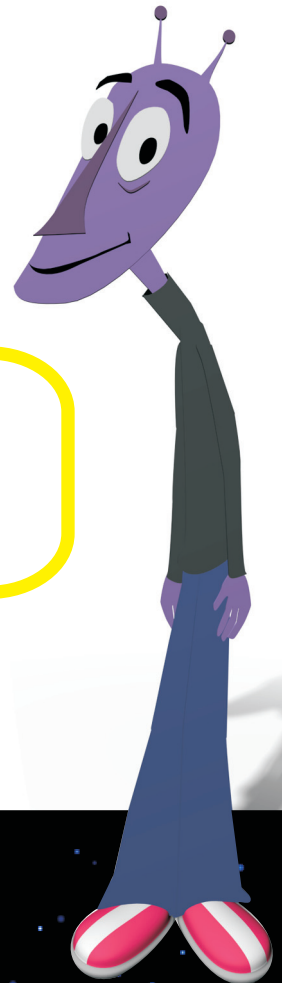


# Measurement

## ★ Module 12 ★

### Attributes and Tools

#### Lesson 3 Measurement: Time



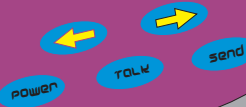


# Teacher Notes

## 12.3

### Objectives

- ◆ Solve real-world problems involving one elapsed time, counting forward and backward (clock and calendar).
- ◆ Solve real-world problems involving two or more elapsed times, counting forward and backward (clock and calendar).



### Prerequisites

Converting units of time  
Counting forward and backward  
on a number line

### Vocabulary

Elapsed time  
Leap year (12.2)

### Get Started

- Divide the class into groups of two or three.
- Have each group convert 142 minutes into hours and minutes. Tell students that the whole group should agree on an answer. Each group can only give one answer and each group that gives an incorrect answer will be eliminated. **2 h 22 min**
- Walk around the class and check answers. Groups that answer correctly move on to the next round. Groups that do not answer correctly should still answer questions although their answers will not count towards winning.

- Repeat by using the problems below until one group remains as the winner.

3 h 14 min to minutes    **194 min**  
 125 h to days and hours    **5 days 5 h**  
 15 h to seconds    **54,000 sec**  
 20,160 min to weeks    **2 weeks**

- If more than one group remains after these problems are used, determine a winner by finding which group correctly calculates the number of seconds in one non-leap year in the least amount of time.    **31,536,000 sec**

## Subtopic 1

## Elapsed Clock Time

### Expand Their Horizons

In this subtopic, students learn how to find elapsed time. If possible, have an analog clock in the room for students to model elapsed time by actually turning the hands of the clock.

Discuss how finding elapsed time is similar to subtracting. For example, one way to find the difference between 15 and 28 is to find the difference between 15 and 20, the difference between 20 and 28, and then to add those differences ( $5 + 8 = 13$ ). Likewise, to find the elapsed time between 7:35 P.M. and 8:16 P.M., find the number of minutes between 7:35 and 8:00, find the number of minutes between 8:00 and 8:16, and then add the minutes:  $25 + 16 = 41$  minutes.

Students can shortcut some counting by remembering that there are 12 hours between the A.M. and P.M. of the same time. For instance, there are 12 hours between 8:20 A.M. and 8:20 P.M.

**1**

Add four hours to 2:30 P.M. to get to 6:30 P.M. Then, add the half hour to make 7:00 P.M.

**2**

Work backwards from 5:45 P.M. Break down 1 h 35 min into 1 h + 30 min + 5 min. One hour before 5:45 P.M. is 4:45 P.M. Thirty minutes before 4:45 P.M. is 4:15 P.M. Five minutes before 4:15 P.M. is 4:10 P.M. Note that students can also count back the minutes before counting back the hour.

## Additional Examples

1. Martin listened to a music CD that lasted 47 minutes. If the CD stopped at 3:42 P.M., at what time did he start the CD?

Counting backwards to 3:00 P.M. is 42 minutes. Count another five minutes back to make 47 minutes. The CD began at 2:55 P.M.

2. Sherri rode a bus from 8:05 A.M. until 2:15 P.M. How long was her trip?

From 8:05 A.M. to 2:05 P.M. is six hours.  
From 2:05 P.M. to 2:15 P.M. is 10 minutes.  
Sherri was on the bus for 6 h 10 min.

## Subtopic 2

### Elapsed Calendar Time

### Expand Their Horizons

In this subtopic, students solve problems involving calendar time. To help find the number of days from one date to the next, students can use a calendar to count the number of days. Show students that a calendar is not needed for all these problems. For example, to find the number of days from June 5 to June 11, students can simply list the numbers from five to 11 and then can count the numbers they have listed: 5, 6, 7, 8, 9, 10, and 11. It is seven days.

#### Common Error Alert:

Students may simply subtract the number part of two dates when determining elapsed time. In the problem above, for example, students may subtract:  $11 - 5 = 6$ . However, the answer is seven, not six days. Show how this is similar to counting pages in a book. If they read pages one and two, then they read two pages, but if they subtract the starting and ending page numbers, they get one page less:  $2 - 1 = 1$ .

Students may find it odd that the prefixes of the months of September, October, and December mean seven, eight, and 10; however, September is the ninth month not the seventh; October is the tenth month not the eighth; and December is the twelfth month not the tenth. This is because these names are based on the ancient Latin calendar, which only had ten months instead of 12. January and February were added to the calendar in the eighth century B.C.

3

On a calendar, start on December 25 and count backwards 12 days, with December 24 being day one.

If students are confused as to why they do not use December 25 as day one, ask them what day is one day before December 25. The answer is not December 25, it is December 24. So, two days before is December 23, and so on.

### Additional Examples

1. Nancy started writing her book report on May 16. She finished the report on May 28. How many days did she spend writing the report if she worked on it every day since she started?
2. How many days are between March 21 and April 4?

Count the number of days, including the starting and finishing dates: 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, and 28. She worked on the report for 13 days.

There are 31 days in March. Starting with March 22 as day one, count 10 days in March. Then, add three days in April. That makes a total of 13 days.

## Subtopic 3

### Problem Solving with Two or More Elapsed Times

#### Expand Their Horizons

In this subtopic, students solve problems that may require converting or renaming of times. For example, 4 h 70 min is the same as 5 h 10 min because 70 min can be renamed as 1 h 10 min. Likewise, students may need to regroup. Show students that four hours is the same as 3 h 60 min.

4

Find the number of days *between* 7:20 A.M. on August 4 and 7:20 A.M. on August 14 by subtracting:  $14 - 4 = 10$  days. Then, find the elapsed time between 7:20 A.M. and 2:15 P.M. It is six hours 55 minutes. The flight was 10 days, six hours, 55 minutes long.

### Additional Examples

1. Ray watched three movies. The first was two hours, 12 minutes long. The second was one hour, 47 minutes long and the third was 135 minutes long. What was the total running time of the three movies? Express the answer in hours and minutes.
2. Renate ran a race in two hours, 28 minutes. Lisa ran the same race in three hours, 15 minutes. How much longer did it take Lisa to run the race than Renate?

continued on next page

Add the times.

$$\begin{array}{r} 2 \text{ h } 12 \text{ min} \\ 1 \text{ h } 47 \text{ min} \\ + 135 \text{ min} \\ \hline 3 \text{ h } 194 \text{ min} \end{array}$$

Convert 194 minutes to hours and minutes.

$$194 \cancel{\text{ min}} \times \frac{1 \text{ h}}{60 \cancel{\text{ min}}} = \frac{194}{60} \text{ h} = 3 \frac{14}{60} \text{ h}$$

$$3 \text{ h} + 3 \frac{14}{60} \text{ h} = 6 \text{ h } 14 \text{ min}$$

The total running time was 6 h 14 min.

Subtract.

$$\begin{array}{r} 3 \text{ h } 15 \text{ min} \\ - 2 \text{ h } 28 \text{ min} \\ \hline \end{array}$$

Regroup 60 minutes from three hours. Add these 60 minutes to the 15 minutes.

$$\begin{array}{r} 2 \text{ h } 75 \text{ min} \\ - 2 \text{ h } 28 \text{ min} \\ \hline 47 \text{ min} \end{array}$$

It took Lisa 47 minutes longer than Renate.

## Look Beyond

In this course, students will continue the practice of renaming units when they solve problems involving distance and weight.

At some point, students will learn about military time. Military time does not start over after 12 hours, rather it continues as 13, 14, 15 hours and so on, up to 24 hours. Using a unique number to identify each of the 24 hours in a day eliminates any confusion over morning and evening times.

## Connections

Pilots of major airlines are required to have a certain number of hours of rest between flights. Schedulers of airline flights must take this into account when creating and updating flight schedules.

Businesspersons calculate elapsed time when they travel, especially when determining how much time they have between two connecting flights. A miscalculation may result in missing their flight.

