6th Grade Math

Unit 2: Equivalent forms of fractions, decimals, and percents
6.4E, 6.4F, 6.4G, 6.5B, 6.5C

This unit continues to build a strong foundation of numeracy through using visual models to solve problems with percents, fractions, and decimals.

☐ Represent percents with concrete models including double number lines and strip diagrams
☐ Find equivalent percents, decimals, and fractions
☐ Solve word problems involving percents

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| 6.4E: Represent ratios and percents with concrete models, fractions, and decimals | Misunderstanding percents | Percents can be confusing and some students might not understand that a percent is simply a way of expressing a number as a fraction of 100. The word percent means “per cent” or “per 100.” For example, 80% means 80 out of 100 or \( \frac{80}{100} \).

How to help: Remind students often that “% = percent = per cent = per 100” and this will help them to internalize the meaning of a percent. You can write this on the board or make a poster for easy reference. Repetition and practice are crucial.

“Percents greater than 100% are not possible” | Some students might think that percentages can't go over 100%, but that’s not true! If you have a percent that is greater than 100%, it just means that there is more that there was before.

How to help: Show students examples where percents are greater than 100%. If something grows over time it can be represented with a percent greater than 100%. For example, if Mikey had a goal to raise $80 for a charity and they actually raised $100, then they raised 125% of their goal.

“Percents, decimals, and fractions are totally different” | Some students might not realize that percents, decimals, and fractions are simply different ways of expressing parts of a whole.
**How to help:** When solving word problems, have students write the answer out in each form. For example, if the answer is “The apple weighed 75% of a pound,” students should also write “The apple weighed 0.75 of a pound,” and “The apple weighed 75/100 of a pound.” Using visuals of number lines and fraction diagrams are also helpful. When they see that all three forms of the same number occur on the same point of a number line or that pictures of all three forms result in the same visual model, it will help them to see that all three forms represent the same quantity. The more practice, the better!

**Misaligning values on double number lines** | Some students might struggle with lining up the corresponding values on the lines. The two lines represent the same quantities, just in different forms—one line is the quantity as the raw number and the other is the quantity as a percent.

**How to help:** It’s important to emphasize that each point on one line corresponds to a point on the other line that is vertically aligned. For some students, this is a detail they may understand, but they might not have the dexterity to easily make double number lines with alignment. A straight edge can help students with this, especially when they use it to make vertical marks on both number lines at the same time.

**Misinterpreting the whole in a strip diagram** | It is important for students to correctly identify the “whole” in a strip diagram. Usually the entire length of a strip diagram represents a whole, but that is not always true. The labels will identify if there is a different quantity that represents a whole in a specific problem.

**How to help:** Emphasize how important it is to read all parts of a problem carefully, including the diagram. Here’s an example of a diagram in which the “whole” is not the entire length of the strip.

**Only fractions with a denominator of 100 can be represented as percents** | Some students think that if a fraction doesn’t have a denominator of 100, it can’t be written as a percent.

**How to help:** Students will get lots of practice writing equivalent fractions. Emphasize that to write a percent, they need to find the equivalent fraction with a denominator of 100.
Unit resources

- For Lesson 2, students can use this Double number line worksheet when they solve problems with double number lines and this Strip diagram worksheet when they solve problems with strip diagrams.
- Print this Double number line graphic organizer and this Strip diagram graphic organizer back-to-back and put it in a sheet protector for students to use with dry erase markers.
- For the videos in this unit, use the Learning summary video notetaking guide.
- For the articles in this unit, use the Article notetaking guide.
- For the exercises in this unit, use the Blank workspace template. Since the strip diagrams vary in size, use this template when students work with strip diagrams, and have students copy the diagram onto their paper.
- To record key terms and information, use the Vocabulary and notation notetaker.

Lesson overview

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| Lesson 1: Intro to percents    | Students will be able to write percents, less than and greater than 100, from diagrams. Students will be able to write equivalent fractions, decimals, and percents from diagrams. | - Students will see a variety of diagrams to represent fractions, decimals, and percents. These diagrams should be familiar to them but it would be beneficial to give warm up problems that include different types of diagrams. Remind students that it’s important to pay attention to what part of the diagram represents one whole.  
- In the videos, Sal talks about “tape diagrams.” They are the same as strip diagrams. |
| Lesson 2: Visualizing percents | Students will be able to use double number lines and strip diagrams to find percents. | - Students will be expected to use double number lines and strip diagrams (which they saw in Unit 1) to find percents. Review these models with students (see “Best practices,” below, for notes on this).  
- Percents are ratios out of 100, so leverage students’ knowledge of ratios as they work through percent problems. |
<p>| Lesson 3: Percent, decimal, fraction conversions | Students will be able to write equivalent percents, decimals, and fractions in simplest form. | - Students will write equivalent percents as decimals and fractions, fractions as percents, and decimals as percents. This lesson focuses on conversion of percents since students have previously worked with decimals and fractions. |</p>
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- The language that Sal uses in the videos may be helpful for students when they think about percentages and it may be beneficial to post where students can see it.

\[
\% = \text{percent} = \text{per cent} = \text{per 100}
\]

**Lesson 4: Equivalent representations of percent problems**

TEKS standard: 6.5B, 6.5C

Students will be able to determine percents of whole numbers, i.e. 30% of 6.

- For students who are struggling, it might be helpful to use a double number line or strip diagram when solving these problems. The goal is to move away from these tools for problems like this, but they can be used as a scaffold if needed.

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**Lesson 5: Percent problems**

TEKS standard: 6.5B

Students will be able to determine the percent of a number, find the whole given a part and the percent, find the part given the whole and the percent, and find the percent given the part and the whole.

- These problems can feel tricky to students because they’ll need to read carefully to determine what information they have and what they are trying to find. Focus on identifying the part, whole, and/or percent and discuss strategies to find each missing piece. Encourage students to work slowly and read carefully.

- Double number lines and strip diagram models can be helpful when working with these problems.

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**Lesson 6: Percent word problems**

TEKS standard: 6.5B

Students will be able to determine the percent of a number, find the whole given a part and the percent, find the part given the whole and the percent, and find the percent given the part and the whole in word problems.

- In addition to using double number lines and strip diagrams, students can also use tables to solve these problems. See “Best practices” for more information.

- Encourage students to work slowly and read the problems carefully.
Best practices

EXPERT INSIGHT

In this unit, students will model and solve problems with percents using double number lines and strip diagrams. These strategies were introduced in Unit 1, so students will continue to gain experience with these models and see how they can be used in many types of problems. Students should be able to use both of these strategies, but let them choose a favorite to use when solving problems on their own.

Double number lines
Double number lines can be used when working with ratios and percentages to help compare quantities visually. We use two number lines, one vertically below the other. The two number lines must be divided into the same number of pieces so there is vertical alignment to find equivalent percentages.

Let's say an adult giant Pacific octopus has a mass of 60kg. We want to find out what mass is equivalent to 40% of the octopus’s mass. We can use a double number line to find the answer.

First, I know that 60kg is 100% because that is the total mass, so they align at the far right. Then, I want to find 40% of the mass, but 40% is not evenly divisible into 100%, so I'll use 20% instead (I could use 10% or 5% or 1% here, but that would be a lot of tiny parts!). Since 20% is \( \frac{1}{5} \) of 100%, I divided the Percentage number line into 5 equal parts, each worth 20%.

Since the Percentage number line is divided into 5 parts, I also need to divide the Mass number line into 5 parts because both number lines must be divided into the same number of parts. 60 divided into 5 equal parts is 12, so each part on the Mass number line is worth 12kg. Once both number lines are labeled, I can see that 40% corresponds to 24kg, so that tells me that 40% of 60kg is 24kg.

Strip diagrams
Strip diagrams provide another way to visualize percentages. A strip diagram is a rectangle divided into equal sized parts and each part is labeled with the value that it represents.

We'll continue working with the same situation as above, with the giant Pacific octopus that has a mass of 60kg. Here is a strip diagram to represent the situation.

Since we want to find 40% of 60kg, we'll divide the strip diagram into 5 equal parts for the same reason that the double number line, above, was divided into 5 equal parts. Each part will represent 20% (again, you could divide it into 10 equal parts of 10% or 100 equal parts of 1%, etc., but then you'd have a lot of small parts).
Now that we know each part is 20%, we need to find out how many kilograms each part represents. We'll divide 60 by 5 and get 12, so each part represents 12kg.

We can see that 40% will be two parts, and each part is worth 12, so two parts will be worth 24. Thus, 40% of 60kg is 24kg.

PRO TIP

**Percents are ratios**
Students were formally introduced to ratios in Unit 1, and the foundational idea of consistent relationships is also used when finding percents. Percents are really just ratios out of 100! The word “percent” means “per cent” or “per hundred.” For example, if I have a ratio of 1:4, an equivalent ratio is 25:100, which is 25%. To put it another way, 25% is 25/100, so if you want to find 25% of something, you’re looking for an equivalent ratio to 25:100.

**GENERAL CLASSROOM IMPLEMENTATION RESOURCES:**

- **Weekly Khan Academy quick planning guide**: Use this template to plan your week using Khan Academy.
- **Using Khan Academy in the classroom**: Learn teaching techniques and strategies to support your students and save time with Khan Academy.
- **Differentiation strategies for the classroom**: Discover strategies to support the learning of all students.