## CCSS Unpacking Template

### Standard Information:

<table>
<thead>
<tr>
<th>Code:</th>
<th>MACC.6.RP.1.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain:</td>
<td>Ratios &amp; Proportional Relationships</td>
</tr>
<tr>
<td>Cluster:</td>
<td>Understand ratio concepts and use ratio reasoning to solve problems.</td>
</tr>
<tr>
<td>Standard:</td>
<td>Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.</td>
</tr>
<tr>
<td>a.</td>
<td>MACC.6.RP.1.3a Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.</td>
</tr>
</tbody>
</table>

### Focus:

| Critical Areas: | 1) Connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems. |
| Content Emphasis: | Major Cluster |

### Coherence:

<table>
<thead>
<tr>
<th>Prior/Prerequisite Standards:</th>
<th>Related Standards</th>
<th>Subsequent Standards:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MACC.5.NF.2.3</td>
<td>MACC.6.RP.1.1</td>
<td>MACC.7.RP.1.1</td>
</tr>
<tr>
<td>MACC.5.NF.2.4</td>
<td>MACC.6.RP.1.2</td>
<td>MACC.7.RP.1.2</td>
</tr>
<tr>
<td>MACC.5.NF.2.5</td>
<td></td>
<td>MACC.7.RP.1.3</td>
</tr>
<tr>
<td>MACC.5.NF.2.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MACC.5.NF.2.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Standards for Mathematical Practice:

MP1. Make sense of problems and persevere in solving them.
MP6. Attend to precision.
MP7. Look for and make use of structure.
**Key Terms Defined:**

**Equivalent ratios:** Different ratios that can be obtained by multiplying or dividing both numbers in a ratio pair by the same amount. For example, 8 to 12 and 32 to 48 are equivalent ratios because 32 to 48 could be obtained by multiplying both 8 and 12 from the first ratio pair by 4. In the CCSS these equivalent ratios may be described as being “in the same ratio”. For example, one could say that 8 to 12 is *in the same ratio* as 32 to 48.

**Double number line diagram:** A pair of parallel number lines used to display equivalent ratios for the ratio $A:B$. The top number line shows multiples of quantity $A$, and the bottom number line shows multiples of quantity $B$. On the diagram, $A$ and $B$ are equidistant from 0, and the distance of all equivalent ratios is a multiple of the $A:B$ distance from zero. For example, in the double number line diagram below all of the ratios are equivalent to 4:5. The ratio 20:25 is 5 times greater than 4:5, so it is also exactly 5 times farther from 0 than 4:5.

![Double Number Line Diagram](image)

**Quantity:** A measurement of an attribute that can either be discreet or continuous. A discreet quantity is the total count of normally separate items (e.g., 6 students or 132 tennis balls). A continuous quantity is the identification of an amount normally measured against a scale (e.g., 158 lbs, 3 hours, or 47 feet).

**Ratio:** A pair of numbers, $A$ and $B$, where $A$ and $B$ are not both negative. In the CCSS “ratio” may be used to describe ratios, rates, proportional relationships, and percentages. Common ratio phrases notation includes $A$ to $B$, $A$ for every $B$, $A$ out of every $B$, $A:B$, and $A/B$. The two numbers that make up ratio may be referred to as a “ratio pair”.

**Rate:** A ratio that compares quantities that have different units. In the CCSS for grades 6 & 7, “rate” always refers to a consistent quantity of a unit compared to one of the other unit. For example, for a ratio of 12 dogs: 4 cats, the rate would be 3 dogs per cat or 3 dogs for each cat. The following terms may be used to identify rates: “for each 1”, “for each”, “in each”, and “per”.

**Table of Equivalent Ratios (Ratio Table):** A table of equivalent ratio pairs consisting of two rows or columns. Each row (in a horizontal table) or column (in a vertical table) consists of multiples of the quantity in the first ratio. A third
A tape diagram is illustrated below.

The mix ratio for purple paint is 5 quarts red for every 3 quarts blue. In the tape diagram, each section of tape is 1/8 of the total quantity (5 + 3 parts).

"Filling" each section of tape with the same amount (9) will give an equivalent ratio (45:27) that is visually equivalent to 5:3, but numerically it is 9 times greater. 45 quarts red mixed with 27 quarts blue will produce the same shade of purple. Note that 45 + 27 = 72, which is a multiple of 8.
Student Thinking and Misconceptions:

Students may initially struggle with ratios because the two quantities are related multiplicatively, because their experience may tempt them to view a ratio pair as being related by addition. Early on, students may solve problems through repeated addition of the initial quantities to find equivalent ratios; however, this approach breaks down when the equivalent ratio is many times larger or if they are asked to find a fractional ratio, such as 1/6th of a ratio. It is important for students to recognize that relative “size” of the two quantities compared to each other remains constant. Initial experiences with equivalent ratios that use well-established ideas of twice (or double), triple, half, or a quarter of a ratio may help provide effective support for students in their first experiences explicitly dealing with ratios. To help students build proportional reasoning. [1] [2] [3]

Although proportional reasoning builds on a student’s understanding of fractions and multiplication, it should be made clear that equivalent fractions are not the same as equivalent ratios. In equivalent fractions with larger denominators, the whole remains the same, while the equal parts get smaller and smaller. In equivalent ratios with larger quantities, the total amount of quantities increases, while the multiplicative relationship between the two quantities remains the same. [1] (The figure below illustrates the difference).

Equivalent fractions 1/2 and 5/10. Note: The whole remains the same, while parts get smaller in 5/10.

To avoid possible confusion, fraction notation for ratios should not be used in 6th grade. Instead use representational contexts that support the development of proportional reasoning. Good examples of ratio and proportional contexts include “bottles per case”, adjusting recipes, or the number of spaces in parking lots that are bigger or smaller. [3] The strategies suggested in the possible instructional objectives above, such as ratio tables, tape diagrams, graphs of coordinates, and double-number lines are effective for supporting this reasoning as well. These approaches should be used instead of teaching cross-multiplication in grade 6, which may keep students from actually understanding the nature of proportional relationships. [1]
What Students Must Know and Be Able to Do

Concepts:
- Ratios
- Equivalent ratios
- Multiplicative comparison

Skills:
- Use ratio reasoning
- Solve problems
- Making tables
- Relating quantities
- Finding missing values
- Plotting coordinate pairs
- Comparing ratios

Contexts:
- Real-world problems
- Mathematical problems
- Ratio tables (tables of equivalent ratios)
- Whole-number measurements
- Coordinate Plane

Assessable Instructional Objectives with Examples:

Students will relate quantities in a table of equivalent ratios (ratio table) by identifying how many times greater or less a quantity in one ratio is compared to a corresponding quantity in an equivalent ratio.

Example: A recipe for fruit punch uses 2 cups of pineapple juice for every 5 cups of lemon/lime soda. If the host of the party triples the recipe, what will be the ratio of pineapple juice to lemon/lime soda? How big will the punch bowl have to be to hold all of the tripled recipe?

<table>
<thead>
<tr>
<th>Pineapple Juice (cups)</th>
<th>Lemon/Lime Soda (cups)</th>
<th>Total Punch (cups)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
<td>21</td>
</tr>
</tbody>
</table>

After the recipe is tripled, the ratio of pineapple juice to lemon/lime soda will be 6 cups:15 cups.

The punch bowl will need to be big enough to hold 21 cups altogether.

Students will construct a table of equivalent ratios (ratio table) either in columns or rows to find a missing value in a real-world or mathematical problem. An additional column or row may be added for totaling quantities in cases where units are the same.
Example: To make a cream sauce a cook uses a ratio of 1 cup of cream to 4 cups of broth. Create a ratio table to find the number of cups of cream needed for 24 cups of broth.

<table>
<thead>
<tr>
<th>Cups of Cream</th>
<th>Cups of Broth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>

6 cups of cream will be needed for 24 cups of broth, because $1 \times 6 = 6$.

Students will plot ratio pair values from a (ratio table) on a coordinate plane to solve problems. This method may be used to find missing values or to make a multiplicative comparison between equivalent ratios.

Example: A car on cruise control covered 8 miles in 12 minutes and it covered 48 miles in 72 minutes. Construct a ratio table and plot the ratio pairs on a coordinate plane to determine the number of miles the car traveled in 60 minutes.

Example: A car on cruise control covered 8 miles in 12 minutes and it covered 48 miles in 72 minutes. Construct a ratio table and plot the ratio pairs on a coordinate plane to determine the number of miles the car traveled in 60 minutes.

After 60 minutes, the car will have covered 40 miles, because $40 \div 60$ is 5 times greater than $8 \div 12$. 
Students will compare ratios from two different ratio tables to solve problems by finding corresponding quantities that have the same value on both tables.

Example: Alena is trying to decide which babysitting job she should take. Job A pays $14 every 3 hours, and job B has a pay ratio of $9:2 hours. Using ratio tables, compare the two jobs and explain which job pays better.

(One possible solution.)

![Image of ratio tables]

According to the ratio tables, Job A pays better because in 6 hours Alena would earn $28 dollars, while Job B would only pay $27 for 6 hours of work.

Further Reading:

