Preparing the Classroom Environment

This section provides suggestions for setting up the physical environment in a way that enhances collaborative learning and student ownership. It also provides suggestions for student notebook organization, teacher material organization, and family information distribution. As teachers prepare their classroom space, they can consider the following questions:

- How can I foster opportunities for student collaboration by arranging their seating?
- How can I ensure that there is room for students to move comfortably in the classroom?
- Where can I place the tools that students may need (calculators, rulers, angle rulers, grid paper, technology, material kits, and so forth) so that they are easily accessible?
- What is the best location for student materials (scissors, markers, colored pencils, glue sticks, construction paper, chart paper, material kits, and so forth)?
- How can I use wall space to display artifacts of student learning that will foster continued growth in our knowledge of mathematics?
- Where can we keep a record of our learning and the unresolved questions posed for further thinking during a unit? During the school year?

Organizing the Classroom

- Post the Mathematical Goals, the Mathematical Reflection, and/or the Now What Do You Know? questions on a wall so that students may refer to them as they work through a unit.
- Add key terms to visual representations of student work as the terms are formally developed during class. For example, when students make a graph from the bike tour in *Variables and Patterns* in the grade 6 unit place the terms *independent variable* and *dependent variable* along the *x*-axis and the *y*-axis.
- Post key terms as they are introduced and developed, making a word wall vocabulary poster for each unit.
- Make a memory wall to display key visual displays of learning from each unit.
- Post the questions "What connections do you see?" and "How can you make use of them?"

The idea behind a memory wall is that the classroom should reflect students' mathematical journey toward deeper understanding. Over the course of a unit, students will benefit from having a visual reference. As the unit draws to a close, students can select which visual display best represents their learning. Initially teachers may make those selections with the knowledge of what comes next.

Grouping Arranging student seating so that learners can move freely in the classroom is helpful. Students should display their work, including their conjectures and evidence to support or contradict them. Students often explore daily problems individually, with a partner, or with a small group of 3 or 4 students. Therefore, having flexible seating for ease in grouping is effective. As you determine where materials will be located, remember that students should be able to move freely and have the freedom to choose which tools and materials are used to delve into a problem.

Working collaboratively allows students to tackle more complicated and more conceptually difficult problems. Carefully managed, collaborative learning can be a powerful tool for teachers to use during classroom instruction. CMP suggests two types of collaborative-learning groupings: partner work and small-group work. Many of the problems in CMP are mathematically demanding, requiring students to gather data, consider ideas, look for patterns, make conjectures, and use problem-solving strategies to reach a solution. For this reason, the Teacher Edition often suggests that students work on a problem collaboratively. Group work supports the generation of a variety of ideas and strategies to be discussed and considered, and it enhances the perseverance of students in tackling more complicated multistep and multipart problems.

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It is appropriate to ask students to think about a problem individually before moving them into groups, allowing them to formulate their own ideas and questions to bring to the group. These multiple perspectives often lead to interesting and diverse strategies for solving a problem.

It is important that teachers clearly communicate their expectations about group work to their students and then hold them to those expectations. A handout or posting a set of guidelines could help students understand their responsibilities. A suggested set of student guidelines follows.

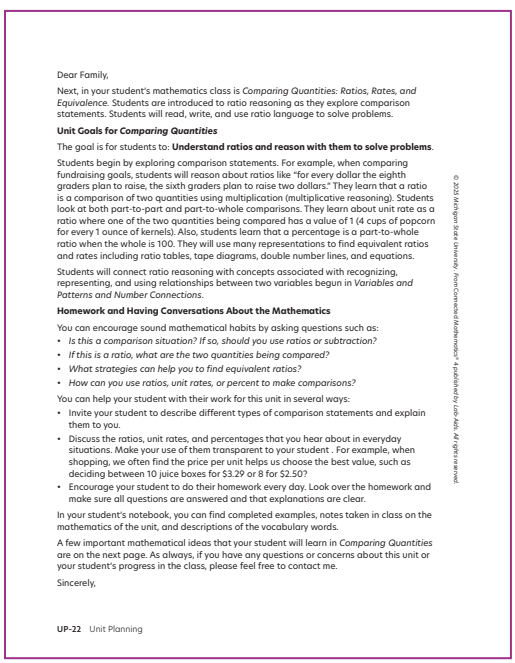
- Move into your groups quickly, and get right to work.
- Read the problem aloud, or repeat what the teacher has challenged you to find out. Be sure every group member knows what the challenge is.
- Part of group work is learning to listen to each other. Don’t interrupt your classmates. Make sure each person’s ideas are heard and that the group answers each person’s questions.
- If you are confused, ask your group to explain. If no one in the group can answer the question and it is an important question, raise your hand for the teacher.
- If someone in your group uses a word or an idea you do not understand, ask for an explanation. You are responsible for learning all you can from your group. You are also responsible for contributing to the work of your group. Your explanations for others will help you to understand better.
- Give everyone in the group a chance to talk about their ideas. Talking out loud about your thinking will help you learn to express your arguments and clarify your ideas.
- If your group gets stuck, go over what the problem is asking and what you know so far. If this does not give you a new idea, raise your hand for the teacher.
- Keep notes and diagrams so you can refer back to the problem as needed. You are responsible for recording your group’s ideas and solutions in your notes.
- Be prepared to share your group’s ideas, solutions, and strategies and to explain why you think you are correct. Make sure you look back at the original problem and check that your solutions make sense.

Note on forming groups: This varies from class to class and teacher to teacher. Some teachers use the same groups for a whole unit, using random strategies (e.g., drawing straws) to group students. Some teachers randomly assign students in groups for just one problem. Some CMP4

teachers report that more frequent random grouping encourages more engagement by more students. But each class is different. Thus it is the teacher who selects a grouping strategy that meets the needs of the class.

Preparing Communication and Organization Tools

Family Letters There is a Family Letter available for each of the 23 units. These letters provide valuable information about the unit goals and key terms that will be used, as well as information on how to support their students in learning mathematics. Letters can be sent home with students or sent electronically. Some teachers have found it helpful for their students to write personal letters to their parents or guardians at the end of each unit to share specific examples of their learning. Visit the Connected Mathematics website (https://connectedmath.msu.edu/) for detailed support for families.



Dear Family,

Next, in your student's mathematics class is *Comparing Quantities: Ratios, Rates, and Equivalence*. Students are introduced to ratio reasoning as they explore comparison statements. Students will read, write, and use ratio language to solve problems.

Unit Goals for *Comparing Quantities*

The goal is for students to: **Understand ratios and reason with them to solve problems**.

Students begin by exploring comparison statements. For example, when comparing fundraising goals, students will reason about ratios like "for every dollar the eighth graders plan to raise, the sixth graders plan to raise two dollars." They learn that a ratio is a comparison of two quantities using multiplication (multiplicative reasoning). Students look at both part-to-part and part-to-whole comparisons. They learn about unit rate as a ratio where one of the two quantities being compared has a value of 1 (4 cups of popcorn for every 1 ounce of kernels). Also, students learn that a percentage is a part-to-whole ratio when the whole is 100. They will use many representations to find equivalent ratios and rates including ratio tables, tape diagrams, double number lines, and equations.

Students will connect ratio reasoning with concepts associated with recognizing, representing, and using relationships between two variables begun in *Variables and Patterns* and *Number Connections*.

Homework and Having Conversations About the Mathematics

You can encourage sound mathematical habits by asking questions such as:

- *Is this a comparison situation? If so, should you use ratios or subtraction?*
- *If this is a ratio, what are the two quantities being compared?*
- *What strategies can help you to find equivalent ratios?*
- *How can you use ratios, unit rates, or percent to make comparisons?*

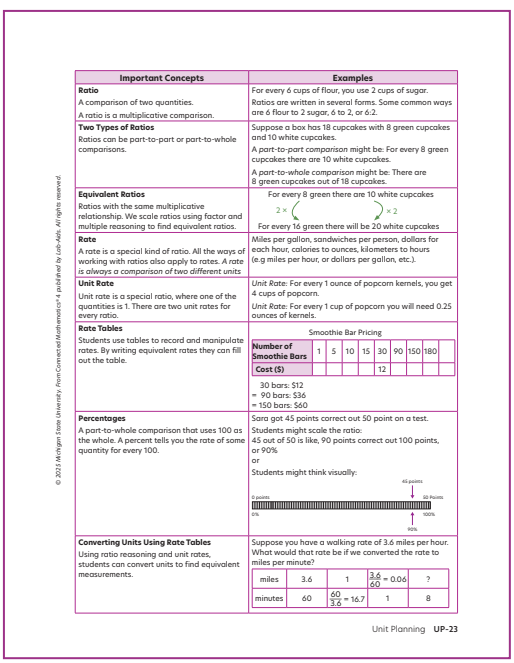
You can help your student with their work for this unit in several ways:

- Invite your student to describe different types of comparison statements and explain them to you.
- Discuss the ratios, unit rates, and percentages that you hear about in everyday situations. Make your use of them transparent to your student . For example, when shopping, we often find the price per unit helps us choose the best value, such as deciding between 10 juice boxes for $3.29 or 8 for $2.50?
- Encourage your student to do their homework every day. Look over the homework and make sure all questions are answered and that explanations are clear.

In your student's notebook, you can find completed examples, notes taken in class on the mathematics of the unit, and descriptions of the vocabulary words.

A few important mathematical ideas that your student will learn in *Comparing Quantities* are on the next page. As always, if you have any questions or concerns about this unit or your student's progress in the class, please feel free to contact me.

Sincerely,



Important Concepts	Examples
Ratio A comparison of two quantities. A ratio is a multiplicative comparison.	For every 6 cups of flour, you use 2 cups of sugar. Ratios are written in several forms. Some common ways are 6 flour to 2 sugar, 6 to 2, or 6:2.
Two Types of Ratios Ratios can be part-to-part or part-to-whole comparisons.	Suppose a box has 18 cupcakes with 8 green cupcakes and 10 white cupcakes. A *part-to-part comparison* might be: For every 8 green cupcakes there are 10 white cupcakes. A *part-to-whole comparison* might be: There are 8 green cupcakes out of 18 cupcakes.
Equivalent Ratios Ratios with the same multiplicative relationship. We scale ratios using factor and multiple reasoning to find equivalent ratios.	For every 8 green there are 10 white cupcakes 2 × ( ) × 2 For every 16 green there will be 20 white cupcakes
Rate A rate is a special kind of ratio. All the ways of working with ratios also apply to rates. *A rate is always a comparison of two different units*	Miles per gallon, sandwiches per person, dollars for each hour, calories to ounces, kilometers to hours (e.g miles per hour, or dollars per gallon, etc.).
Unit Rate Unit rate is a special ratio, where one of the quantities is 1. There are two unit rates for every ratio.	*Unit Rate:* For every 1 ounce of popcorn kernels, you get 4 cups of popcorn. *Unit Rate:* For every 1 cup of popcorn you will need 0.25 ounces of kernels.
Rate Tables Students use tables to record and manipulate rates. By writing equivalent rates they can fill out the table.	Smoothie Bar Pricing Number of Smoothie Bars: 1, 5, 10, 15, 30, 90, 150, 180 Cost ($): 12 30 bars: $12 = 90 bars: $36 = 150 bars: $60
Percentages A part-to-whole comparison that uses 100 as the whole. A percent tells you the rate of some quantity for every 100.	Sara got 45 points correct out 50 point on a test. Students might scale the ratio: 45 out of 50 is like, 90 points correct out 100 points, or 90% or Students might think visually: 45 points, 50 Points, 0%, 100%, 90%
Converting Units Using Rate Tables Using ratio reasoning and unit rates, students can convert units to find equivalent measurements.	Suppose you have a walking rate of 3.6 miles per hour. What would that rate be if we converted the rate to miles per minute? miles: 3.6, 1, $\frac{3.6}{60} = 0.06$, ? minutes: 60, $\frac{60}{3.6} = 16.7$, 1, 8

Student Notebooks The following are suggestions from CMP teachers.

Example 1. Students can use a three-ring binder to hold their texts and their work with the following organization:

- Student Edition of current unit
- Journal: a record of the in-class problems with Summarize notes for the Initial Challenge, What If . . . ?, and Now What Do You Know?
- Mathematical Reflections
- Key Terms: student-created
- Homework: ACE and additional practice exercises
- Assessments: Checkups, Partner Quizzes, and Unit Tests

Example 2. Students use a simpler organization of student notebooks as follows:

- Front pocket for the current work in an investigation
- Student Edition
- Back pocket for assessed student work to include in-class problems, ACE, Mathematical Reflection, and assessments