The Monumental Pyramids of Egypt and the Pythagorean Theorem

Author: Santosh Rooprai
Grade Level: 8
Duration: 2 class periods

<table>
<thead>
<tr>
<th>National Standards</th>
<th>AZ Standards</th>
<th>Arizona Social Science Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOGRAPHY</td>
<td></td>
<td>Geography</td>
</tr>
<tr>
<td>Element 2: Places</td>
<td></td>
<td>The use of geographic</td>
</tr>
<tr>
<td>and Regions</td>
<td></td>
<td>representations and tools helps</td>
</tr>
<tr>
<td>4. The physical</td>
<td></td>
<td>individuals understand their</td>
</tr>
<tr>
<td>and human</td>
<td></td>
<td>world.</td>
</tr>
<tr>
<td>characteristics of</td>
<td></td>
<td>8.G1.1 Use geographic tools and</td>
</tr>
<tr>
<td>places</td>
<td></td>
<td>representations to analyze</td>
</tr>
<tr>
<td>Element Five:</td>
<td></td>
<td>historical and modern political</td>
</tr>
<tr>
<td>Environment and</td>
<td></td>
<td>and economic issues and events.</td>
</tr>
<tr>
<td>Society</td>
<td></td>
<td>Key tools and representations</td>
</tr>
<tr>
<td>14. How human</td>
<td></td>
<td>such as maps, globes, aerial and</td>
</tr>
<tr>
<td>actions modify the</td>
<td></td>
<td>other photos, remotely sensed</td>
</tr>
<tr>
<td>physical</td>
<td></td>
<td>images, tables, graphs, and</td>
</tr>
<tr>
<td>environment</td>
<td></td>
<td>geospatial technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Human-environment interactions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>are essential aspects of human</td>
</tr>
<tr>
<td></td>
<td></td>
<td>life in all societies.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.G2.2 Evaluate how political,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>social, and economic decisions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>throughout time have influenced</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cultural and environmental</td>
</tr>
<tr>
<td></td>
<td></td>
<td>characteristics of various places</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and regions.</td>
</tr>
</tbody>
</table>

| SIOP Elements     |              | Assessment                        |
| Preparation       | Scaffolding  |          |
| Adapting content  | Modeling     | Individual |
| Linking to        | Guided practice| Group   |
| background        | Independent practice |  |
| Linking to past   | Comprehensible input|    |
| learning          |                  |    |
| Strategies used   |                  |    |
|                   |                  |    |
| Integrating       | Application     |    |
| Processes         | Hands on        |    |
| Reading           | Meaningful      |    |
| Writing           | Linked to       |    |
| Speaking          | objectives      |    |
| Listening         | Promotes        |    |
|                   | engagement      |    |
|                   |                  |    |
| Arizona English Language Proficiency Standards | |    |
The Monumental Pyramids of Egypt and the Pythagorean Theorem

Grade 6-8
Basic
Listening and Reading
Standard 1 By the end of each language proficiency level, an English learner can construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.
B-2: recount specific details and information in a variety of texts.

Listening, Speaking, Reading, and Writing
Standard 6 By the end of each language proficiency level, an English learner can participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.
B-5: contribute relevant information and evidence to collaborative oral and written discussions.
Standard 7 By the end of each language proficiency level, an English learner can conduct research and evaluate and communicate findings to answer questions or solve problems.
B-1: gather information from multiple provided resources to answer questions.
B-2: paraphrase observations/information notes with labeled illustrations, diagrams, or other graphics, as appropriate.

Overview
Several ancient cultures around the world have created pyramids but the best-known ones are perhaps the Egyptian pyramids. These pyramids were a monumental engineering feat, and students should know how they were constructed and how does math play a part in the story of the pyramids.

Purpose
In this lesson students will use various resources to analyze the strategies that ancient Egyptians might have used in building the huge pyramids and the impact of building these pyramids on daily life and the landscape. Students will also learn and apply the Pythagorean Theorem to calculate the missing side of a right triangle.

Key Vocabulary
exert: apply force to something
intact: something is still whole not damaged
technique: a special way of doing something

Materials
- Venn Diagram Graphic Organizer
- Monumental Pyramids images
- Projection device/computer/Internet
- We May Finally Know How the Pyramids Were Built https://www.discovery.com/exploration/how-the-pyramids-were-built
- 3D models of pyramids
- Pythagorean Theorem—Egyptian Pyramids video (1.20 min) https://pythagoreantheorempyramids.tumblr.com/
- Pythagorean Theorem Inquiry
- Pythagorean Theorem Water Demo video (1.04 min) https://www.youtube.com/watch?v=CAkMUdeB060
- Pythagorean Theorem Practice and Vocabulary Practice
- Anchor Chart
- Independent or Group Practice and Answer Key
- Vocabulary Quiz

Objectives
The student will be able to:
- Locate countries on a world map.
- Cite the possible strategies used in building huge pyramids of Egypt.
- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world context and mathematical problems in two and three dimensions.
The Monumental Pyramids of Egypt and the Pythagorean Theorem

- Explain the impact of building of pyramids on the daily life of ancient Egyptians and on the physical landscape.

**Procedures**

*Prerequisite Knowledge: Students know how to calculate squares and square roots.*

**SESSION ONE:**

**Engage:**
1. Distribute the Venn Diagram Graphic Organizer. Project the images labeled Monumental Pyramids. In a pair/share have students describe and compare the two pictures using the Venn Diagram. Have the students identify which picture is of an Egyptian Pyramid (Image Two) and which one is Chichen Itza from Mexico (Image One). (Preparation: Linking to background)
2. Have students locate these places (Egypt and Mexico) on the world map by drawing a triangle in these two countries.
3. Ask if students know of any pyramids in other part of the world (Cambodia, China, Iraq, Sudan, Java—Indonesia, Guatemala, Italy, Peru, etc.). Have students locate and identify these countries on the map with additional triangles. (Grouping Option: Small groups, Integrating Processes: Listening, Writing, Reading)

**Explore:**
4. Pose the question: What strategies do you think ancient Egyptians used to build those pyramids? Provide the sentence starter: I think ancient Egyptians used _____. Record their ideas on the whiteboard. (Preparation: Strategies used, Grouping Option: Whole class)
5. Project YouTube video- Building the Pyramids (3.04 min) https://www.youtube.com/watch?v=Tc2M2RmdJAg
6. Instruct students to watch the video and look for any strategies that might have been used in building the pyramids. Give students the sentence starter: From the video, I learned that _________. (Preparation: Adapting content)
7. Have students predict how the building of pyramids might have affected the lives of the Egyptians. (Preparation: Linking to past learning)

**Explain:**
8. Project or have students access How Did Pyramids Affect People’s Lives in Ancient Egypt? https://classroom.synonym.com/did-

**SESSION TWO**

**Elaborate:**
11. Divide students into groups of four. Provide each group with a concrete 3D model of a geometrical pyramid. Have students examine the shape of pyramid and determine the mathematical shapes they see. Randomly call on students and have them use the sentence starter: Some of the shapes we saw were ______. (Preparation: Adapting content and Past learning; Application: Promotes engagement and Linked to objectives)
12. List the shapes that students shared on the whiteboard. Lead a discussion about triangles—types of triangles and then specifically right triangles. (Preparation: Linking to past learning)
13. Project video Pythagorean Theorem—Egyptian Pyramids (1.20 min only) https://pythagoreanthemepyramids.tumblr.com/ and project How did they create the pyramids? Discuss how the rope and knots could be materials already in their
environment and used for measuring accurately.  

(Scaffolding: Comprehensible input)

14. Project Math Interactives video: Shape and Space: Pythagoras (1.09 min) to see a real-world application of the theorem.  

15. Distribute or project the Pythagorean Theorem Inquiry. Have the groups of four write their observations on the whiteboard or on the paper.  
(Grouping options: Small group)

16. Project Pythagorean Theorem Water Demo video to understand how the Pythagorean Theorem works for right triangles. (1.04 min)  
https://www.youtube.com/watch?v=CAkMUdeB06o  
(Application: Linked to objectives)

17. Review the definitions for right triangle, hypotenuse, and Pythagorean Theorem.

18. Project the Pythagorean Theorem Practice worksheet that has a vocabulary practice at the bottom. Have students orally practice the vocabulary.

19. Model problem-solving using Pythagorean Theorem using the problem of Alex and the ladder.

20. Project or post the Anchor Chart which helps students see the process.  
(Scaffolding: Modeling and Guided Practice, Grouping Options: Whole class)

21. Project or distribute the Independent or Group Practice. Share how the work will be evaluated by the teacher or by another student.  
(Assessment: Group or Individual, Written)

Evaluate: (See Assessment)

Assessment

Geography
The Venn Diagram Graphic Organizer and map work can be graded for completeness and accuracy. Mastery will be considered a score of 80% or higher.

Geography, Science, and ELA
The Readings Worksheet can be graded for completeness and accuracy. Mastery will be considered a score of 80% or higher.

ELA and Science
Vocabulary acquisition can be measured using the Vocabulary Test. Mastery will be considered a score of 80% or higher.

Mathematics
The Pythagorean Theorem Inquiry can be graded for completeness. Mastery will be considered a score of 90% or higher.

The Pythagorean Theorem Practice can be graded for completeness. Mastery will be considered a score of 90% or higher.

Independent or Group Practice can be graded for accuracy. Mastery will be considered a score of 80% or higher or a 3-4 on the Scoring Rubric.  
(Assessment: Written, Individual or Group)

Extensions

Further extension of application of this concept will be solving other real-world problems including 2D and 3D objects.

Sources

How did Pyramids Affect People’s Lives in Ancient Egypt?  

Video link: connection between pyramid building and Pythagorean Theorem  
https://pythagoreantheorem-pyramids.tumblr.com

Video link: real world Pythagorean application  

Video link: Pythagorean Theorem Demo  
https://www.youtube.com/watch?v=CAkMUdeB06o

How Did Egypt build the Pyramids?  
https://www.thegreatcoursesdaily.com/how-did-egyptians-build-the-pyramids/

We May Finally Know How the Pyramids Were Built  
https://www.discovery.com/exploration/how-the-pyramids-were-built