Name: _____ Date: _____

The Clock That Solved the Longitude Puzzle

Circle group

For hundreds of years, ships at sea could get lost. Sailors could tell how far north or south they were. They looked at the sun or the stars. That is called latitude. But finding how far east or west they were was much harder. That is called longitude.

The answer depends on time. The Earth turns once a day. So every hour of time between two places is fifteen degrees of longitude. A navigator needed the exact time at his home port. He also had to know local noon from the sun. The gap between the two times showed how far he had gone east or west. But old clocks used swinging pendulums. A pendulum does not work on a ship that pitches and rolls. Heat and damp air also made clocks run too fast or too slow.

In 1714, the British government offered a big prize. A clockmaker named John Harrison worked on the problem for decades. He built sea clocks that a ship's motion and heat did not upset. His fourth clock looked like a big pocket watch. On a trip to Jamaica in the early 1760s, it lost only a tiny bit of time.

Soon more such clocks went to sea. Trips got safer. Captains could now find their place with trust.

Questions

1. What is latitude?

_____

_____

2. How many degrees of longitude equal one hour?

_____

_____

3. Why did pendulum clocks fail at sea?

_____

_____

4. Who worked for decades on better clocks?

_____

_____

5. Why did a navigator need the time at his home port?

_____

_____

6. How did good clocks make sea trips safer?

_____

_____

Words to know

latitude: distance north or south on the Earth
longitude: distance east or west on the Earth
pendulum: a weight that swings back and forth to keep time

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

The Clock That Solved the Longitude Puzzle

Triangle group

For hundreds of years, ships crossing the ocean could easily be lost. Sailors could measure how far north or south they were by checking the height of the sun or the stars. That measurement is called latitude. Finding how far east or west they were, which is longitude, proved much harder.

The answer depends on time. The Earth turns once in a day, so every hour of difference between two places equals fifteen degrees of longitude. If a navigator knew the exact time at the home port and could also tell local noon from the sun, the gap between those two times revealed the distance traveled east or west. The trouble was that the clocks of the age used swinging pendulums, and a pendulum fails on a pitching, rolling ship. Changes in heat and damp air also made early clocks run too fast or too slow.

In 1714, the British government offered a large prize to anyone who could find a practical method. A clockmaker named John Harrison spent decades on the problem. He built several sea clocks with clever parts that were not thrown off by a ship's motion or by changes in temperature. His fourth design looked like a large pocket watch. On a voyage to Jamaica in the early 1760s, it lost only a tiny amount of time.

Over the following years, copies of such timekeepers went to sea. Voyages became safer, because captains could finally fix their position with confidence.

Questions

1. What is latitude?

_____

_____

2. How many degrees of longitude equal one hour of time difference?

_____

_____

3. Why did pendulum clocks fail at sea?

_____

_____

4. Who spent decades building clocks to solve the problem?

_____

_____

5. Why did a navigator need to know the time at the home port?

_____

_____

6. How did good clocks make sea travel safer?

_____

_____

Words to know

latitude: distance north or south on the Earth
longitude: distance east or west on the Earth
pendulum: a weight that swings back and forth to keep time
practical: useful in real life
temperature: how hot or cold something is

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

The Clock That Solved the Longitude Puzzle

Square group

For hundreds of years, ships crossing the ocean could easily lose their way. Sailors were able to determine how far north or south they had traveled by measuring the height of the sun or the stars above the horizon, a measurement known as latitude. Establishing how far east or west they had gone, which is called longitude, proved to be a far more stubborn challenge.

The solution depends on time. Because the Earth rotates once every day, each hour of difference between two places corresponds to fifteen degrees of longitude. If a navigator knew the exact time at his home port and could also identify local noon from the position of the sun, the gap between those two times revealed the distance he had traveled eastward or westward. Unfortunately, the clocks of that era relied on swinging pendulums, and a pendulum cannot function properly on a pitching, rolling ship. Variations in heat and damp air also caused early clocks to run either too quickly or too slowly.

In 1714, the British government announced a large prize for anyone who could devise a practical method. A clockmaker named John Harrison devoted decades to the problem. He constructed several sea clocks with ingenious parts that were not disturbed by a ship's motion or by changes in temperature. His fourth design resembled an oversized pocket watch, and on a voyage to Jamaica in the early 1760s, it lost only a trivial amount of time.

During the years that followed, copies of such timekeepers went to sea in growing numbers. Voyages became considerably safer, since captains could at last fix their position with confidence.

Questions

1. What is latitude, and how could sailors measure it?

_____

_____

2. How many degrees of longitude correspond to one hour of time difference?

_____

_____

3. Why were pendulum clocks unsuitable for use at sea?

_____

_____

4. Who devoted decades to building clocks that could solve the problem?

_____

_____

5. Why did a navigator need to know the exact time at his home port?

_____

_____

6. In what way did accurate clocks make sea voyages safer?

_____

_____

Words to know

latitude: distance north or south on the Earth
longitude: distance east or west on the Earth
pendulum: a weight that swings back and forth to keep time
practical: useful in real life
temperature: how hot or cold something is

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: The Clock That Solved the Longitude Puzzle

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: The Clock That Solved the Longitude Puzzle

Easier · 214 words · Flesch-Kincaid grade 2.8

1. How far north or south a ship is.
2. Fifteen degrees.
3. A pendulum does not work on a ship that pitches and rolls.
4. John Harrison, a clockmaker.
5. The gap between home time and local noon showed how far east or west he had gone.
6. Captains could find their place and not get lost.

Triangle: The Clock That Solved the Longitude Puzzle

This passage · 243 words · Flesch-Kincaid grade 7

1. How far north or south a ship is.
2. Fifteen degrees.
3. A pendulum does not work on a pitching, rolling ship.
4. John Harrison, a clockmaker.
5. The difference between home time and local noon shows how far east or west the ship has gone.
6. Captains could find their position accurately and avoid getting lost.

Square: The Clock That Solved the Longitude Puzzle

Harder · 269 words · Flesch-Kincaid grade 10.2

1. It is how far north or south a ship is, found by measuring the height of the sun or stars.
2. Fifteen degrees.
3. A pendulum cannot work properly on a pitching, rolling ship.
4. John Harrison, a clockmaker.
5. The gap between home time and local noon revealed how far east or west the ship had traveled.
6. Captains could fix their position accurately and avoid losing their way.