Multiple Towers

Connections to the mathematics TEKS

(5.3) Number, operation, and quantitative reasoning. The student adds, subtracts, multiplies, and divides to solve meaningful problems.

The student is expected to:

(B) use multiplication to solve problems involving whole numbers (no more than three digits times two digits without technology

(C) use division to solve problems involving whole numbers (no more than two-digit divisors and three-digit dividends without technology)

(D) identify prime factors of a whole number and common factors of a set of whole numbers

(5.5) Patterns, relationships, and algebraic thinking. The student makes generalizations based on observed patterns and relationships.

The student is expected to:

(B) use lists, tables, charts, and diagrams to find patterns and make generalizations such as a procedure for determining equivalent fractions

(C) identify prime and composite numbers using concrete models and patterns in factor pairs

(5.14) Underlying processes and mathematical tools. The student applies Grade 5 mathematics to solve problems connected to everyday experiences and activities in and outside of school.

The student is expected to:

(C) select or develop an appropriate problem-solving strategy, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem

(D) use tools such as real objects, manipulatives, and technology to solve problems

(5.15) Underlying processes and mathematical tools. The student communicates about Grade 5 mathematics using informal language.

The student is expected to:

(A) explain and record observations using objects, words, pictures, numbers, and technology

(B) relate informal language to mathematical language and symbols

(5.16) Underlying processes and mathematical tools. The student uses logical reasoning to make sense of his or her world.

The student is expected to:

(A) make generalizations from patterns or sets of examples and non-examples

(B) justify why an answer is reasonable and explain the solution process

Mathematics overview

Students identify factor pairs of whole numbers and use patterns in the factor pairs to identify prime and composite numbers.

Lesson Overview

Students use interlocking cubes to build towers to represent factors of numbers and place the towers in the appropriate places on a Tower chart in order to look for patterns.

Materials

interlocking cubes (10 different colors)

Tower Chart (a blackline master appears at the end of this lesson)

Multiple Towers worksheet (a blackline master appears at the end of this lesson)

Set-up *(to set the stage and motivate the students to participate)*

1. Have the students build towers of cubes on a Tower Chart. Explain that these towers will be built using the directions on the Multiple Towers worksheet. (5.3B, C, D; 5.14D)

2. Discuss the first steps

   - Put dark green cube on the multiples of 1. What are the multiples of 1? Why?
   - Put a light green cube on multiples of 2. How will you decide on which numbers to put the cubes? What do we mean by a multiple? Can you give other examples? (5.3B, C, D; 5.14D)

3. Let partners work together, following the directions and answering the questions on the worksheet. As pairs finish their towers, ask them to write statements concerning prime numbers, composite numbers, or patterns of factors they notice from their towers. Ask students to predict what their observations might be if their tower chart were extended to 25. (5.5C; 5.15A, B)

Guiding Questions *(to engage students in mathematical thinking during the lesson)*

- What is your strategy for finding multiples? (5.3B, C, D; 5.14C, D)
- Can you identify a pattern to help you? (5.5B, 5.14C, 5.16A)
- What do you notice about your towers?
- How can you use your towers to find factor pairs of the numbers?
- What are the factor pairs of 6?
- What are the factor pairs of 4?
- What do you notice about the number of cubes of the towers on the numbers 1, 4, and 9? Why did this happen? If you extended your tower chart to 25, what are other numbers for which you would observe the same thing? Why?
- Compare the towers for 2, 4, and 8. What do you notice? Why do you think this happened? If you extended your tower chart to include 16, how would this pattern extend? Explain.
- How can you use your towers to decide if a number is prime? Composite? Why?
- How can you communicate your findings so that someone else will understand them? (5.14A, B)

Teacher notes (to personalize the lesson for your classroom)

Summary Questions *(to direct students' attention to the key mathematics in the lesson)*

To emphasize the use of multiples and factors to describe prime and composite numbers, ask questions such as:

- Which numbers had the tallest towers? Why? (They have the most factors from 2 to 10.) Which colors were in them? (5.3B, C, D; 5.5C; 5.14D; 5.15A, B; 5.16B)
- Which numbers had only one cube? Why? (5.3B, C, D; 5.5C; 5.14D; 5.15A, B; 5.16B)
- Look at the towers that have a yellow cube, what do you notice about these towers? Did you notice that whenever you put a black cube on a number, it already had a blue cube on it? Why do you suppose that happened? (Because a number that is a multiple of 9 also always is a multiple of 3.) If you extended you tower chart to 16, what cubes would the 16th tower contain? (5.3B, C, D; 5.5C; 5.14D; 5.15A, B; 5.16B)
- What happened when you removed the towers and tried to put them back on correct numbers? What did you do to try to figure out where the tower might be placed? Did anyone try anything different? How did it work? (5.3B, C, D; 5.5C; 5.14D; 5.15A, B; 5.16A, B)
- Did you discover anything else from the activity that we have not already discussed? (5.16A, B)

Teacher notes (to personalize the lesson for your classroom)

Assessment Tasks *(to identify the mathematics students have learned in the lesson)*

- Give students a number between 1 and 100 and have them identify all of its factors, telling whether it is prime or composite.
- Have students write everything they know about prime numbers and about composite numbers.
- Have students identify three patterns they observed in their towers (e.g., everything with a brown cube also has a blue, a light green, and a dark green cube) and record them in their math journals.

Teacher notes (to personalize the lesson for your classroom)

Extensions *(to lead students to connect the mathematics learned to other situations, both within and outside the classroom)*

- Have students predict what will happen if they extended their towers chart. Test their predictions.
- Have students predict which numbers will have tall or short towers and test their predictions.

Teacher notes (to personalize the lesson for your classroom)

Tower Chart

1	2	3	4	5
6	7	8	9	10

Multiple Towers Worksheet

You need:

interlocking cubes (10 different colors)

Tower chart

a partner

Activity 1:

Put a **dark green** cube on multiples of **1**.

Put a **light green** cube on multiples of **2**.

Put a **blue** cube on multiples of **3**.

Put a **yellow** cube on multiples of **4**.

Put a **red** cube on multiples of **5**.

Put a **brown** cube on multiples of **6**.

Put a **white** cube on multiples of **7**.

Put an **orange** cube on multiples of **8**.

Put a **black** cube on multiples of **9**.

Put a **maroon or pink** cube on multiples of **10**.

Write statements concerning prime numbers, composite numbers, or patterns of factors.

Activity 2:

Now remove the towers. (Be careful not to break them apart.)

Try to put them back on the correct numbers.

Write about how you did this.