Problems*, which are sets of problems that help students to use what they know to find the solution to harder problems.

- Read the Activity, *Introduction to Cluster Problems*, pp. 92-93. Complete Student Activity Book p. 35, Multiplication Cluster Problems.

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**Discuss**

- What are the relationships among the problems in each set of cluster problems?
- How did you use the problems in the cluster to solve the larger problem?
- How do cluster problems help students efficiently solve multiplication problems? How do they help students understand the operation of multiplication?

- Read the Teacher Note, *Multiplication Strategies*, pp. 161-162.

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**Discuss**

- Look again at the cluster problems on SAB p. 35. Which multiplication strategy is suggested by each set of clusters?

#### 5. Using Multiple Towers (Session 3.2)

In this Investigation, students develop various strategies for solving division problems. In this session, students list a sequence of multiples and use it to solve multiplication and division problems.

- Read the Activities, *Introducing Multiple Towers*, pp. 122-124, and *Using Multiple Towers*, pp. 124-125. Use the multiple tower shown on p. 124 to solve the problems on Student Activity Book pp. 49-50, Problems about Multiples of 21.

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**Discuss**

- What numbers and/or relationships on the Multiple Towers did you use to solve the problems?
- How does the solution to one problem help to solve the others?

- Read the Teacher Note, *The Relationship Between Multiplication and Division*, p. 169.

**Discuss**

- How is the relationship between multiplication and division highlighted in the Multiple Tower work? (That is, how would you describe the relationship between  $126 \div 21 = \underline{\hspace{1cm}}$  and  $\underline{\hspace{1cm}} \times 21 = 126$ ?)
- How does this work help students solve multiplication and division problems?

**6. Wrap Up**

- Look back at the unit overview, pp. 8-9.

**Discuss**

- How do the activities done during this unit study fit into the overall mathematical storyline of the unit?

### Other Key Features of *Number Puzzles and Multiple Towers*

- Algebra Connections in This Unit, pp. 16-19
- Ten-Minute Math, p. 20
  - Quick Images*
  - Number Puzzles*
- Assessment:
  - Number Puzzles (Session 1.5)
    - Resource Master M34, Assessment Checklist
  - What Is the Answer? (Session 2.7)
    - Teacher Note: Assessment, pp. 166-168
  - End-of-Unit Assessment (Session 3.8)
    - Teacher Note, pp. 174-177