Measurement

8

SECTION 8.5

Operations with Time and Mixed Units

Objectives

A Convert mixed units to a single unit.

B Add and subtract mixed units.

C Use multiplication with mixed units.

Operations with Time and Mixed Units

Many occupations require the use of a time card. A time card records the number of hours and minutes at work.

At the end of a work week the hours and minutes are totaled separately, and then the minutes are converted to hours.

In this section we will perform operations with mixed units of measure.

Operations with Time and Mixed Units

Mixed units are used when we use 2 hours 30 minutes, rather than 2 and a half hours, or 5 feet 9 inches, rather than five and three-quarter feet.

As you will see, many of these types of problems arise in everyday life.

A Converting Time to Single Units

Converting Time to Single Units

We use the information in the table to solve the following problems.

The relationship between	is	To convert from one to the other, multiply by
minutes and seconds	1 min = 60 sec	$\frac{1\text{ min}}{60\text{ sec}}$ or $\frac{60\text{ sec}}{1\text{ min}}$
hours and minutes	1 hr = 60 min	$\frac{1\text{ hr}}{60\text{ min}}$ or $\frac{60\text{ min}}{1\text{ hr}}$

Example 1

Convert 3 hours 15 minutes to

a. minutes

b. hours.

Solution:

a. To convert to minutes, we multiply the hours by the conversion factor and then add minutes.

$$3 \text{ hr } 15 \text{ min} = \cancel{3}\,\text{hr} \times \frac{60 \text{ min}}{\cancel{1}\,\text{hr}} + 15 \text{ min}$$

$$= 180 \text{ min} + 15 \text{ min}$$

$$= 195 \text{ min}$$

Example 1 – *Solution*

cont'd

b. To convert to hours, we multiply the minutes by the conversion factor and then add hours.

$$3 \text{ hr } 15 \text{ min} = 3 \text{ hr} + 15 \cancel{\text{min}} \times \frac{1 \text{ hr}}{60 \cancel{\text{min}}}$$

$$= 3 \text{ hr} + 0.25 \text{ hr}$$

$$= 3.25 \text{ hr}$$

B Addition and Subtraction with Mixed Units

Addition and Subtraction with Mixed Units

Adding mixed units is similar to adding mixed fractions in that we add each type of unit separately.

That is, we align the whole numbers with the whole numbers and the fractions with the fractions.

Example 2

Add 5 minutes 37 seconds and 7 minutes 45 seconds.

Solution:

First, we align the units properly.

$$\begin{array}{rr} 5 \text{ min} & 37 \text{ sec} \\ +\ 7 \text{ min} & 45 \text{ sec} \\ \hline 12 \text{ min} & 82 \text{ sec} \end{array}$$

Example 2 – *Solution*

cont'd

Since there are 60 seconds in every minute, we write 82 seconds as 1 minute 22 seconds.

We have

$$12 \text{ min } 82 \text{ sec} = 12 \text{ min} + 1 \text{ min } 22 \text{ sec}$$

$$= 13 \text{ min } 22 \text{ sec}$$

Addition and Subtraction with Mixed Units

The idea of adding the units separately is similar to adding mixed fractions.

When we subtract units of time, we “borrow” 60 seconds from the minutes column, or 60 minutes from the hours column.

Example 3

Subtract 34 minutes from 8 hours 15 minutes.

Solution:

Again, we first line up the numbers in the hours column, and then the numbers in the minutes column.

$$\begin{array}{rr} 8\text{ hr} & 15\text{ min} \\ - & 34\text{ min} \\ \hline & \end{array} \Rightarrow \begin{array}{rr} 7\text{ hr} & 75\text{ min} \\ - & 34\text{ min} \\ \hline 7\text{ hr} & 41\text{ min} \end{array}$$

C Multiplication with Mixed Units

Example 4

Jake purchases 4 halibut. The fish cost $6.00 per pound, and each weighs 3 lb 12 oz. What is the cost of the fish?

Solution:

First, we multiply each unit by 4, the number of halibut purchased.

$$\begin{array}{rr} 3 \text{ lb} & 12 \text{ oz} \\ \times & 4 \\ \hline 12 \text{ lb} & 48 \text{ oz} \end{array}$$

Example 4 – *Solution*

cont'd

To convert the 48 ounces to pounds, we multiply the ounces by the conversion factor.

$$12 \text{ lb } 48 \text{ oz} = 12 \text{ lb} + 48 \text{ oz} \times \frac{1 \text{ lb}}{16 \text{ oz}}$$

$$= 12 \text{ lb} + 3 \text{ lb}$$

$$= 15 \text{ lb}$$

Finally, we multiply the 15 lb and \$6.00/lb for a total price of \$90.00.