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Lesson 6: Fluency with Percents

Student Outcomes

* Students solve various types of percent problems by identifying the type of percent problem and applying appropriate strategies.
* Students extend mental math practices to mentally calculate the part, the percent, or the whole in percent word problems.

Lesson Notes

This lesson provides further development of mental math strategies with percents, additional exercises involving a variety of percent problems from Lessons 2–5, and a Sprint exercise.

Classwork

**Opening Exercise (4 minutes)**

The Opening Exercise reviews concepts learned in Lesson 5; students continue to use mental math strategies with other percent problems in Example 1. Provide two minutes for students to find a solution to the problem, and then ask for students to share their strategies with the class.

Opening Exercise

Solve the following problem using mental math only. Be prepared to discuss your method with your classmates.

Cory and Everett have collected model cars since the third grade. Cory has model cars in his collection, which is more than Everett has. How many model cars does Everett have?

The number of cars that Everett has is the whole; more than Everett would be of Everett’s cars. cars is of Everett’s number of cars. There are five intervals of in , so I have to divide both and by . divided by is . Therefore, of the cars would be cars. Everett has model cars.

* What made this problem fairly easy to solve in our heads?
	+ *The numbers were easily compatible and shared factors with .*

**Example 1 (10 minutes): Mental Math and Percents**

In Lesson 5, students practiced using mental math strategies to calculate the whole when given the part and its corresponding percent. In this example, students extend those strategies to mentally calculate the part when given its corresponding percent and the whole.

 **Example 1: Mental Math and Percents**

1. **of the students in Jesse’s class are inches or taller. If there are students in her class, how many students are inches or taller?**
* Is this question a comparison of two separate quantities, or is it part of the whole? How do you know?
	+ *The problem says that the students make up of Jesse’s class, which means they are part of the whole class; this is a part of the whole problem.*
* What numbers represent the part, whole, and percent?
	+ *The part is the number of students that are inches or taller, the whole is the students that make up Jesse’s class, and the percent is .*

Instruct students to discuss the problem with a partner; challenge them to solve it using mental math only. After 1–2 minutes of discussion, ask for students to share their mental strategies with the class.

*Scaffolding:*

Challenge struggling students to solve these problems by writing down as little as possible, internalizing their strategy, and repeating it without paper.

* + *Possible strategies:*
		- *is the same as of . We know that students represent and so , which means is of .*

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* + - *is the same as of ; and , which means that is of .*

Have students write a description of how to mentally solve the problem (including the math involved) in their student materials.

* Was this problem easy to solve mentally? Why?
	+ *The numbers involved in the problem shared factors with that were easy to work with.*
1. **Bobbie wants to leave a tip for her waitress equal to of her bill. Bobbie’s bill for her lunch is . How much money represents of the bill?**
* Is this question a comparison of two separate quantities, or is it part of a whole? How do you know?
	+ *She is leaving a quantity that is equal to of her bill, so this is a comparison of two separate quantities.*
* What numbers represent the part, the whole, and the percent? Is the part actually part of her lunch bill?
	+ *The part is the amount that she plans to leave for her waitress and is not part of her lunch bill but is calculated as if it is a part of her bill; the whole is the lunch bill, and the percent is .*

Instruct students to discuss the problem with a partner; challenge them to solve it using mental math only. After 1–2 minutes of discussion, ask for students to share their mental strategies with the class.

* + *Possible strategy includes the following:*

*; of is ; half of is , so of would be equal to ; therefore, .*

* Was this problem easy to solve mentally? Why?
	+ *The numbers involved in the problem shared factors with that were easy to work with.*
* Could you use this strategy to find of Bobbie’s bill?

*Yes; ; of is , so of would be equal to ; therefore,
.*

*So, of is equal to .*

Have students write a description of how to mentally solve the problem in their student materials including the math involved.

Exercises (12 minutes)

The following exercises should be completed independently or with a partner. Students must apply their understanding of percents from previous lessons and choose an appropriate strategy to solve each problem.

Exercises

1. Express hours as a percentage of days.

days is the equivalent of hours since .

 hours represents the whole.

. Let represent the unknown percent.

1. Richard works from 11:00 a.m. to 3:00 a.m. His dinner break is of the way through his work shift. What time is Richard’s dinner break?

The total amount of time in Richard’s work shift is hours since .

 hours represents the whole.

. Let represent the number of hours until Richard’s dinner break.

Richard’s dinner break is hours after his shift begins.

 hours after 11:00 a.m. is 11:00 p.m.

Richard’s dinner break is at 11:00 p.m.

1. At a playoff basketball game, there were fans cheering for school A and fans cheering for school B.
	1. Express the number of fans cheering for school A as a percent of the number of fans cheering for school B.

The number of fans for school B is the whole.

. Let represent the unknown percent.

The number of fans cheering for school A is of the number of fans cheering for school B.

* 1. Express the number of fans cheering for school B as a percent of the number of fans cheering for school A.

The number of fans cheering for school A is the whole.

. Let represent the unknown percent.

The number of fans cheering for school B is of the number of fans cheering for school A.

* 1. What percent more fans were there for school B than for school A?

There were more fans cheering for school B than for school A.

1. Rectangle A has a length of and a width of . Rectangle B has the same area as the first, but its length is of the length of the first rectangle. Express the width of Rectangle B as a percent of the width of Rectangle A. What percent more or less is the width of Rectangle B than the width of Rectangle A?

To find the length of Rectangle B:

The length of Rectangle A is the whole.

**.** Let represent the unknown length of Rectangle B.

*The length of Rectangle B is .*

To find the width of Rectangle B:

The area of Rectangle Bis of the area of Rectangle A because the problem says the areas are the same.

. *Let represent the unknown area of Rectangle A.*

. *Let represent the unknown width of Rectangle B.*

*The width of Rectangle B is* .

To express the width of Rectangle B as a percent of the width of Rectangle A:

The width of Rectangle A is the whole.

. *Let represent the unknown percent.*

; The width of Rectangle B is of the width of Rectangle A.

Therefore, the width of Rectangle B is more than the width of Rectangle A.

1. A plant in Mikayla’s garden was inches tall one day and was feet tall one week later. By what percent did the plant’s height increase over one week?

feet is equivalent to inches since .

 inches is the whole.

. Let represent the unknown percent.

The plant’s height increased by in one week.

1. Loren must obtain a minimum number of signatures on a petition before it can be submitted. She was able to obtain signatures, which is more than she needs. How many signatures does she need?

The number of signatures needed represents the whole.

. Let represent the number of signatures needed.

Loren needs to obtain signatures on her petition.

Fluency Exercise 7 (12 minutes): Percent More or Less

Students complete two rounds of a Sprint exercise included at the end of this lesson (Percent More or Less) that focuses on finding the part, the whole, and the percent more or percent less. Please provide one minute for each round of the Sprint. Refer to the Sprints and Sprint Delivery Script sections in the Module Overview for directions to administer a Sprint. The Sprint exercises and answer keys are provided at the end of the lesson.

Closing (2 minutes)

* Describe how to find the percent that is of .
	+ *Since and have a common factor of (or ), and .*
* Describe how you can mentally determine the whole given that is of a number.
	+ *Divide both and by to get and . If is of the number, then is . Therefore, the whole is .*

Lesson Summary

* **Identify the type of percent problem that is being asked as a comparison of quantities or a part of a whole.**
* **Identify what numbers represent the part, the whole, and the percent, and use the representation**

.

* **A strategy to solving percents using mental math is to rewrite a percent using , , or . These percents can be solved mentally. For example: . To find of , find of as , and of as , so of is .**

Exit Ticket (5 minutes)

The use of a calculator is recommended for the Exit Ticket.

Name Date

Lesson 6: Fluency with Percents

Exit Ticket

1. Parker was able to pay for of his college tuition with his scholarship. The remaining he paid for with a student loan. What was the cost of Parker’s tuition?
2. Two bags contain marbles. Bag A contains marbles, and Bag B contains marbles. What percent fewer marbles does Bag A have than Bag B?

1. There are students on a large bus, and the rest are on a smaller bus. If of the students are on the smaller bus, how many total students are on the two buses?

Exit Ticket Sample Solutions

1. Parker was able to pay for of his college tuition with his scholarship. The remaining he paid for with a student loan. What was the cost of Parker’s tuition?

***Parker’s tuition is the whole; represents the amount paid by a student loan.***

. Let represent the cost of Parker’s tuition.

Parker’s tuition was .

1. Two bags contain marbles. Bag A contains marbles, and Bag B contains marbles. What percent fewer marbles does Bag A have than Bag B?

***The number of marbles in Bag B is the whole.***

***There are fewer marbles in Bag A.***

. Let represent the unknown percent.

Bag A contains fewer marbles than Bag B.

1. There are students on a large bus, and the rest are on a smaller bus. If of the students are on the smaller bus, how many total students are on the two buses?

The students on the larger bus represent of the students. If I divide both and by , then I get students, which represents of the whole group. Multiplying both by , I get , which represents of the group of students. There are total students on the buses.

Problem Set Sample Solutions

This problem set is a compilation of all types of percent problems from Lessons 2–6. For each problem, students should choose an appropriate strategy to find a solution. Students may also be asked to describe the mental math they used to solve the problem.

1. Micah has songs stored in his phone, which is of the songs that Jorge has stored in his phone. How many songs are stored on Jorge’s phone?

. Let represent the number of songs on Jorge’s phone.

There are songs stored on Jorge’s phone.

1. Lisa sold magazine subscriptions, which is of her class’s fundraising goal. How many magazine subscriptions does her class hope to sell?

. Let represent the number of magazine subscriptions Lisa’s class wants to sell.

Lisa’s class hopes to sell magazine subscriptions.

1. Theresa and Isaiah are comparing the number of pages that they read for pleasure over the summer. Theresa read pages, which was of the number of pages that Isaiah read. How many pages did Isaiah read?

. Let represent the number of pages that Isaiah read.

Isaiah read pages over the summer.

1. In a parking garage, the number of SUVs is greater than the number of non-SUVs. Gina counted SUVs in the parking garage. How many vehicles were parked in the garage?

 greater means of the non-SUVs plus another of that number, or .

. Let represent the number of non-SUVs in the parking garage.

There are non-SUVs in the parking garage.

The total number of vehicles is the sum of the number of the SUVs and non-SUVs.

. There is a total of vehicles in the parking garage.

1. The price of a tent was decreased by and sold for . What was the original price of the tent in dollars?

If the price was decreased by , then the sale price is less than of the original price, or .
. Let represent the original price of the tent.

Because this quantity represents money, the original price was after rounding to the nearest hundredth.

1. of the students at Rockledge Middle School are musicians. of those musicians have to read sheet music when they play their instruments. If of the students can play their instruments without reading sheet music, how many students are there at Rockledge Middle School?

Let represent the number of musicians at the school, and let represent the total number of students. There are two whole quantities in this problem. The first whole quantity is the number of musicians. The students who can play an instrument without reading sheet music represent of the musicians.

|  |  |
| --- | --- |
| There are musicians in the school. | There is a total of students at Rockledge Middle School. |

1. At Longbridge Middle School, students said that they are an only child, which is of the school’s student enrollment. How many students attend Longbridge Middle School?

. Let represent the number of students who attend Longbridge Middle School.

There are students attending Longbridge Middle School.

1. Grace and her father spent hours over the weekend restoring their fishing boat. This time makes up of the time needed to fully restore the boat. How much total time is needed to fully restore the boat?

. Let represent the total time that is needed to restore the boat.

The total amount of time to restore the boat is hours.

1. Bethany’s mother was upset with her because Bethany’s text messages from the previous month were of the amount allowed at no extra cost under her phone plan. Her mother had to pay for each text message over the allowance. Bethany had text messages last month. How many text messages is she allowed under her phone plan at no extra cost?

. *Let represent the number of text messages Bethany’s phone plan allows with no extra cost.*

Bethany is allowed text messages without extra cost.

1. Harry used of the money in his savings account to buy a used dirt bike that cost him . How much money is left in Harry’s savings account?

. *Let represent the amount of money, in dollars, in Harry’s bank account before buying the bike.*

Harry started with in his account but then spent of it on the dirt bike.

Harry has left in his savings account.

1. of the students in Mr. Riley’s social studies classes watch the local news every night. Mr. Riley found that of his students do not watch the local news. How many students are in Mr. Riley’s social studies classes?

If of his students do watch their local news, then do not.

 Let represent the number of students in Mr. Riley’s class.

There are total students in Mr. Riley’s social studies classes.

1. Grandma Bailey and her children represent about of the Bailey family. If Grandma Bailey has children, how many members are there in the Bailey family?

. Let represent the number of members in the Bailey family.

The Bailey family has members.

1. Shelley earned more money in tips waitressing this week than last week. This week she earned in tips waitressing. How much money did Shelley earn last week in tips?

. Let represent the number of dollars Shelley earned waitressing last week.

Shelley earned waitressing last week.

1. Lucy’s savings account has more money than her sister Edy’s. Together, the girls have saved a total of . How much money has each girl saved?

The money in Edy’s account corresponds to . Lucy has more than Edy, so the money in Lucy’s account corresponds to . Together, the girls have a total of , which is of Edy’s account balance.

. Let represent Edy’s savings account balance in dollars.

Edy has saved in her account. Lucy has saved the remainder of the , so .

Therefore, Lucy has saved in her account.

1. Bella spent of her paycheck at the mall, and of that was spent at the movie theater. Bella spent a total of at the movie theater for her movie ticket, popcorn, and a soft drink. How much money was in Bella’s paycheck?

If represents , this amount can be divided by to determine that represents . Then, this amount can be multiplied by to determine that represents of the portion of the paycheck that was spent.

Bella spent at the mall.

Therefore, represents of the entire paycheck. This can be divided by to represent . So, represents of the paycheck. Now, to determine of the paycheck, multiply by . .

Bella’s paycheck was .

1. On a road trip, Sara’s brother drove of the trip, and Sara drove of the remainder. If Sara drove for hoursandminutes, how long was the road trip?

*There are two whole quantities in this problem. First, Sara drove of the remainder of the trip; the remainder is the first whole quantity. is equivalent to .*

*. Let represent the remainder of the trip that Sara’s brother did not drive, in hours.*

The remainder of the trip that Sara’s brother did not drive was hours. He drove of the trip, so the remainder of the trip was of the trip, and the whole quantity is the time for the whole road trip.

. Let represent the total length of the trip, in hours.

The road trip was a total of hours.

Percent More or Less—Round 1

Number Correct: \_\_\_\_\_\_

**Directions:**  Find each missing value.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | of is?  |  |  |  | of is ?  |  |
|  | of is ?  |  |  |  | more than is?  |  |
|  | more than is ?  |  |  |  | What is of?  |  |
|  | is more than?  |  |  |  | is of ?  |  |
|  | is of ?  |  |  |  | is more than ?  |  |
|  | is more than ?  |  |  |  | of is ?  |  |
|  | of is ?  |  |  |  | What is less than ?  |  |
|  | less than is ?  |  |  |  | What of is ?  |  |
|  | isless than ?  |  |  |  | What less than is ?  |  |
|  | isof ?  |  |  |  | What less than is ?  |  |
|  | is less than ?  |  |  |  | What of is ?  |  |
|  | of is ?  |  |  |  | What is more than ?  |  |
|  | more than is ?  |  |  |  | What is more than ?  |  |
|  | isof ?  |  |  |  | What is of ?  |  |
|  | ismore than ?  |  |  |  | What of is ?  |  |
|  | is more than?  |  |  |  | What more than is ?  |  |
|  | of is ?  |  |  |  | Whatless than is ?  |  |
|  | less than is ?  |  |  |  | What of is ?  |  |
|  | isof?  |  |  |  | is what of?  |  |
|  | is less than ?  |  |  |  | is what of ?  |  |
|  | is less than?  |  |  |  | ofis?  |  |
|  | isless than ?  |  |  |  | more than is?  |  |

Percent More or Less—Round 1 [KEY]

**Directions:** Find each missing value.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | of is?  |  |  |  | of is ?  |  |
|  | of is ?  |  |  |  | more than is?  |  |
|  | more than is ?  |  |  |  | What is of?  |  |
|  | is more than?  |  |  |  | is of ?  |  |
|  | is of ?  |  |  |  | is more than ?  |  |
|  | is more than ?  |  |  |  | of is ?  |  |
|  | of is ?  |  |  |  | What is less than ?  |  |
|  | less than is ?  |  |  |  | What of is ?  |  |
|  | isless than ?  |  |  |  | What less than is ?  |  |
|  | isof ?  |  |  |  | What less than is ?  |  |
|  | is less than ?  |  |  |  | What of is ?  |  |
|  | of is ?  |  |  |  | What is more than ?  |  |
|  | more than is ?  |  |  |  | What is more than ?  |  |
|  | isof ?  |  |  |  | What is of ?  |  |
|  | ismore than ?  |  |  |  | What of is ?  |  |
|  | is more than?  |  |  |  | What more than is ?  |  |
|  | of is ?  |  |  |  | Whatless than is ?  |  |
|  | less than is ?  |  |  |  | What of is ?  |  |
|  | isof?  |  |  |  | is what of?  |  |
|  | is less than ?  |  |  |  | is what of ?  |  |
|  | is less than?  |  |  |  | ofis?  |  |
|  | isless than ?  |  |  |  | more than is?  |  |

Percent More or Less—Round 2

Number Correct: \_\_\_\_\_\_

Improvement: \_\_\_\_\_\_

**Directions:** Find each missing value.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ofis ?  |  |  |  | of is ?  |  |
|  | of is ?  |  |  |  | more than is ?  |  |
|  | more than is ?  |  |  |  | What is of ?  |  |
|  | is more than ?  |  |  |  | is of ?  |  |
|  |  isof ?  |  |  |  | is more than ?  |  |
|  | is more than?  |  |  |  | of is ?  |  |
|  | of is ?  |  |  |  | What is less than ?  |  |
|  | less than is?  |  |  |  | What of is ?  |  |
|  | is less than ?  |  |  |  | What less than is ?  |  |
|  |  is of ?  |  |  |  | Whatless than is ?  |  |
|  | is less than ?  |  |  |  | What of is ?  |  |
|  | of is ?  |  |  |  | What is more than ?  |  |
|  | more than is ?  |  |  |  | What is more than ?  |  |
|  | is of?  |  |  |  | What is of ?  |  |
|  | is more than ?  |  |  |  | What of is ?  |  |
|  | ismore than ?  |  |  |  | What more than is?  |  |
|  | of is ?  |  |  |  | What less than is ?  |  |
|  | less than is ?  |  |  |  | What of is ?  |  |
|  | is of ?  |  |  |  | is what of ?  |  |
|  | is less than ?  |  |  |  | is what of ?  |  |
|  | is less than ?  |  |  |  | of is?  |  |
|  | is less than ?  |  |  |  | more than is?  |  |

Percent More or Less—Round 2 [KEY]

**Directions:**  Find each missing value.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ofis ?  |  |  |  | of is ?  |  |
|  | of is ?  |  |  |  | more than is ?  |  |
|  | more than is ?  |  |  |  | What is of ?  |  |
|  | is more than ?  |  |  |  | is of ?  |  |
|  |  isof ?  |  |  |  | is more than ?  |  |
|  | is more than?  |  |  |  | of is ?  |  |
|  | of is ?  |  |  |  | What is less than ?  |  |
|  | less than is?  |  |  |  | What of is ?  |  |
|  | is less than ?  |  |  |  | What less than is ?  |  |
|  |  is of ?  |  |  |  | Whatless than is ?  |  |
|  | is less than ?  |  |  |  | What of is ?  |  |
|  | of is ?  |  |  |  | What is more than ?  |  |
|  | more than is ?  |  |  |  | What is more than ?  |  |
|  | is of?  |  |  |  | What is of ?  |  |
|  | is more than ?  |  |  |  | What of is ?  |  |
|  | ismore than ?  |  |  |  | What more than is?  |  |
|  | of is ?  |  |  |  | What less than is ?  |  |
|  | less than is ?  |  |  |  | What of is ?  |  |
|  | is of ?  |  |  |  | is what of ?  |  |
|  | is less than ?  |  |  |  | is what of ?  |  |
|  | is less than ?  |  |  |  | of is?  |  |
|  | is less than ?  |  |  |  | more than is?  |  |