Applying the Pythagorean Theorem on Google Maps

By: Danielle Hulbert
ToolsVis Map Mini-Project
Fall 2016
Target Audience

- 8th grade math class
  - Algebra 1
- 15-20 students
- 42 minute class
  - 3 days
- Pythagorean Theorem
  - Investigate real life scenarios
New Jersey Student Learning Standards

- **Mathematics**
  - **CCSS.MATH.CONTENT.8.G.B.7**
    - Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
  - **CCSS.MATH.CONTENT.8.G.B.8**
    - Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

- **Technology**
  - **Standard 8.1**
    - Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.
Lesson Objectives & Goals

Students will be able to:

- Explain what the Pythagorean Theorem is and identify the formula.
- Identify the legs and hypotenuse of a right triangle
- Use the Pythagorean Theorem to find the side lengths of right triangles.
- Apply the Pythagorean Theorem to determine the unknown side lengths in right triangles in real-world problems on a Google map
  - Find the shortest route between landmarks (hypotenuse) – assuming if there were no buildings in NYC.

Performance Objectives

- Create a Google Map focusing on New York City / Manhattan
- Use landmarks in NYC to create a right triangle and find the distance between landmarks if there were no buildings in NYC
- Use the measurement tool and apply the Pythagorean Theorem to find the distance between landmarks
Lesson Procedure and Timeline

Day 1
- Create your map and title it appropriately
- Zoom into the New York City / Manhattan area on Google Maps
- Find 3 landmarks that will make a right triangle
- Find another 3 landmarks (different) that will make a right triangle
- Include a picture, description and website for each location
- Create a right triangle by connecting 3 locations together (repeat this step again for second right triangle)

Day 2
- On right triangle #1, measure the distance of one leg and record the mileage. Then measure the distance of the other leg and record the mileage.
- Using the Pythagorean theorem, find the mileage of the hypotenuse and show all work.
- Once found, use the measuring tool to check your work and see if your hypotenuse mileage was correct.
- On right triangle #2, measure the distance of one leg and record the mileage. Then measure the distance of the HYPOTENUSE and record the mileage.
- Using the Pythagorean theorem, find the mileage of the missing leg and show all work.
- Once found, use the measuring tool to check your work and see if your leg mileage was correct.
Lesson Procedure and Timeline

- **Day 3**
  - Create a new layer with driving directions to each location (all 6 locations are included in the driving directions)
  - Create a new layer with walking directions to each location (all 6 locations are included in the walking directions)
  - Share your map with another student in the class and check their work.
  - Use the measurement tool and a calculator to see if they used the tool and the Pythagorean Theorem correctly.
  - Discuss with partner about work
Screen Captures of Lesson

Step 1 – My Locations

Step 2 – Creating Right Triangles
Screen Captures of Lesson

Step 3 – Using the Measuring tool
Find the distance of one of the legs

Step 4 – Using the Measuring tool
Find the distance of the other leg
Step 5 – Use the Pythagorean Theorem to find the hypotenuse

\[ a^2 + b^2 = c^2 \]
\[ (0.438)^2 + (0.276)^2 = c^2 \]
\[ 0.191844 + 0.076176 = c^2 \]
\[ 0.26802 = c^2 \]
\[ \sqrt{0.26802} = \sqrt{c^2} \]
\[ 0.5177 = c \]
\[ 0.524 = c \text{ (Map distance)} \]

*Due to rounding, the miles might be tenths off

Step 6 – Check your work by using the measurement tool to measure the hypotenuse
Screen Captures of Lesson

**Step 7 - My Driving Directions**

**Step 8 - My Walking Directions**
Brainy Bits: Sense & Meaning

Sense

- Students will research 6 landmarks that relate to them (student choice)
  - Heritage
  - Vacations
  - Curiosity

- Students can discover new areas in NYC - relating to the content area of Geography

- Students will see how NYC streets are similar to graphing triangles on a coordinate grid.

Meaning

- Students will have a wider range of different landmarks in NYC.

- Deeper understanding of where you are in the NYC and how driving and walking directions can vary.

- Using the Pythagorean Theorem:
  - Predict the shortest route possible between two landmarks (no driving or walking)

- Apply knowledge of the Pythagorean Theorem and use it for other real life situations.
Pedagogy Piece: Gardner’s Mind Styles

Concrete Sequential:
• Organized and productive with creating their own map.
• Step-by-step instructions and being precise with organizing their map and calculations.
• They will like being able to analyze and review their and others work.

Concrete Random:
• Curious about how NYC streets will be able to make a right triangle
• Create their own map.
• They will like that they are using real world experiences to learn about the Pythagorean Theorem

Abstract Random:
• Like that they can choose any landmark that is interesting to them.
• Being productive and on the right track

Abstract Sequential:
• Self-motivated and precise.
• They will like that they will be able to use the measurement tool as many times as needed.
• They will like that they are responsible for their own research, map and calculations.
Citations


Images

- Map on title page:

- Girl thinking on Brainy Bits page