Measuring Elapsed Time

What You'll Learn

OBJECTIVE 1 To add and subtract measures of time

OBJECTIVE 2 To read and use schedules

. . . And Why

To read bus schedules, as in Example 4

✔ **Check Skills You'll Need**

🌱 **For help, go to Lesson 3-4.**

Write an equivalent fraction with a denominator of 60.

1. $\frac{4}{15}$ **16/60**

2. $\frac{3}{12}$ **15/60**

3. $\frac{1}{5}$ **12/60**

4. $\frac{2}{6}$ **20/60**

5. $\frac{2}{3}$ **40/60**

6. $\frac{7}{12}$ **35/60**

New Vocabulary • elapsed time

OBJECTIVE

1

Adding and Subtracting Measures of Time

𝒊 **TEXT** Interactive lesson includes instant self-check, tutorials, and activities.

Reading Math

You can think of 6:30 A.M. as "6 hours and 30 minutes after midnight."

Investigation: Exploring Elapsed Time

1. **a.** What time does Clock 1 show? **6:30**
   b. What time does Clock 2 show? **7:10**

2. **Reasoning** What is the least amount of time that has passed between the times shown on Clock 1 and Clock 2? **40 min**

3. Draw a third clock showing the time 40 minutes after Clock 2. **See left.**

Clock 1   Clock 2

3.

The standard unit of time is the second (s). You use equivalent units to change from one unit of time to another.

Units of Time	
second (s)	
minute (min)	1 min = 60 s
hour (h)	1 h = 60 min
day	1 day = 24 h
week (wk)	1 wk = 7 days
year (yr)	1 yr ≈ 52 wk

4-7 Measuring Elapsed Time **201**

⏱ Ongoing Assessment and Intervention

Before the Lesson
Diagnose prerequisite skills using:
• Check Skills You'll Need

During the Lesson
Monitor progress using:
• Check Understanding
• Additional Examples
• Test Prep

After the Lesson
Assess knowledge using:
• Lesson Quiz
• Computer Test Generator CD
• Chapter Checkpoint 2 (p. 205)

Professional Development ⭐

Math Background

Elapsed time is the time between two events. To calculate elapsed time, subtract one unit of time from another. Often you need to change from one unit of time to another unit before subtracting. For example, in order to change from years to months, multiply the number of years by 12.

Teaching Notes

Investigation (Optional)
Elicit the fact that the hour hand on a clock moves slowly from one hour to the next in 60 minutes. Furthermore, the minute hand makes one complete rotation in one hour. Ask:
- *How many hours does it take the hour hand to make one complete rotation on a clock?* **12 hours**
- *How many rotations does the minute hand make in 12 hours?* **12 rotations**

② EXAMPLE Inclusion

Demonstrate elapsed time on a clock face that has movable hands. Have volunteers take turns moving the hands on the clock to show the passing of time from 1:45 P.M. to 3:27 P.M.

③ EXAMPLE Teaching Tip

You might want students to break the problem into two separate parts relative to 12:00 noon as shown below.
$$8:15 \to 12:00 \text{ A.M.} = 3 \text{ h } 45 \text{ min}$$
$$12:00 \to 3:25 \text{ P.M.} = \underline{3 \text{ h } 25 \text{ min}}$$
$$\text{Add the parts} \to 7 \text{ h } 10 \text{ min}$$

Diversity
Have students familiar with the 24-hour clock (military time) share their knowledge with the class.

④ EXAMPLE Error Prevention

Make sure students understand that "..." means buses leave every 30 minutes between 7:50 A.M. and 11:20 P.M.

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① EXAMPLE   Writing Equivalent Times

How many seconds are equivalent to 1 minute 20 seconds?

$$1 \text{ minute } 20 \text{ seconds} = 60 \text{ s } + 20 \text{ s} \quad \leftarrow \textbf{One minute is equivalent to 60 seconds.}$$
$$= 80 \text{ s} \quad \leftarrow \textbf{Simplify.}$$

So, 1 minute 20 seconds is equivalent to 80 seconds.

✔ **Check Understanding** ① How many days are equivalent to 4 weeks 3 days? **31 days**

The time between two events is called **elapsed time.** To find elapsed time, you can subtract hours and minutes.

② EXAMPLE   Calculating Elapsed Time

Find the elapsed time between 1:45 P.M. and 5:27 P.M.

To find the elapsed time, subtract 1:45 from 5:27.

$$5:27 \to 5 \text{ h } 27 \text{ min} \to \qquad 4 \text{ h } 87 \text{ min} \quad \leftarrow \textbf{Rename 5 h 27 min as 4 h 87 min.}$$
$$1:45 \to 1 \text{ h } 45 \text{ min} \to \underline{- 1 \text{ h } 45 \text{ min}}$$
$$3 \text{ h } 42 \text{ min} \quad \leftarrow \textbf{Subtract.}$$

The elapsed time is 3 hours 42 minutes.

Test-Prep Tip
A drawing of a clock face can help you compute elapsed time.

✔ **Check Understanding** ② Find the elapsed time between 7:25 A.M. and 8:12 A.M. **47 min**

To find elapsed time between a morning and an afternoon or between an evening and the next morning, add 12 hours to the later time.

③ EXAMPLE   Real-World 🌎 Problem Solving

School How long is a school day that goes from 8:15 A.M. to 3:25 P.M.?

Since 3:25 P.M. is later than 8:15 A.M., you need to add 12 hours to 3:25.

$$3:25 \quad \to \qquad 3 \text{ h } 25 \text{ min}$$
$$\underline{+ 12 \text{ h}} \quad \leftarrow \textbf{Add 12 to the later time.}$$
$$15 \text{ h } 25 \text{ min}$$

$$15:25 \quad \to \qquad 15 \text{ h } 25 \text{ min}$$
$$8:15 \quad \to \quad \underline{- 8 \text{ h } 15 \text{ min}} \quad \leftarrow \textbf{Subtract the earlier time.}$$
$$7 \text{ h } 10 \text{ min} \quad \leftarrow \textbf{Subtract.}$$

The school day that goes from 8:15 A.M. to 3:25 P.M. is 7 h 10 min long.

✔ **Check Understanding** ③ a. Find the elapsed time between 10:00 A.M. and 7:15 P.M. **9 h 15 min**
b. **Reasoning** Explain why you add 12 in Example 3. **Answers may vary. Sample: Adding 12 hours makes both times the hours elapsed since midnight, so they can be subtracted.**

202   **Chapter 4**   Adding and Subtracting Fractions

👥 Reaching All Students

Below Level Have students write what the time will be 30 minutes later.	**Advanced Learners** Which is longer—1,000,000 minutes or 1,000 days? Explain. **1,000 days; there are 1,440 minutes in one day (24 h × 60 min per h), and 1,440,000 minutes in 1,000 days.**	**Inclusion** See note on page 202. **Diversity** See note on page 202.
10:00 A.M. **10:30 A.M.** 2:07 P.M. **2:37 P.M.** 5:45 A.M. **6:15 A.M.**		

You think about elapsed time when reading and using schedules.

4 **EXAMPLE**   **Reading and Using a Schedule**   🌎 **Real World**

Yellow Bus Line	
Buses Run Every 30 Minutes Monday–Friday	
Leave Willson St.	Arrive Kagy Blvd.
7:20 A.M.	7:45 A.M.
7:50 A.M.	8:15 A.M.
. . .	. . .
11:20 P.M.	11:45 P.M.

Bus Schedules Use the bus schedule at the left. Suppose you arrive at the Willson Street bus stop 5 minutes after the 11:50 A.M. bus leaves.

a. How long will you wait for the next bus?

   The bus runs every 30 minutes. You will wait 30 − 5 min, or 25 minutes.

b. How long is the bus ride?

   Using the first run, the elapsed time is 7:45 A.M − 7:20 A.M., or 25 min.

c. When will you arrive at Kagy Boulevard?

   11:50 + 30 min = 11:80 min   ← **Find when the next bus leaves.**
   = 11 h 80 min   ← **Since 80 min is more than 1 h, rename.**
   = 12 h 20 min

   The next bus will leave at 12:20 P.M. The trip takes 25 minutes. So, you will arrive at 12:20 + 25 min or 12:45 P.M.

✔ **Check Understanding** **4** It is a 5-minute walk from the bus stop on Kagy Boulevard to a gym. Which bus should you take from Willson Street to get to the gym by 6:00 P.M.?
5:20 P.M.

EXERCISES

💚 **For more practice, see** *Extra Practice.*

🔴 **A** **Practice by Example**

For each time, write an equivalent time using only the smaller unit.

Example 1
(page 202)

1. 1 h 30 min **90 min**   **2.** 2 min 59 s **179 s**   **3.** 8 h 2 min   **482 min**

4. 5 min 36 s **336 s**   **5.** 3 wk 5 days **26 d**   **6.** 2 days 17 h **65 h**

Example 2
(page 202)

Find the elapsed time between each pair of times.

7. from 2:25 P.M. to 3:35 P.M.
   1 h 10 min

8. from 8:25 A.M. to 10:52 A.M.
   2 h 27 min

9. from 5:25 P.M. to 11:11 P.M.
   5 h 46 min

10. from 9:28 A.M. to 11:07 A.M.
   1 h 39 min

Example 3
(page 202)

11. from 11:25 A.M. to 2:45 P.M.
   3 h 20 min

12. from 8:30 P.M. to 7:39 A.M.
   11 h 9 min

13. How long is a car parked on the street if it arrives at 10:25 P.M. and leaves at 8:12 A.M.? **9 h 47 min**

4-7 Measuring Elapsed Time   **203**

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1 How many minutes are equivalent to 1 hr 45 min?
105 min

2 Find the elapsed time between 7:25 A.M. and 9:05 A.M. **1 h 40 min**

3 Find the elapsed time between 10:15 A.M. and 2:25 P.M. **4 h 10 min**

4 You arrive at the Glenmont bus stop at 8:00 A.M. and buy a ticket for the next bus.

   a. How long will you wait for the next bus? **10 min.**

   b. What time will you arrive at the Reedville bus stop?
   8:45 A.M.

Buses Run Every 15 min Monday–Friday	
LEAVE	**ARRIVE**
Glenmont	**Reedville**
7:40 A.M.	8:15 A.M.
7:55 A.M.	8:30 A.M.
. . .	. . .
9:55 A.M.	10:30 A.M.

Closure

What is elapsed time? **the time between two events**

3. Practice

Assignment Guide

1 Objective 1
Ⓐ Ⓑ Core 1–13
Ⓒ Extension 23–24

2 Objective 2
Ⓐ Ⓑ Core 14–22
Ⓒ Extension 25

Test Prep 26–29
Mixed Review 30–35

Error Prevention!

Exercises 11–12 Watch for students who neglect to add 12 hours to the later time.

Practice 4-7   Measuring Elapsed Time

Clark is trying to plan his Saturday. He estimates each activity will take the following times.

Make a schedule for Clark's day if he wakes up at 7:00 A.M. Assume all his activities are done in the given order.

Activity	Amount of Time	Time of Day
1. Get up, eat breakfast	30 min	7:00 A.M. – 7:30 A.M.
2. Mow lawn	1 h	7:30 A.M. – 8:30 A.M.
3. Rake yard	2 h	8:30 A.M. – 10:30 A.M.
4. Wash, wax car	45 min	10:30 A.M. – 11:15 A.M.
5. Walk dog	15 min	11:15 A.M. – 11:30 A.M.
6. Clean room	45 min	11:30 A.M. – 12:15 P.M.
7. Eat lunch	30 min	12:15 P.M. – 12:45 P.M.
8. Shop for school clothes	1 h 30 min	12:45 P.M. – 2:15 P.M.
9. Read book	45 min	2:15 P.M. – 3:00 P.M.
10. Do homework	1 h 15 min	3:00 P.M. – 4:15 P.M.
11. Baby-sit brother	2 h	4:15 P.M. – 6:15 P.M.
12. Eat supper	45 min	6:15 P.M. – 7:00 P.M.
13. Get ready for party	30 min	7:00 P.M. – 7:30 P.M.
14. Ride to party	20 min	7:30 P.M. – 7:50 P.M.
15. Party	2 h	7:50 P.M. – 9:50 P.M.
16. Ride home	20 min	9:50 P.M. – 10:10 P.M.

Find the elapsed time between each pair of times.

17. from 2:12 P.M. to 10:18 P.M.
8 h 6 min

18. from 9:35 A.M. to 8:48 P.M.
11 h 13 min

19. from 6:45 P.M. to 11:24 A.M.
16 h 39 min

20. from 2:55 A.M. to 8:13 A.M.
5 h 18 min

21. from 7:00 P.M. to 8:56 P.M.
1 h 56 min

22. from 8:22 P.M. to 11:47 A.M.
15 h 25 min

23. The movie begins at 7:45 P.M. and lets out at 10:20 P.M. How long is the movie?
2 h 35 min

24. A plane left at 10:45 A.M. and landed at 4:37 P.M. How long was the flight?
5 h 52 min

Reteaching 4-7   Measuring Elapsed Time

Find the elapsed time between 6:15 A.M. and 11:10 A.M.

1. Set up as subtraction.
11:10
−6:15

2. Rename 11:10 as 10:70.
11:10 → 10:70
−6:15 → −6:15

3. Subtract.
10:70
−6:15
4:55

The elapsed time is 4 hours 55 minutes.

You can find elapsed time from a schedule.

Leave	Arrive
Boston 7:09 A.M.	New York 11:02 A.M.

For travel time, find the elapsed time between 7:09 A.M. and 11:02 A.M.
11:02 − 7:09 = 3 hours 53 minutes

For each time, write an equivalent time using only the smaller unit.

Example: 4 hours 55 minutes = 4 × 60 + 55 = 295 minutes

1. 3 hours 25 minutes
205 min

2. 2 hours 17 minutes
137 min

3. 2 hours 48 minutes
168 min

4. 5 hours 18 minutes
318 min

5. 6 hours 13 minutes
373 min

6. 5 hours 39 minutes
339 min

Find the elapsed time between each pair of times.

7. 6:45 P.M. and 9:20 P.M.
2 h 35 min

8. 9:36 A.M. and 11:50 A.M.
2 h 14 min

9. 5:45 A.M. and 11:30 A.M.
5 h 45 min

10. 3:11 P.M. and 10:40 P.M.
7 h 29 min

11. 8:15 A.M. and 10:09 P.M.
13 h 54 min

12. 1:00 A.M. and 7:28 P.M.
18 h 28 min

Use the schedule to answer the following questions.

Leave for game	6:15 P.M.
Game begins	7:35 P.M.
Game ends	10:20 P.M.

13. How much time do you have to get to the game?
1 h 20 min

14. How long is the game?
2 h 45 min

Example 4
(page 203)

21. **Answers may vary. Sample:** If it is 1:00 A.M. on a Tuesday in the Eastern time zone, it is 10:00 P.M. on Monday in the Pacific time zone.

22. **10:45 A.M.** leave 1st party
11:45 A.M. arrive at 2nd party
12:30 P.M. leave 2nd party
1:30 P.M. arrive at 3rd party
2:15 P.M. leave 3rd party

Use the train schedule for Exercises 14–16.

Train Schedule

Station	Train A	Train B
Fairview	8:15 A.M.	8:42 A.M.
Huntville	8:26 A.M.	8:55 A.M.
Rush City	8:34 A.M.	9:04 A.M.
Grayland	8:45 A.M.	9:19 A.M.

14. Which train takes less time to travel from Fairview to Grayland?
Train A

15. How long do you wait for the train if you get to Rush City at 8:35 A.M.?
29 min

16. How long does it take to get to Grayland from Huntville on Train B?
24 min

Ⓑ **Apply Your Skills** 🌎 **Time Zones** The map below shows the time zones in the continental United States. Find the time for each city if it is 12:00 noon in Denver.

PST   MST   CST   EST
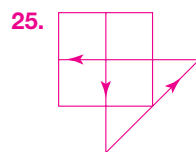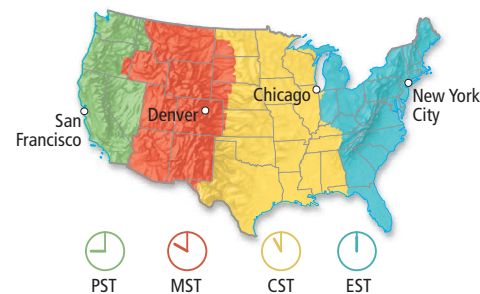
17. Chicago **1:00 P.M.**

18. New York City
2:00 P.M.

19. San Francisco
11:00 A.M.

20. **Algebra** What time is it in New York if the time in San Francisco is x?
$x + 3$

21. **Writing in Math** Explain how it can be Monday in one part of the United States and Tuesday in another part of the United States.
See above left.

🌎 22. **Clowns** A clown wants to perform a 45-minute show at each of three
🅶🅿🆂 birthday parties on the same Saturday. The first party must begin at 10:00 A.M. and he needs to leave the third party by 2:15 P.M. He wants to allow one hour between each party. Make a schedule for the clown.
See above left.

23. **Estimation** Estimate each elapsed time.
a. from 1:38 A.M. to 4:50 A.M.
3 h
b. from 11:49 A.M. to 7:12 P.M.
7 h 20 min

Ⓒ **Challenge**

24. Find the elapsed time from Saturday at 7:15 A.M. to Sunday at 3:05 P.M.
31 h 50 min

25. **Stretch Your Thinking** Draw a square. Then, without lifting your pencil, draw three line segments that divide it into four identical squares.
See above left.

25.

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🅶🅿🆂 Use the Guided Problem Solving worksheet with Exercise 22.

29. **[2] a.** 12:15 P.M.

b. Mix, bake, cool, frost cake; answers may vary. Sample: Yes;

decorate room while the cake bakes and cools.

c. Answers may vary. Sample: Start at 12:50 P.M. Mix cake (40 min), decorate room while cake

bakes and cools (80 min), frost cake (20 min), shower and dress (25 min).

[1] incorrect starting time OR incorrect explanation

Multiple Choice

26. How many minutes are in 3 h 25 min? **D**

 A. 28 min   **B.** 75 min   **C.** 105 min   **D.** 205 min

27. What is the elapsed time between 4:25 A.M. and 7:24 A.M.? **G**

 F. 2 h 1 min   **G.** 2 h 59 min   **H.** 3 h 1 min   **I.** 3 h 59 min

28. Jack has 2 hours of homework. He will take one 30-minute break. To finish by 9:30 P.M., what is the latest time he can begin? **C**

 A. 6:00 P.M.   **B.** 6:30 P.M.   **C.** 7:00 P.M.   **D.** 7:30 P.M.

Short Response

29. You make a list of things to do before a party that starts today at 4:00 p.m. **a–c. See margin.**

 a. If you follow the list in order, at what time should you begin?

 b. Which activities must you do in order? Can any be done at the same time? Revise the list.

 c. Use the revised list of part (b) to make a new schedule. Allow yourself an extra 25 minutes before the party.

> Decorate room (1 h)
> Mix cake (40 min)
> Bake cake (35 min)
> Cool cake (45 min)
> Frost cake (20 min)
> Shower and dress (25 min)

Take It to the NET
Online lesson quiz at
www.PHSchool.com
Web Code: aaa-0407

Mixed Review

Lesson 2-6

Solve each equation.

30. $a + 14 = 31$ **17**   **31.** $t - 8 = 28$ **36**   **32.** $b - 2.4 = 5.1$ **7.5**

33. $9.1 - c = 5.3$ **3.8**   **34.** $15 = w + 9$ **6**   **35.** $23 = d - 16$ **39**

✓ Checkpoint Quiz 2   Lessons 4-4 through 4-7

TEXT Instant self-check quiz online and on CD-ROM

Find each sum or difference.

1. $2\frac{1}{2} + 3\frac{1}{8}$ **$5\frac{5}{8}$**   **2.** $9\frac{1}{2} - 4\frac{3}{4}$ **$4\frac{3}{4}$**   **3.** $6\frac{1}{3} + 8\frac{1}{2}$ **$14\frac{5}{6}$**   **4.** $7\frac{5}{9} - 1\frac{2}{3}$ **$5\frac{8}{9}$**

Solve each equation.

5. $a + \frac{2}{6} = \frac{5}{6}$ **$\frac{1}{2}$**   **6.** $p - \frac{5}{9} = \frac{2}{3}$ **$1\frac{2}{9}$**   **7.** $\frac{1}{5} + b = \frac{1}{2}$ **$\frac{3}{10}$**   **8.** $h + \frac{2}{3} = \frac{12}{15}$ **$\frac{2}{15}$**

9. Find the elapsed time between 8:42 A.M. and 3:29 P.M. **6 h 47 min**

10. Find the elapsed time between 6:35 P.M. and 4:18 A.M. **9 h 43 min**

4-7 Measuring Elapsed Time   **205**