

# 13 Time, Temperature, Weight, and Capacity

## Dear Student,

If someone says it's  $80^{\circ}\text{F}$  outside, do you need a jacket? Or is it hot outside?

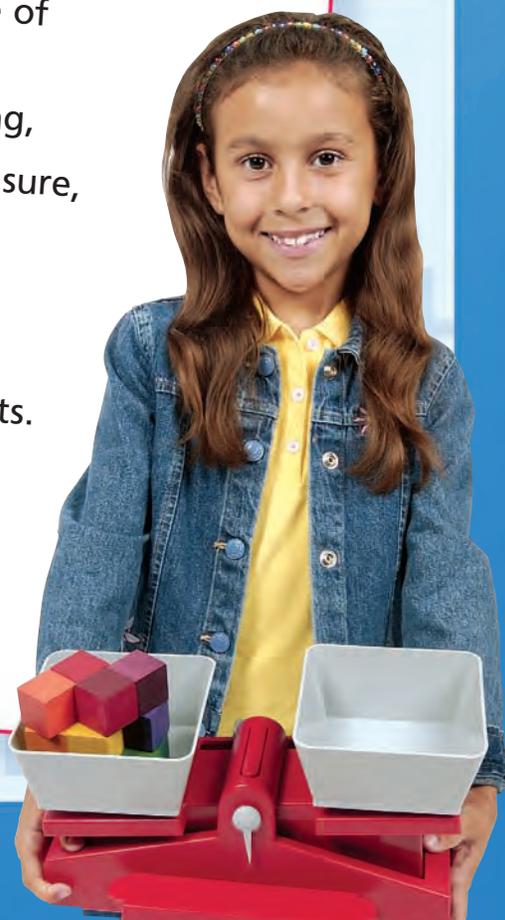
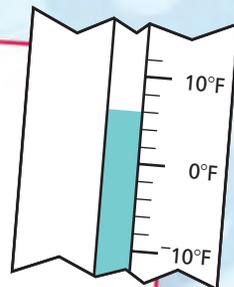
Some things can be measured, but not with a ruler. Once you have some experience measuring the temperature, you can tell someone what the temperature is. You will know whether it's cold, hot, or just right. In this chapter, you will measure different things, using tools such as clocks, thermometers, scales, and measuring cups.

You will use several skills to make sense of all the things you measure, including:

- understanding what you are measuring,
- choosing the right kind of tool to measure,
- using and reading the tool,
- knowing what measurement numbers mean, and
- drawing conclusions from measurements.

Get ready to measure!

Mathematically yours,  
The authors of *Think Math!*



# Winter Pleasures: Cold and Hot

In snowy places in the winter, many children make snowmen. It can snow a lot in Boston, Massachusetts. A typical temperature in Boston in February is  $32^{\circ}\text{F}$ . Fairbanks, Alaska, is even snowier and colder. A typical temperature in Fairbanks in February is  $-4^{\circ}\text{F}$ .

## FACT • ACTIVITY 1

Use the temperatures to answer the questions.

- 1 What temperature does the thermometer for Boston show? What temperature does the Fairbanks thermometer show?
- 2 Is the Boston temperature on the thermometer higher or lower than Boston's typical February temperature? How much higher or lower?
- 3 Is the Fairbanks temperature on the thermometer higher or lower than it's typical February temperature? How much higher or lower?

Use the times to answer the questions.

- 4 It is morning in Fairbanks. Write the time. What time will it be in 5 hours?
- 5 It is daytime in Boston. Suppose the temperature in Boston increases  $3^{\circ}\text{F}$  an hour for the next 5 hours. What will the temperature be in 5 hours? What will the time be?
- 6 A snowman will begin to melt when the temperature is  $32^{\circ}\text{F}$  or above. Will the snowman in Boston begin to melt in the next 5 hours? Explain.

Boston

Fairbanks



**A**fter playing in the snow, children and adults might enjoy hot soup or hot cocoa. Sammy's mother made 2 gallons of soup for a hungry crowd. However, the soup pot is too big to store in the refrigerator. Help Sammy's mom figure out how she can refrigerate the soup.



## FACT • ACTIVITY 2 >

**Write yes or no for each choice. If no, tell how many more and what containers are needed.**

- 1 Can the soup be stored in 3 half-gallon jugs?
- 2 Can the soup be stored in 8 one-quart containers?
- 3 Can the soup be stored in 4 one-quart containers and 4 one-pint jars?

## CHAPTER PROJECT

**Find out how long it takes for a cup of cold water and a cup of tap water to warm to room temperature.**

- Fill a 4-ounce plastic cup with water from the tap. Make it colder by refrigerating it for 4 hours.
- When the 4 hours are up, fill a second cup with 4 ounces of tap water.
- Use a thermometer to measure the temperature of each cup of water.
- Measure the temperature every 30 minutes until each cup reaches the air temperature in your room. Record the temperatures and time in a table.
- Make a graph to show your results.
- Analyze the results. Compare the amount of time it took for each cup of water to reach room temperature.

## ALMANAC Fact

To create a snow sculpture, experts usually begin with a single block of snow about 6 to 15 feet on each side. The winner of the 2006 International Snow Sculpture Competition was a puppy looking in a mirror.

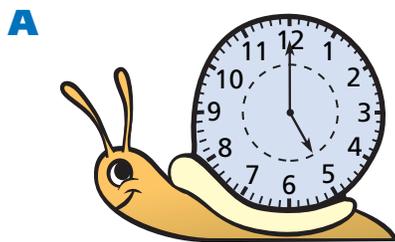


## EXPLORE

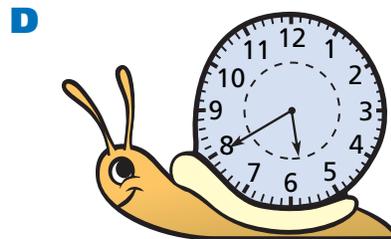
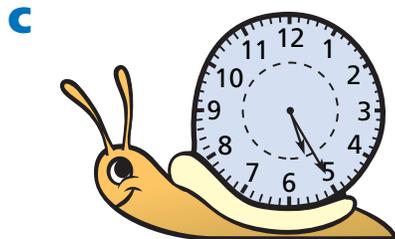
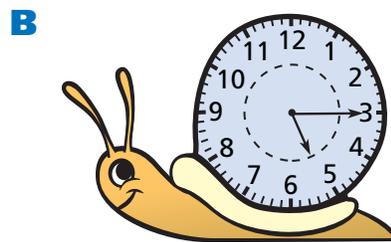
## How Much Time Is Left?

Snaily needs to be home at 5:45 P.M. She is worried that she will be late, so she looks at her watch several times.

- 1 For each picture of Snaily's watch, write the time and the number of minutes left until 5:45.



5:00,  
45 minutes  
left



- 2 How many minutes passed without Snaily looking at her watch . . .
- . . . between times A and B?
  - . . . between times B and C?
  - . . . between times C and D?

- 3 Snaily can travel **1 inch** in **5 minutes**.
- A** How far can she go in **10 minutes**?
  - B** How far can she go in a half hour?
  - C** If Snaily was **10 inches** away from home at **4:50 P.M.**, could she make it home on time? Explain.

## REVIEW MODEL

## Time, Distance, and Speed

You can draw a picture to help you find how far you can travel or how much time it takes.

It takes Matt 10 minutes to walk his dog 1 block. If he continues walking at the same speed, how far can Matt walk his dog in 20 minutes?

Think:

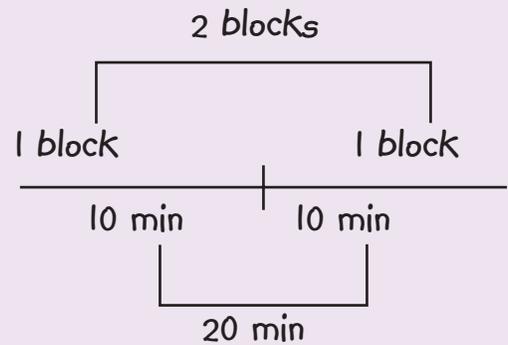
20 minutes  $-$  10 minutes =  
10 minutes

In 10 minutes, Matt can walk his dog 1 block.

In the remaining 10 minutes, he can walk his dog another block.

So, Matt can walk his dog 2 blocks in 20 minutes.

You may draw a picture like this to help you.



### ✓ Check for Understanding

You may draw a picture to help answer the questions.

- 1 How long would it take Matt to walk his dog 3 blocks?
- 2 The park is 2 blocks away from Matt's house. How long will it take Matt to walk his dog to the park and back?
- 3 How many blocks can Matt and his dog walk in 1 hour?

## Estimating Weight

**How many pounds of books do you have in your classroom?**

1 How many books do you have in your desk?

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2 About how many books are in your classroom?

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3 Find a **light** book. How much does it weigh?

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4 Find a **heavy** book. How much does it weigh?

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5 Find an **average** book—one that is not very light and not very heavy. How much does it weigh?

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6 About how much do you think all the books in your classroom weigh?

Be ready to explain how you made your estimates.

# REVIEW MODEL

## Comparing Capacities

You can use a diagram to help you write the same capacity in different ways.

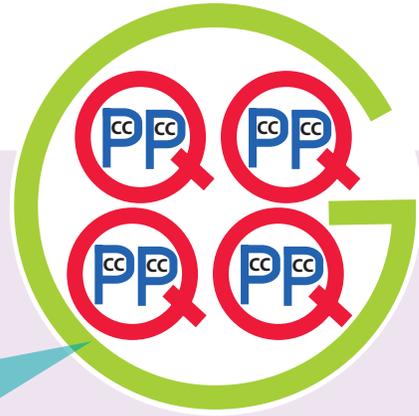
This diagram can help you find how many cups, pints, and quarts are in 1 gallon.

Different letters in the diagram show different units of capacity. The size of each letter is important.

The largest letter, G, is 1 gallon. The gallon is the largest unit of capacity in the diagram. It helps you see that one G (gallon) holds more than one Q (quart).

How many quarts does 1 gallon hold?  
Count the quarts.  
There are 4 quarts (Q) in 1 gallon (G).

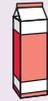
So, 4 quarts = 1 gallon.



G = gallon



Q = quart



P = pint



C = cup



You can use the diagram to help you write the same capacity in different ways.

Follow these steps to show the number of cups in 1 quart:

**Step 1** Find the Q (quart).

**Step 2** Count the number of cups (C) inside the Q (quart).

**Step 3** Write the equal capacities.

**4 cups = 1 quart**

### ✓ Check for Understanding

Use the diagram to help you write the same capacity in different ways.

- 1 How many pints are in 1 gallon?
- 2 How many cups are in 1 gallon?
- 3 How many pints are in 2 quarts?
- 4 Jill brought 4 quarts of water to the game. Brandon brought 6 pints. Who brought more water? How do you know?

## REVIEW MODEL

## Problem Solving Strategy

## Act It Out

The Art Club had a party. They served 3 pounds of cheese. The guests ate 29 ounces of the cheese. How much cheese was left?

**Strategy:** Act It Out**Read to Understand**

What do you know from reading the problem?

There were 3 pounds of cheese. The guests ate 29 ounces.  
You need to find how much cheese was left.

**Plan**

How can you solve this problem?

You can act it out by using objects, such as counters, to represent the number of ounces.

**Solve**

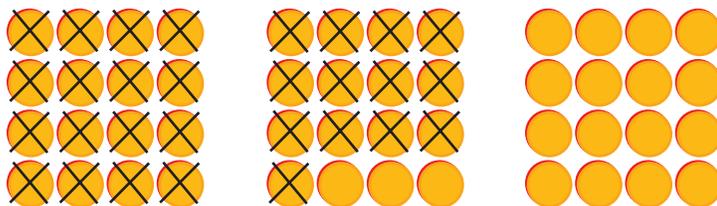
How can you act it out?

To find how many ounces of cheese are left, you need to know how many ounces are in 3 pounds of cheese.

Since there are 16 ounces in 1 pound, you can count out 3 groups of 16 counters.  $3 \times 16 = 48$  counters, so 3 pounds = 48 ounces.

Then subtract 29 counters for the number of ounces that were eaten.

$48 - 29 = 19$ , so there were 19 ounces of cheese left.

**Check**

Look back at the problem. Did you answer the question that was asked? Does the answer make sense?

## Problem Solving Practice

Use the strategy *act it out*.

- 1 The Art Club made 16 cups of berry punch. The guests drank 96 fl oz of punch. How many ounces of punch were left?
- 2 At 6:00 P.M. when the snowstorm began, the temperature was  $4^{\circ}\text{F}$ . At 9:00 P.M., it was  $12^{\circ}\text{F}$  colder. What was the temperature at 9:00 P.M.?

## Mixed Strategy Practice

Use any strategy to solve. Explain.

- 3 The Drama Club put on a play for the school. It started at 2:15 P.M. and lasted 1 hour 45 minutes. What time did the play finish?
- 4 It takes Jenna 6 minutes to walk 3 blocks. Her house is 9 blocks from her school. If she leaves school at 3:00 P.M., what time will Jenna get home?

For 5 and 6, use the table.

- 5 Which day had the warmest afternoon temperature?
- 6 How would you describe the trend in the temperatures from Monday to Thursday?

Day	Temperature	
	Morning	Afternoon
Monday	$62^{\circ}\text{F}$	$78^{\circ}\text{F}$
Tuesday	$63^{\circ}\text{F}$	$79^{\circ}\text{F}$
Wednesday	$68^{\circ}\text{F}$	$84^{\circ}\text{F}$
Thursday	$70^{\circ}\text{F}$	$86^{\circ}\text{F}$

## Problem Solving Strategies

### Act It Out

- ✓ Draw a Picture
- ✓ Guess and Check
- ✓ Look for a Pattern
- ✓ Make a Graph
- ✓ Make a Model
- ✓ Make an Organized List
- ✓ Make a Table
- ✓ Solve a Simpler Problem
- ✓ Use Logical Reasoning
- ✓ Work Backward
- ✓ Write a Number Sentence

Choose the best vocabulary term from Word List A for each sentence.

- 1 A customary unit for measuring something that weighs less than a pound is a(n) \_\_\_\_?
- 2 Any number that is less than zero is a(n) \_\_\_\_?
- 3 \_\_\_\_? is a measure of how hot or cold it is.
- 4 The amount of time that passes from the start of an activity to the end of that activity is \_\_\_\_?
- 5 The amount that a container can hold is called its \_\_\_\_?
- 6 A(n) \_\_\_\_? is a customary unit of capacity that is the same as 2 pints.

Complete each analogy using the best term from Word List B.

- 7 Length is to ruler as temperature is to \_\_\_\_?
- 8 Clock is to time as \_\_\_\_? is to weight.

### Word List A

capacity  
cup  
decrease  
elapsed time  
Fahrenheit  
fluid ounce  
gallon  
increase  
negative number  
negative sign  
ounce  
pint  
pound  
quart  
temperature  
ton

### Word List B

balance  
estimate  
thermometer

### Talk Math

Discuss with a partner what you have learned about measurement. Use the vocabulary terms *decrease*, *increase*, *earlier*, and *later*.

- 9 How can you find a change in temperature on a thermometer?
- 10 How can you find elapsed time on an analog clock?

## Degrees of Meaning Grid

- 11 Create a degrees of meaning grid for *capacity*, *temperature*, *time*, and *weight*. Use what you know and what you have learned about measurement.

General	Less General	Specific	More Specific

## Analysis Chart

- 12 Create an analysis chart using the words *cup*, *pint*, *quart*, and *gallon*.


### What's in a Word?



**POUND** A car might be towed to the *pound* for parking in the wrong place. A *pound* is a place where stray animals are taken. In England, a *pound* is a unit of money. You can *pound* a nail with a hammer. You can *pound* your fist on a door. You can eat *pound* cake, which got its name because the original recipe called for one *pound* of each ingredient. In math, a *pound* is a customary unit of weight equal to 16 ounces.



#### Technology

Multimedia Math Glossary

[www.harcourtschool.com/thinkmath](http://www.harcourtschool.com/thinkmath)

# GAME

## The Freezing Game

### Game Purpose

To practice reading temperatures on a thermometer

### Materials

- Activity Master 170: The Freezing Game
- 4 counters
- 2 number cubes



### How To Play The Game

**1** This is a game for 2 players. The goal is to land on  $32^{\circ}\text{F}$  as many times as you can. Use the *Freezing Game* Activity Master. Choose your color counter. Put 1 counter at the freezing point for water ( $32^{\circ}\text{F}$ ) to mark the temperature. Put 1 counter in your 0 box to count the times you land at freezing. Toss the number cubes to see who goes first. After that, take turns.

**2** Toss both number cubes.

- Find the sum or difference of the two numbers.
- Move your temperature counter that many spaces up or down on the thermometer.
- You must move your counter.

**Example:** You get these numbers. You may move up or down 7 degrees. You may move up or down 3 degrees.



But if you get these numbers, you must move up or down 6 degrees. You may not use the difference of 0 to stay where you are.



**3** Each time you land on  $32^{\circ}\text{F}$  at the end of your turn, move your counting counter to the next box. The first player to land on the freezing point 4 times is the winner.

# GAME

## Time Concentration

### Game Purpose

To practice telling time

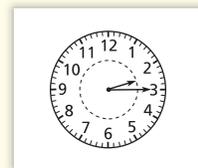
### Materials

- Activity Master 171: Time Concentration Cards (Deck 1)
- Scissors



### How To Play The Game

- 1** This is a game for 2 players. The game is played like any other *Concentration* game. The object is to match times shown on an analog clock to times written as they would appear on a digital clock.
- 2** Cut out the *Time Concentration Cards* from Deck 1. Mix up the cards. Place them face down to form a 4-by-6 rectangular array. Decide who will go first. After that, take turns.
- 3** Turn over two cards.
  - If both cards show the same time (one analog and one digital), it's a match. Take the cards. You get another turn.
  - If the cards do not match, turn them face down again. Your turn is over.
- 4** When all the matching pairs have been found, count your cards. The player with more cards is the winner. (There could be a tie.) If there is time, mix up all the cards again, and play another game.



2:15

# CHALLENGE



Ms. Clark gave each student in her class a paper bag with marbles hidden inside. Each bag has a different number of marbles. The students made up measurement riddles about the number of marbles in their bags.

**How many marbles does each student have?  
Solve each riddle to find out.**

- 1 Drake has as many red marbles as there are quarts in a half gallon. He has as many blue marbles as there are cups in 2 pints. How many marbles does Drake have?
- 2 Joelle has as many green marbles as there are ounces in a half pound. She has as many red marbles as there are tons in 4,000 pounds. How many marbles does Joelle have?
- 3 Calvin has as many blue marbles as there are pints in  $2\frac{1}{2}$  quarts. He has as many orange marbles as there are fluid ounces in  $\frac{1}{2}$  cup. How many marbles does Calvin have?
- 4 Aiko has as many clear marbles as there are quarts in 16 cups. She has as many yellow marbles as there are gallons in 8 quarts. How many marbles does Aiko have?
- 5 Scott has as many green marbles as there are cups in  $1\frac{1}{2}$  pints. He has as many orange marbles as there are quarts in  $1\frac{1}{2}$  gallons. How many marbles does Scott have?
- 6 Donette has as many red marbles as there are pints in 2 gallons. She has as many blue marbles as there are cups in 2 quarts. How many marbles does Donette have?
- 7 Javon has as many green marbles as there are pounds in 48 ounces. He has as many blue marbles as there are ounces in  $1\frac{1}{2}$  pounds. He has as many clear marbles as there are tons in 6,000 pounds. How many marbles does Javon have?