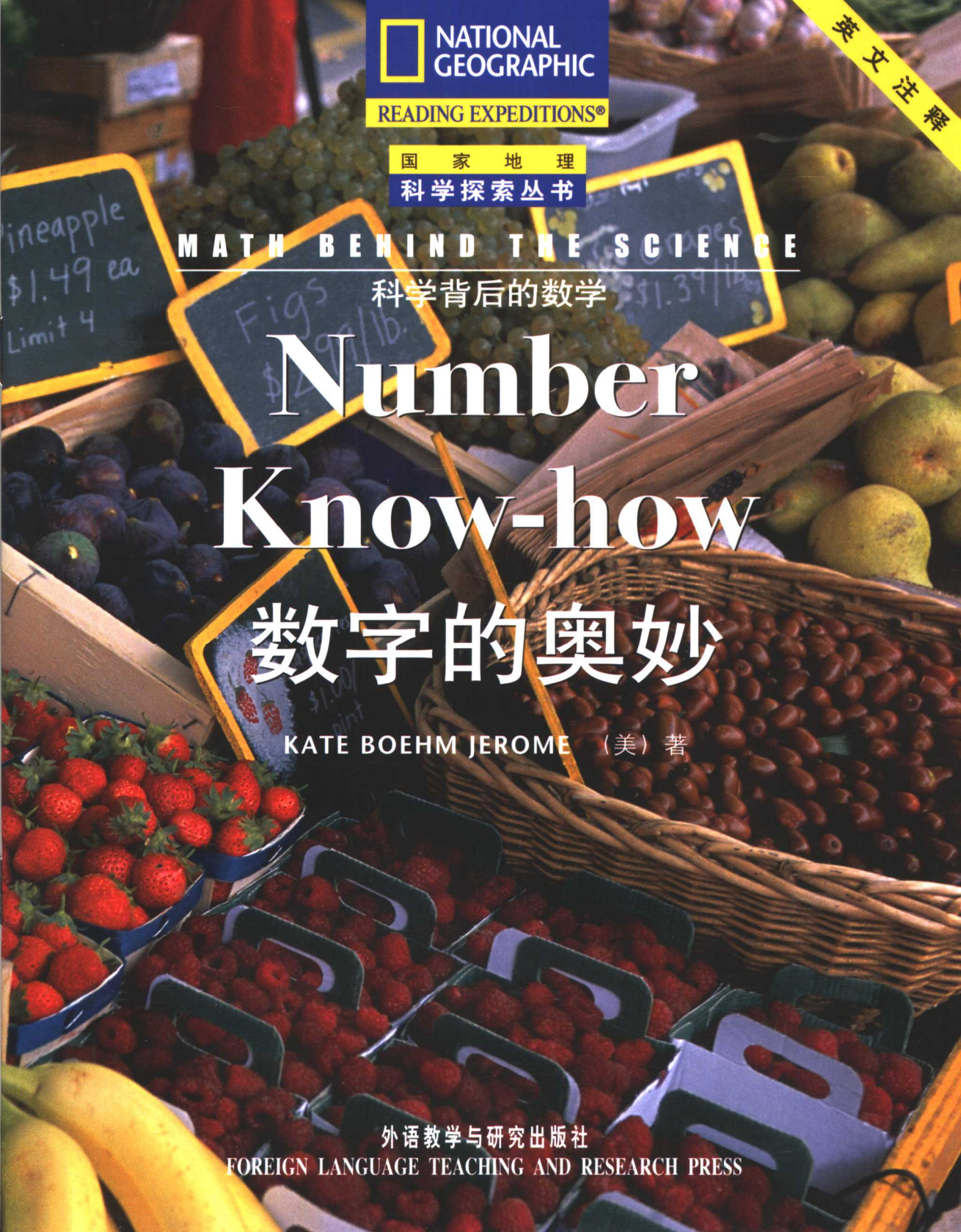
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Number know-how lets this gardener figure out how many plants will fit in the space.

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引 言

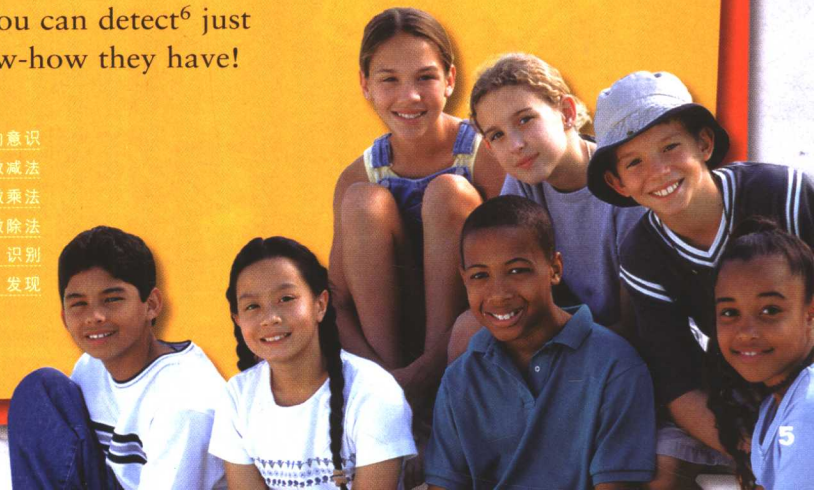
Sense with Numbers
理解数字的含义

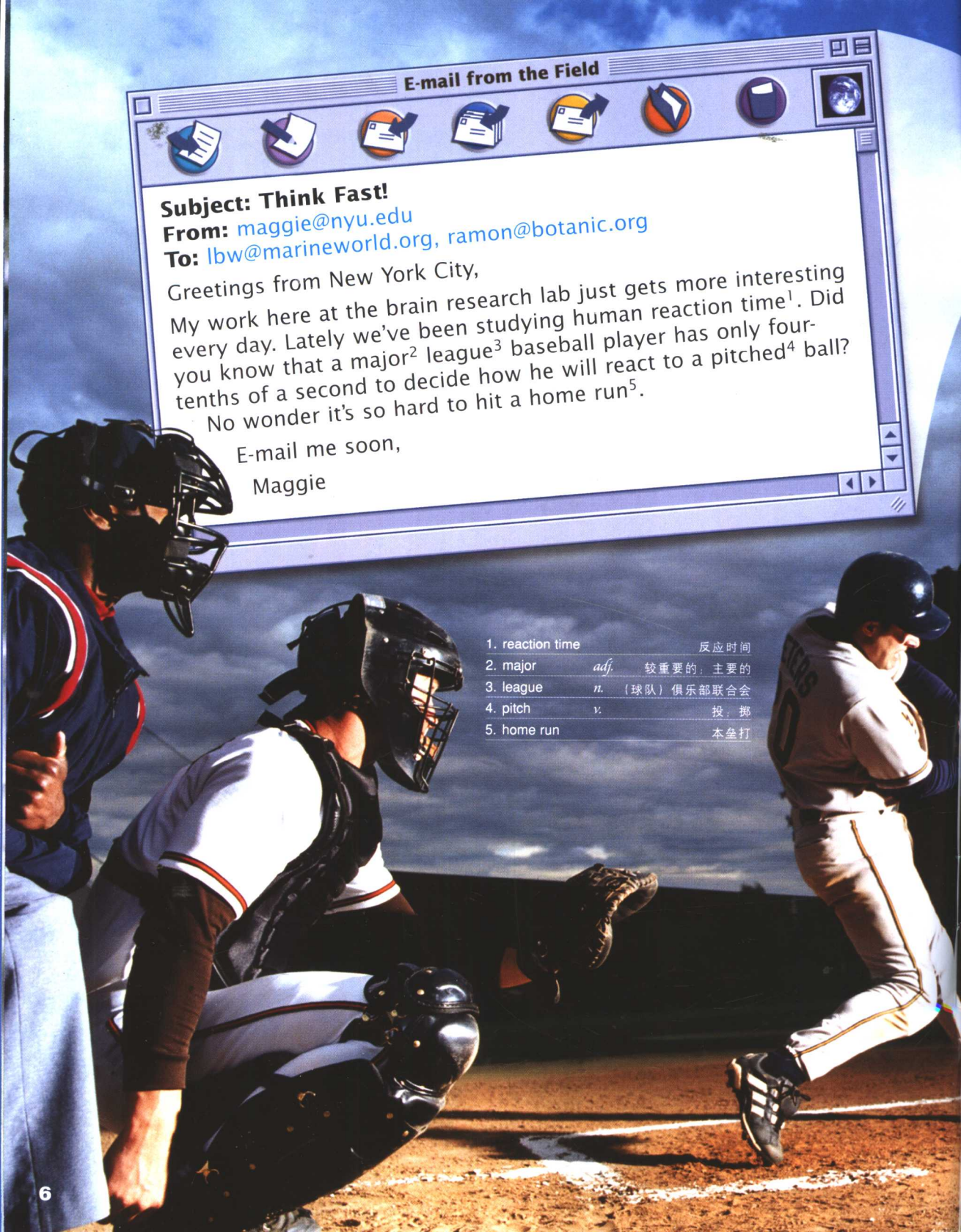
How much does a full-grown tiger weigh? **About as much as seven kids your age weigh all together.** ***Can you make an object go twice as far?*** **Of course, if you double the force. Many of the questions of science are answered using the skills of math—especially number sense[1] skills.**

Number sense is more than just knowing how to add, subtract[2], multiply[3], and divide[4]. A person with good number sense can make an estimate, quickly carry out some mental math, and recognize[5] when an answer is reasonable. If you have good number sense, you can use math to help you make sense of the world around you.

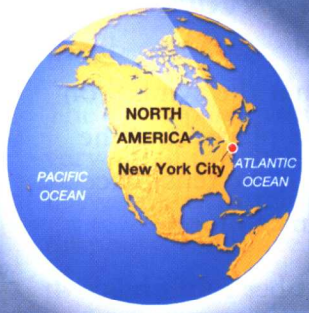
What's my best guess? Does that answer make sense? How can I solve this problem in a different way? These are the kinds of questions that scientists with good number sense ask themselves every day. So let's take a look at some e-mails from a few scientists in the field. Then maybe you can detect[6] just how much number know-how they have!

1. number sense		数的意识
2. subtract	*v.*	做减法
3. multiply	*v.*	做乘法
4. divide	*v.*	做除法
5. recognize	*v.*	识别
6. detect	*v.*	发觉，发现





1. reaction time		反应时间
2. major	*adj.*	较重要的；主要的
3. league	*n.*	（球队）俱乐部联合会
4. pitch	*v.*	投；掷
5. home run		本垒打



Imagine That!

想象一下！

The human brain is an incredible[1] organ[2]. It weighs only about 1,450 grams (about 3 pounds) at full size, but it is more complex[3] than any supercomputer[4] ever built.

Scientists have learned a great deal about the brain, especially during the past decade[5]. In fact, there are now more than 30,000 research papers published about the brain each year.

Maggie and her coworkers report on many different studies. Sometimes they describe the actions of billions[6] of brain cells. Sometimes they record response time in tiny fractions[7] of a second. Clearly these scientists need to understand both very large and very small numbers.

1. incredible	*adj.*	不可思议的
2. organ	*n.*	器官
3. complex	*adj.*	复杂的
4. supercomputer	*n.*	超级计算机
5. decade	*n.*	十年
6. billion	*n.*	大量；无数
7. fraction	*n.*	小部分

The Importance of Place

Maggie and her team know that the human brain receives about 100 million[1] signals[2] every second. How many is that? Well, there are 100 million pennies in one million dollars. And the state of California[3] has about 100 million acres of land. (That's about 100 million football fields!) But it's still hard to imagine a number so big.

You can get a better sense of just how large or small a number is by understanding place value. Place value is the value given to the place a digit[4] has in a number.

Our place value system is based on groups of ten. So each place in a number is ten times greater than the value of the place to the number's right.

How Place Value Works

Think about place value in a two-digit number. You know that the symbol on the right is in the ones place. And the symbol on the left is in the tens place—which is worth ten times more.

Now think of the number 54. It has a 4 digit in the ones place on the right and a 5 digit in the tens place on the left. This means the number stands for 5 tens and 4 ones.

1. million *n.* 百万
2. signal *n.* 信号
3. California 加利福尼亚州
4. digit *n.* 数字

Unlike our system, the numbering system of the ancient Maya used many symbols for zero—including a half flower, a head and hand, and a seashell.

The same place value system works for very small numbers between 0 and 1. However, with these very small numbers, the place values are positioned to the right of a decimal point[1].

In the example below, 0.25 stands for 2 tenths and 5 hundredths, or 25 hundredths. Notice that the hundredths place is worth $\frac{1}{10}$ the value of the tenths place, which is to the left of it.

0	.	2	5
ones		tenths	hundredths

Making Zero Sense

The ancient Maya[2] were one of the first people to use place value. They also created a symbol for zero in their number system. This was a very important achievement[3]. Why? Read on.

In the number system that we use today, there are ten symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Remember, though, that the value of a symbol depends not only on what it is but also on where it is.

A zero is important because it holds a place in a number. For example, the zero in the number 102 is in the tens place and it means that there are no tens in this number. Without the zero, the number 102 would look like 12.

Look at the place value chart[4] along the bottom of this page for the number 100 million. Eight zeros hold places in this number. If you remember that each place value is ten times larger than the place to its right, you can begin to get a sense of just how large 100 million must be!

1. decimal point 小数点
2. Maya *n.* 马雅人
3. achievement *n.* 成就
4. chart *n.* 图表

1	0	0	,	0	0	0	,	0	0	0
hundred millions	ten millions	millions		hundred thousands	ten thousands	thousands		hundreds	tens	ones

That Looks Familiar

Maggie works with so many large and small numbers that you might wonder how she can make sense of her results. Maggie relies on benchmarks to keep things in perspective[1]. Benchmarks are guides that help us connect unfamiliar numbers to something more familiar.

Although you may have never heard of benchmarks, you probably use them all the time. For example, you know how to split[2] a pizza evenly[3] between two people. Cutting it in half is easy. But what if you had to split the pizza between four or eight people? If you use $\frac{1}{2}$ as your benchmark, you can quickly figure out what $\frac{1}{4}$ or $\frac{1}{8}$ of the pizza would be.

Take Time to Connect

Benchmarks are useful for getting a better sense of "how many." But they can also be used to get a better feel for distance[4] and even time.

Think back to Maggie's e-mail about the major league baseball player. He has 0.4 of a second to react to a pitched ball. How long is that? One benchmark you could use for

1. in perspective		关系恰当的
2. split	*v.*	切开
3. evenly	*adv.*	均等地
4. distance	*n.*	距离

The difference in time between first and second place is often less than the blink of an eye.

comparison[1] is an eye blink[2]. The average[3] blink lasts about 0.3 of a second. That means the baseball player has about the same time as the blink of an eye to start a swing[4] that will connect with the ball!

1. comparison *n.* 比较
2. blink *n.* 眨眼睛
3. average *adj.* 普通的
4. swing *n.* 挥动
5. fraction *n.* 分数

Figuring It Out!

Do you think the answer to $\frac{3}{8} + \frac{1}{3}$ will be more than one or less than one? Using $\frac{1}{2}$ as a benchmark can help you answer the question.

$$\frac{3}{8} < \frac{1}{2} \qquad \frac{1}{3} < \frac{1}{2}$$

Since you know that both $\frac{3}{8}$ and $\frac{1}{3}$ are less than $\frac{1}{2}$, adding the two fractions[5] together must give an answer that is less than one.

E-mail from the Field

Subject: Doting on[1] Dolphins[2]
From: lbw@marineworld.org
To: maggie@nyu.edu, ramon@botanic.org

Nice hearing from you, Maggie.

Good thing I don't have to hit a baseball for a living! I need far more than 0.4 of a second to think about how to take care of all the marine[3] animals here in San Diego[4] at Ocean World. It's a constant[5] challenge to keep them all healthy, but I wouldn't trade it for the world.

In fact, I need to feed the dolphins right now. Those smart[6] mammals[7] always know if I'm late.

Keep in touch,

Lisa

1. dote on		溺爱；过分宠爱
2. dolphin	*n.*	海豚
3. marine	*adj.*	海生的
4. San Diego		圣迭戈
5. constant	*adj.*	不断的，连续发生的
6. smart	*adj.*	聪明的
7. mammal	*n.*	哺乳动物

MENTAL MATH
心 算

Underwater Education
水下教学

Lisa is a marine biologist[1] working at a marine park. These kinds of parks provide entertainment[2] and education to tens of thousands of people each year.

Lisa takes care of the many animals in the park, but she also does important research. As she observes[3] the animals in her care, she learns more about their needs and behavior. This information helps the animals in captivity[4], but it also can be used to protect other members of the species[5] in the wild.

It's hard work to care for large aquatic animals[6]. Their needs often change on a daily basis. So Lisa must depend on her science knowledge and good number sense to help her make the right decisions all day long.

1. marine biologist		海洋生物学家
2. entertainment	*n.*	娱乐；文娱节目
3. observe	*v.*	观察
4. captivity	*n.*	樊笼生活
5. species	*n.*	物种
6. aquatic animal		水生动物

Bottlenose dolphins

Double Duty

Even though dolphins spend much of their time underwater, they are mammals. This means that they must come to the surface to breathe air. Dolphins give birth to live[1] young. They're not hatched[2] from eggs. Just like all other mammals, female[3] dolphins must nurse, or feed milk to their babies.

Lisa and her team know this firsthand. One of their female dolphins recently gave birth. A baby dolphin is no small fry[4], either. It was almost 1 meter (about 3 feet) in length the day it was born.

An adult[5] bottlenose dolphin[6] usually eats about 4 percent of its body weight in food every day. So the 300-kilogram (about 661-pound) female dolphin in Lisa's park usually needs about 12 kilograms (about 26 pounds) of food each day.

Lisa knows that a mother dolphin that is nursing needs twice that amount of food. So when the baby dolphin was born, Lisa immediately doubled the mother's food supply to about 24 kilograms (about 52 pounds) per day.

1. live	*adj.*	活的
2. hatch	*v.*	孵出
3. female	*adj.*	雌的
4. fry	*n.*	鱼苗
5. adult	*adj.*	成年的
6. bottlenose dolphin		宽吻海豚

Using Your Head

Doing quick calculations[1] in her head helps Lisa plan her day. For example, there are times when Lisa needs to observe a dolphin at the surface of the water. Lisa knows that dolphins usually come to the surface to take a breath at least once every three minutes. She also knows that dolphins can sometimes stay underwater for as long as 15 minutes.

Lisa does some quick mental math. She figures that the longest she'll need to stay at the pool is about 30 minutes. That will let her see a dolphin surface more than once, which is what she wants. She may even see the dolphin come up for air ten times—if it's taking a breath every three minutes or so. However, what if the dolphin takes two back-to-back[2] dives[3] of 15 minutes? No problem. It will still be forced to come to the surface at least one more time during that 30-minute period.

1. calculation *n.* 计算
3. back-to-back *adj.* 连续的
4. dive *n.* 潜水
5. attach *v.* 使依附

Figuring It Out!

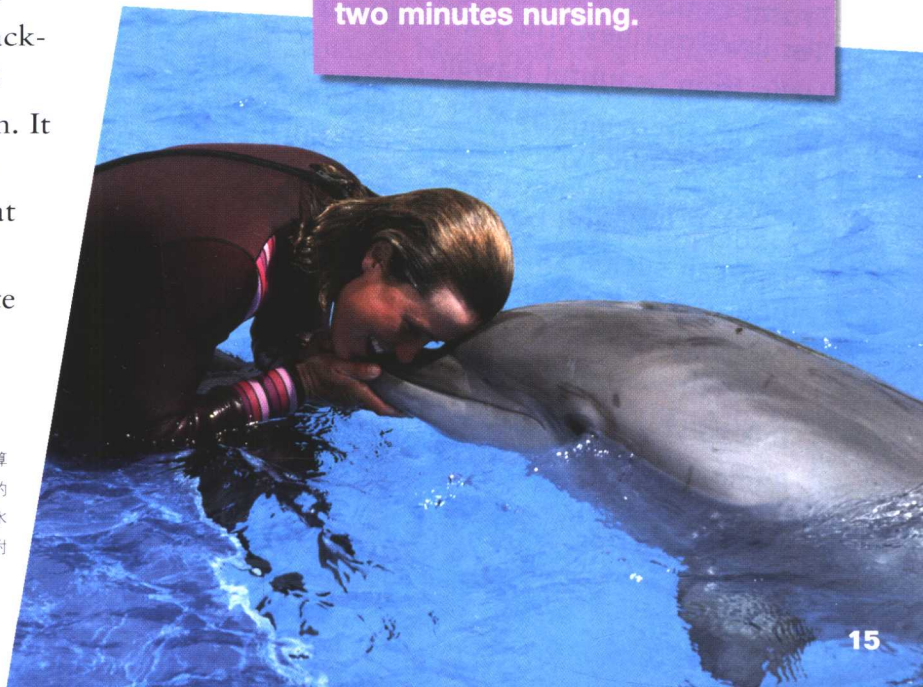
Can you do the mental math?

A baby dolphin spends about ten seconds attached[4] to its mother underwater every time it wants to nurse. If the baby nurses six times an hour, how many total minutes will the baby spend nursing over a two-hour period?

A quick calculation in your head can give you the answer.

10 seconds × 6 = 60 seconds/hour

You know that 60 seconds = 1 minute. So in a two-hour period, the baby will spend a total of two minutes nursing.



Ponds, such as this one in Hawaii, are often home to bladderworts and other carnivorous[7] plants.

1. Hawaii		夏威夷州
2. trap	*v.*	设陷阱捕捉
3. victim	*n.*	受害者
4. bladderwort	*n.*	狸藻
5. botanic garden		植物园
6. field trip		（科研人员的）实地调查旅行
7. carnivorous	*adj.*	食虫的

E-mail from the Field

Subject: Super Gardens
From: ramon@botanic.org
To: lbw@marineworld.org, maggie@nyu.edu

Hello from beautiful Hawaii[1],

I bet "fast-moving" doesn't come to mind when you think about plants. But one type of meat-eating plant that I'm studying can react pretty quickly to trap[2] its victim[3]. It's called the bladderwort[4], and it grows underwater. Believe it or not, this plant can suck a small water animal into the traps on its leaves in about 0.3 of a second.

I'm always learning new things here at the botanic garden[5]. My research seems to take me on a fun field trip[6] every day!

Talk to you soon.

Ramon