Common Core Math in 7th Grade

Seventh grade math is some of the most useful throughout life. Calculating discounts, taxes, interest, etc. are something all adults need to do regularly. Now, however, students do more work of recognizing how a percent or proportion comes about and what it means. For example, we can look at a lot of items at a store and ask for each what would be better: a $20 discount or a 20% discount? Letting students figure out that 20% is best for items over $100, and $20 is best for items under $100, from examples (and reason about why) helps them learn about functions later. In fact, one *can* set this up as a function problem, but reasoning directly, perhaps drawing a picture (like the "tape diagrams" borrowed from Singapore), is more intuitive for many.

Learning about negative numbers will also have an emphasis on both context (money owed, temperatures below zero, blocks to the left and right of some landmark) and how previous arithmetic must apply to it. For example, they'll justify why a negative times a negative must be a positive using area calculations of rectangles with negative numbers (e.g. one side is 10 + -3 =7 feet long).

As data is a key part of understanding our world now, this will be a focus. Students will look at two quantities or two populations, and try to understand not only how they are related but how certain they can be about the relationship. Probability at this grade is important in its own right but also reinforces fraction arithmetic.

While a lot of good work happens in seventh grade, the overlap with sixth and eighth grade means that this can be a time for acceleration if needed. Much of the proportional reasoning is similar to sixth grade, so students who are really fluent in fraction arithmetic and proportional reasoning could gain these skills faster. This could allow for a strong precalculus preparation in eleventh grade and calculus in twelfth grade, though calculus in high school isn't recommended as a standard path. Professors prefer students who thoroughly understand algebra and functions to students who have superficial understanding of concepts through calculus.

Examples:

Cooking with the Whole Cup https://www.illustrativemathematics.org/illustrations/470 (see reverse)

Initially one can use "common sense" here: one cup of butter instead of an eighth cup is eight times as much, so he'll need eight times as much of the other ingredients. This reinforces why dividing by an eighth should be the same as multiplying by eight since "how many times does 1/8 cup fit into 1?" is $1 \div \frac{1}{8}$. Later in the problem, "common sense" is no longer enough on its own. Then, knowing how to systematically set things up and think about things like unit rates solves a problem that isn't so easy. By doing an easier case at the beginning, students can check their mathematical process and make sure it agrees with common sense, when both can be applied.

Tips for parents:

- Talk through some good "real world" problems, especially if it takes you a while and you're sharing your thinking. One-on-one discussions about math thinking and reasoning — with a teacher at times, with friends, with you, with a tutor if you have access — is a great experience.
- Your attitude about learning math is crucial. Students should sense that math is worth their attention, and will require effort more than quick thinking or "innate smarts" to be really good at in the long run. The quick thinkers often have trouble once things get more involved, as real-world problems often do.
- Engaging in activities that use math with them is a great way to reinforce both positive attitude and skills — for example, do fraction arithmetic as part of baking or working through financial calculations.

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Cooking with the Whole Cup

http://www.illustrativemathematics.org/illustrations/470

Travis was attempting to make muffins to take to a neighbor who had just moved in down the street. The recipe that he was working with required $\frac{3}{4}$ cup of sugar and $\frac{1}{8}$ cup of butter.

1. Travis accidentally put a whole cup of butter in the mix.

   A. What is the ratio of sugar to butter in the original recipe? What amount of sugar does Travis need to put into the mix to have the same ratio of sugar to butter that the original recipe calls for?

   B. If Travis wants to keep the ratios the same as they are in the original recipe, how will the amounts of all the other ingredients for this new mixture compare to the amounts for a single batch of muffins?

   C. The original recipe called for $\frac{3}{8}$ cup of blueberries. What is the ratio of blueberries to butter in the recipe? How many cups of blueberries are needed in the new enlarged mixture?

2. This got Travis wondering how he could remedy similar mistakes if he were to dump in a single cup of some of the other ingredients. Assume he wants to keep the ratios the same.

   A. How many cups of sugar are needed if a single cup of blueberries is used in the mix?

   B. How many cups of butter are needed if a single cup of sugar is used in the mix?

   C. How many cups of blueberries are needed for each cup of sugar?

Commentary:

While the task as written does not explicitly use the term "unit rate," most of the work students will do amounts to finding unit rates. A recipe context works especially well since there are so many different pair-wise ratios to consider. This task can be modified as needed; depending on the choice of numbers, students are likely to use different strategies which the teacher can then use to help students understand the connection between, for example, making a table and strategically scaling a ratio. The choice of numbers in this task is already somewhat strategic: in part 1, the scale factor is a whole number and in part 2, the scale factors are fractions. Because of this difference, students will likely approach the parts of the task in different ways.

Solutions:

1. A. The ratio of cups of sugar to cups of butter is $\frac{3}{4}:\frac{1}{8}$. If we multiply both numbers in the ratio by 8, we get an equivalent ratio that involves 1 cup of butter. $8 \times \frac{3}{4} = 6$ and $8 \times \frac{1}{8} = 1$ In other words, $\frac{3}{4}:\frac{1}{8}$ is equivalent to 6:1, and so 6 cups of sugar are needed if there is 1 cup of butter.

   B. In the previous part we saw that we have 8 times as much butter, so all the ingredients need to be increased by a factor of 8. That is, the quantity of each ingredient in the original recipe needs to be multiplied by 8 in order for all the ratios to be the same in the new mixture.

   C. The ratio of cups of blueberries to cups of butter is $\frac{3}{8}:\frac{1}{8}$ in the original recipe, so Travis will need to add $8 \times \frac{3}{8} = 3$ cups of blueberries to his new mixture.

2. …C. The ratio of cups of blueberries to cups of sugar is $\frac{3}{8} : \frac{3}{4}$. If we multiply both numbers in the ratio by $\frac{4}{3}$, we get an equivalent ratio. $\frac{4}{3} \times \frac{3}{8} = \frac{1}{2}$ and $\frac{4}{3} \times \frac{3}{4} = 1$. Since $\frac{3}{8}:\frac{3}{4}$ is equivalent to $\frac{1}{2}$: 1, Travis would need $\frac{1}{2}$ cup of blueberries if there is one cup of sugar.