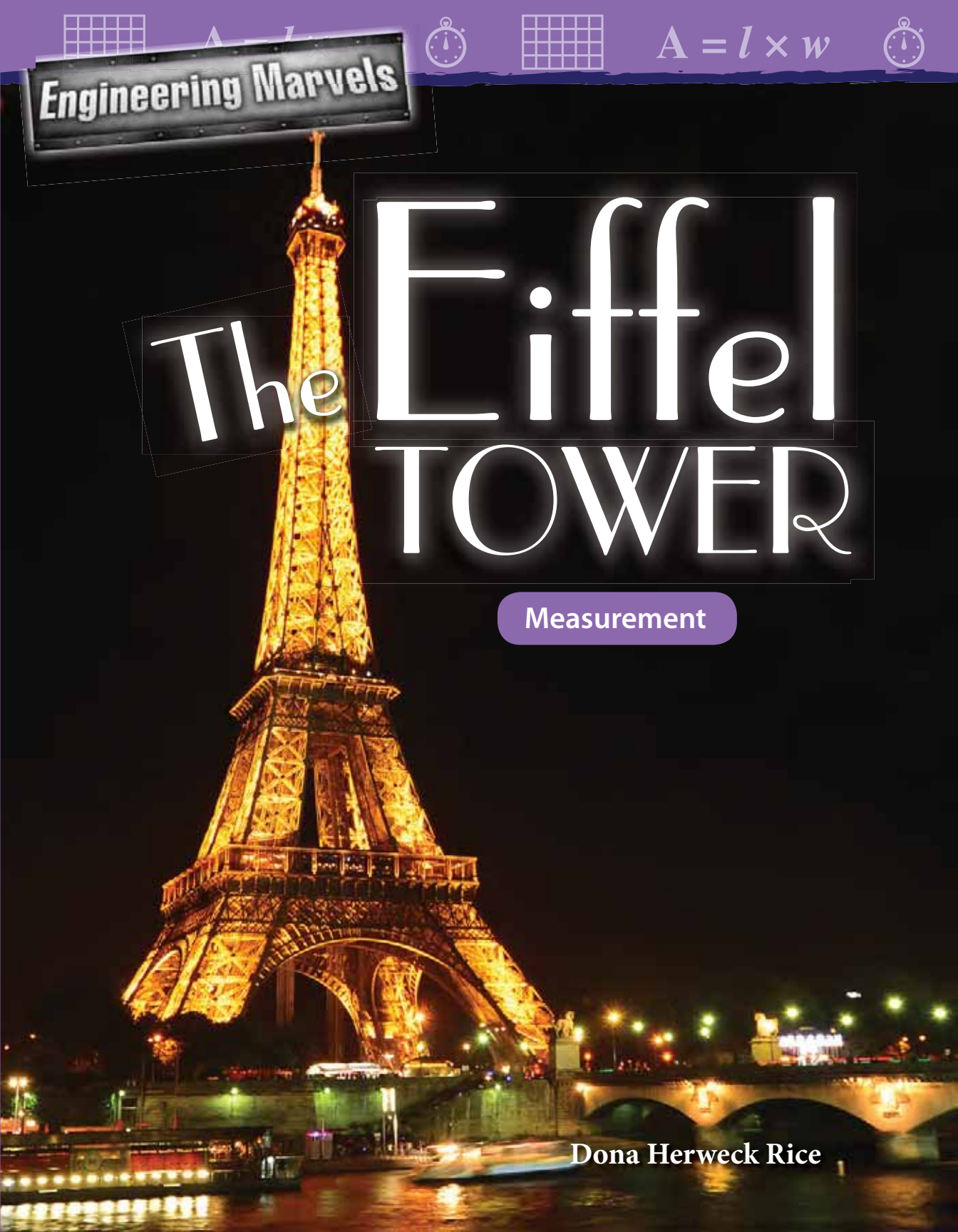
Engineering Marvels

The Eiffel TOWER

Measurement



Dona Herweck Rice

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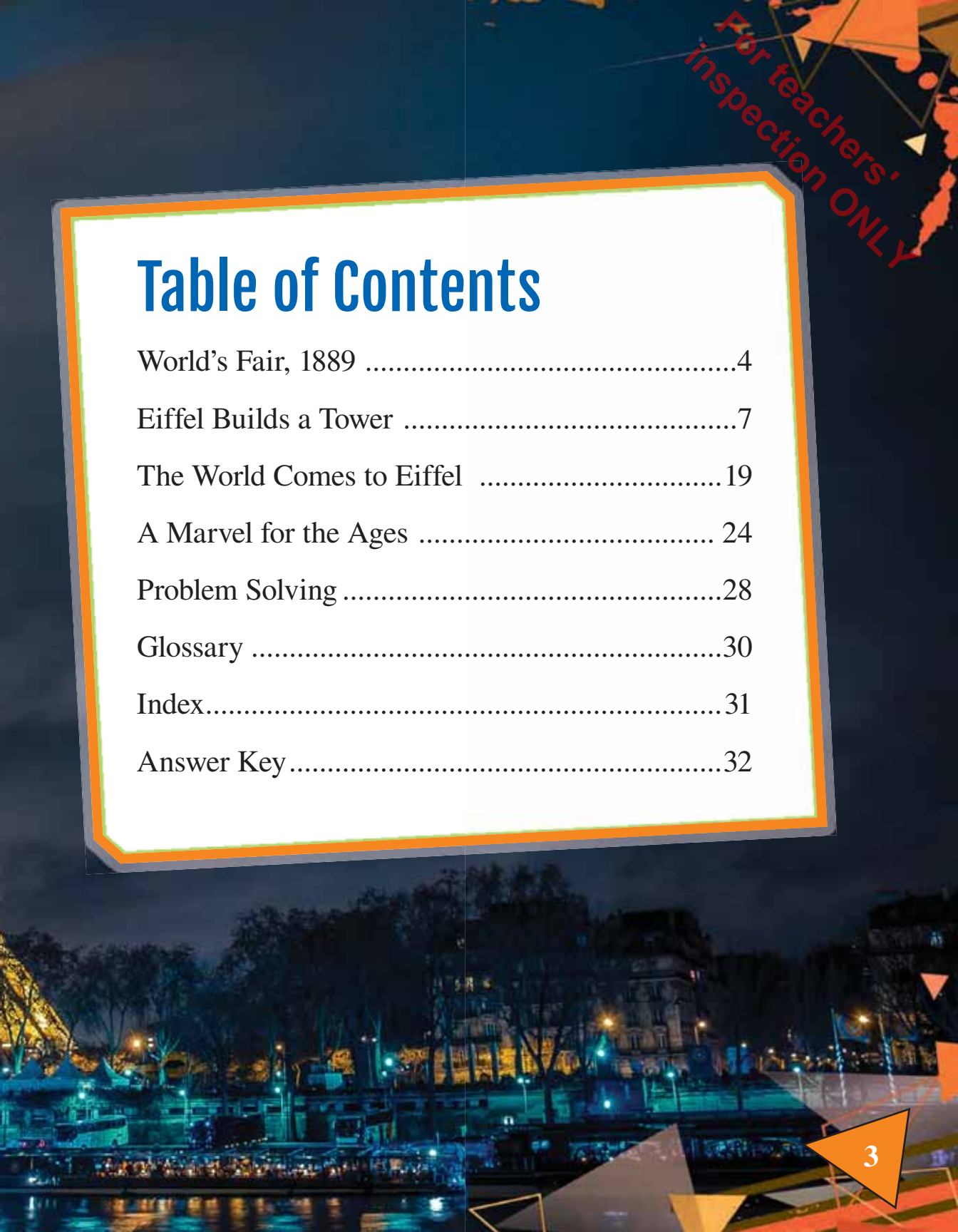
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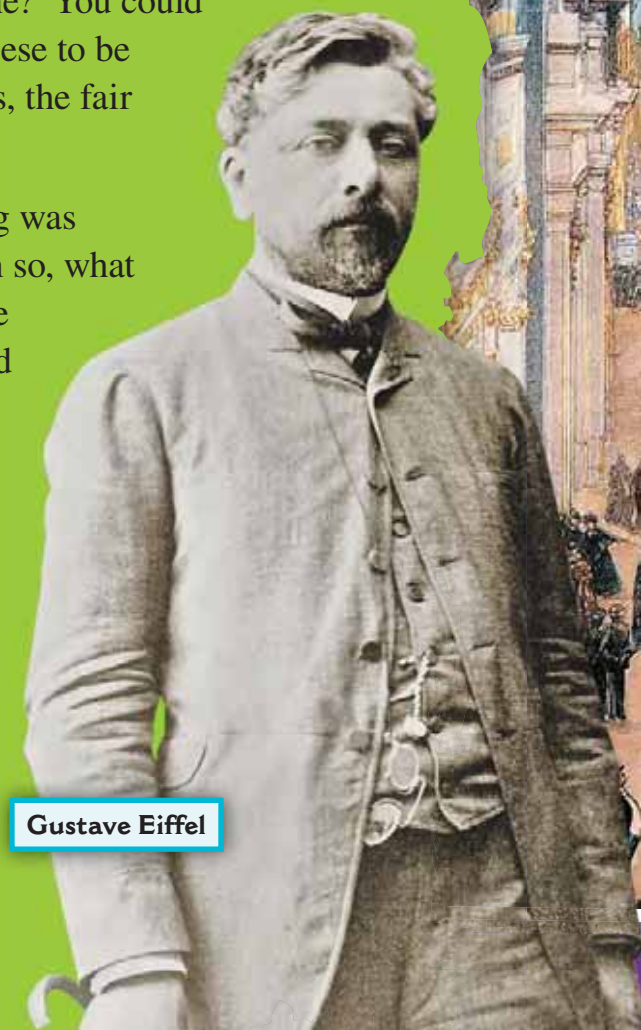


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World's Fair, 1889

The world was changing, and there was no better place to see the change than at the World's Fair. From May 5 to October 21, the World's Fair was the talk of Paris, France. It was the place everyone wanted to be. Countries around the world exhibited there. Visitors to the fair felt as though they had visited the world! They also had a chance to experience what was new and bizarre. A building with **mechanized** parts? The World's Fair had it. A pavilion just for demonstrating good hygiene? You could find it at the fair. Fifty tons of cheese to be enjoyed by visitors each week? Yes, the fair had that, too.

Something different and exciting was everywhere a person looked. Even so, what visitors most wanted to see was the new building by Gustave Eiffel and his team. They thought it was **outrageous**. The French call it the *Tour Eiffel*. We know it as the Eiffel Tower. Today, it stands for France itself. No visit to Paris is complete without a trip to the pointed tower that stands tall over the historic city.



Gustave Eiffel

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Let's Explore Math

In 1889, the Eiffel Tower was the tallest building in the world. It stands about 300 meters tall. Would the tower's height in centimeters be greater than or less than 300? Explain your reasoning.



People visit the 1889 World's Fair in Paris, France.



This is the view of the Champ-de-Mars as seen from the Eiffel Tower.

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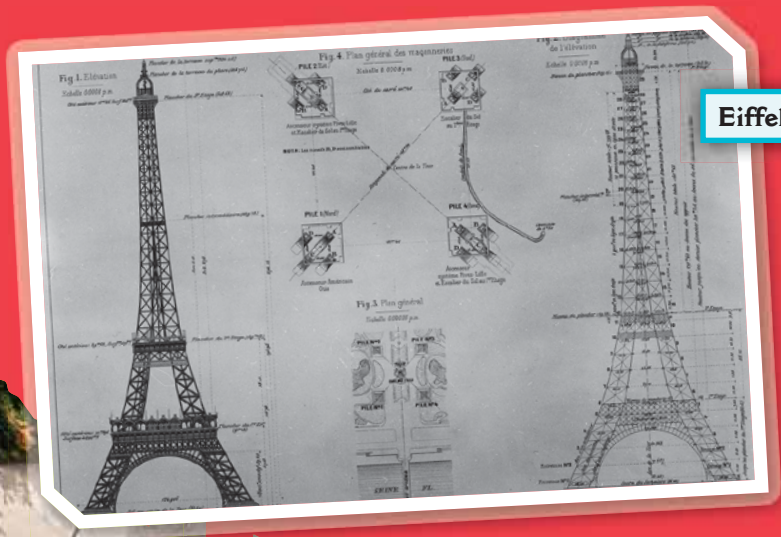
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Eiffel Builds a Tower

The Storming of the Bastille in 1789 marked the start of the French Revolution. The World's Fair was set in Paris in 1889 to mark the 100-year anniversary of that important battle. The people of France no longer wanted to be ruled by a monarch. They began a new age of **democracy**.

To honor the event, **engineers** were asked to submit plans to erect a tower. It would be built at the Champ-de-Mars (shaw-duh-mahrs). The Champ-de-Mars is a long park in Paris. It is named after Mars, the Roman god of war. The park was first used as a site for military drills.

The tower was meant to have a square base. It would be 300 meters (984 feet) tall and 125 meters (410 feet) wide. It would also serve as a model of modern engineering. More than 100 plans were submitted. A man named Gustave Eiffel and his team developed one of those plans. Their plan was chosen. They had just over two years to build the tower. But could they do it? Nothing like it had ever been built before.



Eiffel Tower plans

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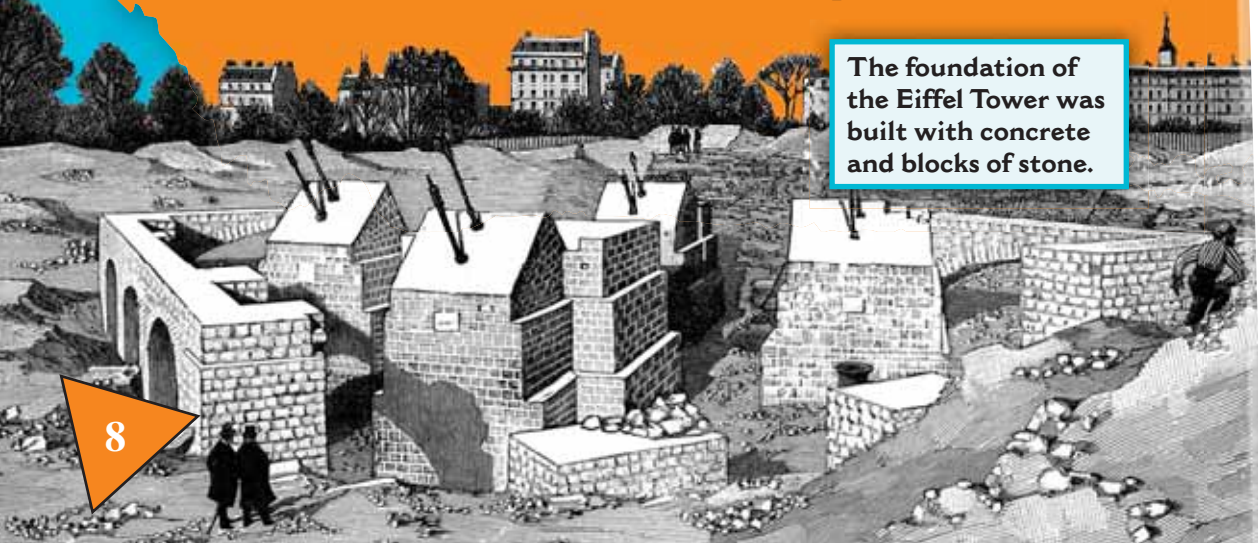
Breaking Ground and Laying a Foundation

Eiffel's project began in January of 1887. His workers dug the square foundation that would **anchor** the tower. They carved a large hole about 15 m (49 ft.) into the ground. They used only shovels to dig the hole!

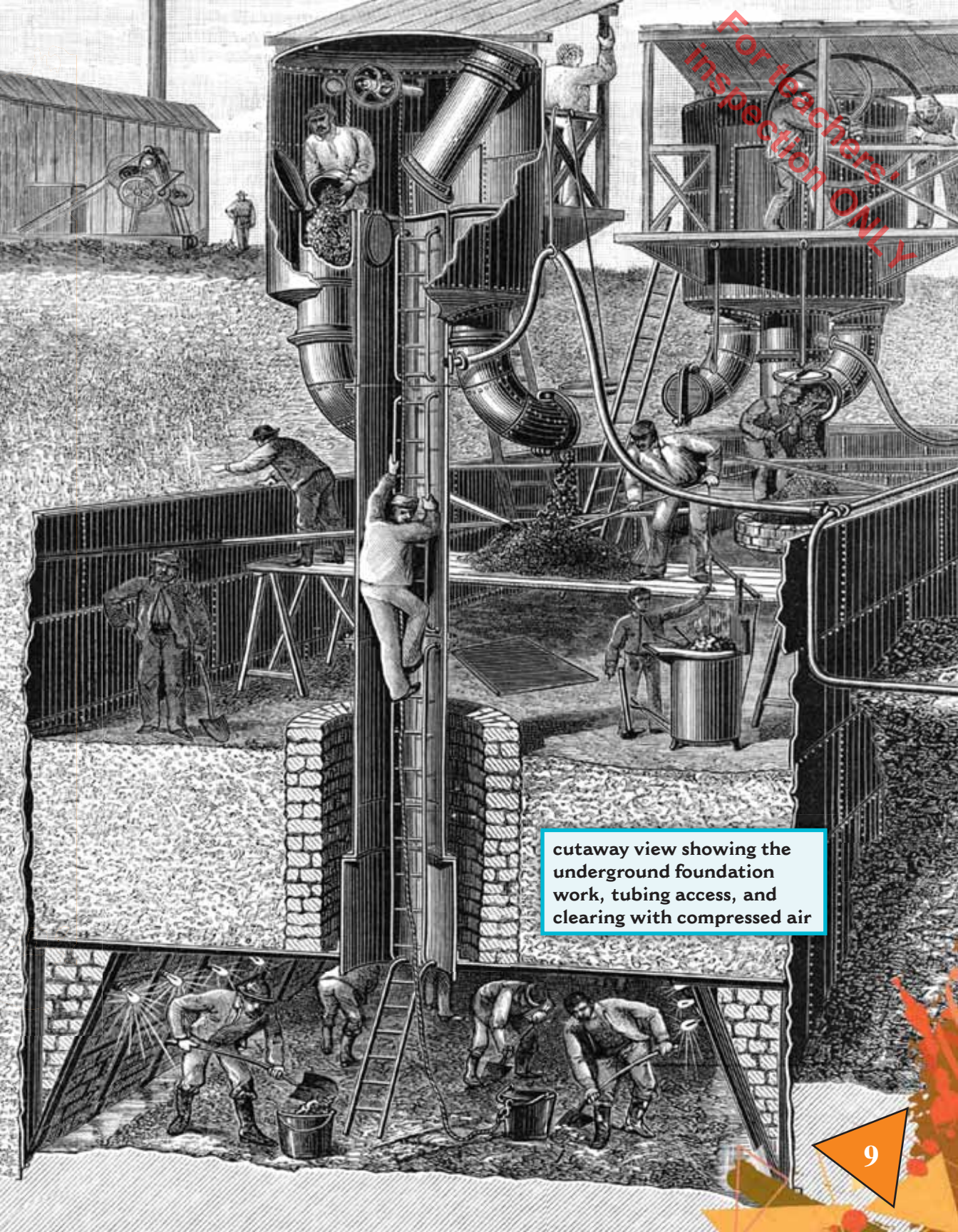
The workers filled about 6 m (19 ft.) of that space with concrete and stone. Eiffel used fast-drying cement to deal with the wet soil. He also used different methods to build each side of the foundation. One side of the soil was wetter than the other. Eiffel dug the wetter side deeper. He also used materials that were often used to build bridges. (Part of every bridge is underwater.)

Soil conditions make a big difference in the materials used. They also make a difference in whether a structure can stand at all. Very soft or wet soil may not hold the structure's weight. It may tip or break if the soil is not right.

It took a lot of work to get the tower's foundation as it should be. In all, about four months went into the process.



The foundation of the Eiffel Tower was built with concrete and blocks of stone.



cutaway view showing the underground foundation work, tubing access, and clearing with compressed air

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Math Talk

1. What are some things that can be measured?
2. Would it be better to measure a large can of paint in gallons or cups? Why?
3. How are kilometers, meters, and centimeters related?
4. How can understanding place value help you convert liters to milliliters?
5. Suppose you measure something in feet. Your friend measures the same thing in inches. Will there be a greater number of feet or a greater number of inches? Why?
6. Why might engineers have to convert units when building a structure such as the Eiffel Tower?