Using Geometry to Create a Nationally Recognized Symmetrical Landmark That Can Be Used to Combat a Community Problem in India

Submitted by: Jennie Wright, Math
Sullins Academy, Bristol, VA/TN

Target Grade: Upper Elementary (3-5)

Time Required: Mathematical component: 5, 45-60 minute periods
Cross-curricular plans have been included which would extend the time each day if the teacher chooses to do them.

Standards:

Math:

- TN 4.G.A Draw and identify lines and angles and classify shapes by properties of their lines and angles.
- TN 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse, straight, reflex), and perpendicular and parallel lines. Identify these in two-dimensional figures.
  - Lines, line segments, and rays (4-W.4)
  - Parallel, perpendicular, and intersecting lines (4-W.5) Parallel sides in quadrilaterals (4-X.4)
  - Acute, right, obtuse, and straight angles (4-Z.1)
- TN 4.G.A.2 Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines or the presence or absence of angles of a specified size. Recognize right triangles as a category and identify right triangles.
  - Acute, obtuse, and right triangles (4-X.1) Parallel sides in quadrilaterals (4-X.4) Identify parallelograms (4-X.5)
  - Identify trapezoids (4-X.6) Identify rectangles (4-X.7) Identify rhombuses (4-X.8) Classify quadrilaterals (4-X.9)
  - Identify three-dimensional figures (4-AA.1)
- TN 4.G.A.3 Recognize and draw lines of symmetry for two- dimensional figures.
  - Identify lines of symmetry (4-Y.1)

Central Focus:

This lesson was used to solidify the geometry terms that the students were taught. As students learn the terminology, the words are used to engage the students with

architecture around the world allowing students to interact with a world they may have never seen or heard about.

Many students have never traveled outside of America and need exposure to life beyond the four walls of the classroom. The students were encouraged to look for solutions to real world problems such as overcrowding and poverty. They will be able to come up with their own "wonder"ful monument that uses design elements of geometry.

The main focus of this lesson takes place in India and extension activities have been provided for every subject area at the end. However, with a few simple changes, this lesson could be easily adapted to any building or area of the world.

Background Information:

Students should have already learned the following terms and standards:

Polygons, Symmetry, Acute Angles, Obtuse Angles, Right Angles, Parallel Lines, Perpendicular Lines, Trapezoid, Rhombus, Quadrilateral, Acute Angles, Obtuse Angles, Right Angles, Parallel Lines, Perpendicular Lines, Trapezoid, Rhombus, Quadrilateral, 2-Dimensional, 3-Dimensional

4.NF.C.6 Read and write decimal notation for fractions with denominators 10 or 100. Locate these decimals on a number line.

- Model decimals and fractions (4-T.2)
- Graph fractions as decimals on number lines (4-T.8)

4.NF.C.7 Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Use the symbols >, =, or < to show the relationship and justify the conclusions.

- Compare decimal numbers (4-T.15) Put decimal numbers in order I (4-T.16)
- Put decimal numbers in order II (4-T.17)
- Compare decimals and fractions on number lines (4-T.18)
- Compare decimals and fractions (4-T.19)

Materials

Day 1	Day 2	Day 3
World Map YouTube Worksheet (1 per student) Straight Edge Ruler (1 per student) Colored Pencils /Markers/Crayons (Yellow,	Worksheet Map Straight edge ruler Access to Google Maps Pictures of other famous landmarks (optional)	Access to Populations Chart Paper Small Cards with the names of the 7 Wonders of the World Calculators

Red, Green, Blue, Orange, Purple)		
Day 4	**Day 5**	
Worksheet for Brainstorming Various building blocks (i.e., Legos, wood, whatever you can find or borrow)	Brainstorming worksheet from day 4 Materials to build design prototype	

Instruction

DAY 1: Introduction to monumental landmarks around the world. The buildings play a specific part in the culture of the city or country in which it is located.

Say "Every country has certain buildings and architectural components that make set them apart. Today we are going to look at some famous landmarks around the world that helps natives and visitors recognize a certain region of the world."

- Make a list together of places that your students may already know. This may be done independently, in small groups or as a whole group. Lead where necessary.
- Next, students will watch a short video to gain additional knowledge. (https://www.youtube.com/watch?v=lxSM_7WUaSc). This may be done whole group or on individual devices.
- Students completed a Google Peardeck (wwwpeardeck.com) to answer questions about the video.
  - What are some famous landmarks around the world that you know about already?
  - Which one did you think was visually the most appealing and why? 3. Highlight a set of perpendicular lines on Petra.
  - Circle the vertices of two acute angles on Chichen Itza. Highlight two sets of parallel lines.
  - What did you notice about the geometric architecture of the Great Wall of China?
  - Do you agree or disagree that Christ the Redeemer is an architectural wonder?
  - Place the star on the map where the monument you found the most interesting is located.
- Briefly discuss the Seven Wonders in the Video as a group using the questions above. Focus on the Taj Mahal in India. Ask what the students noticed about the architecture. You may need to prompt them to use previously used geometry terminology (instead of adjectives such as big, white, pretty, etc.)
- Explain that you are going to examine the Taj Mahal building a little closer.
- Pass out the worksheet. **Based on the level of your students these sheets may be completed independently, in small groups or whole groups.

- Students will analyze a picture of the Taj Mahal to detect symmetry, acute and obtuse angles, vertices, parallel lines and polygons.

Assessment:

Successful completion of worksheet and discussion participation

DAY 2: Create a spreadsheet and look at distances between various cities in India and the Taj Mahal.

Say, "Today we are going to take a trip "as the crow flies". Does anyone know what that means?" (Allow responses) "There is a difference between how a bird flies over the river through the woods to grandmother's house and how we would have to drive on streets, roads, and highways to get to the same location."

- Remind students where the Taj Mahal is located. (Agra, Uttar Pradesh, India)
- Use Google Maps to show the students how to find driving directions from Agra to another city in India.
- Notice the distance in kilometers and the time it takes to drive those miles.
- Give the students the worksheet with the map of India on it.
- Find Agra on the map as you answer question #1.
- Look at the top right hand corner of the map and examine the line segment that tells that 200 miles is equal to one inch and 200 km is about 1/2 inch or 1 1/2 cm.
- Now complete question #2 by drawing a line segment that represents 200 miles, 200 km or both.
- Have the students continue to examine the map of India and choose six cities besides Agra. Write these down on the list.
- The next question asks for them to connect the cities with line segments. Students may have different lines, depending on how they interpreted the question. This can bring up a good class discussion on question interpretation.
- After drawing the line segments, the students were shown how to section off the lines to figure the mileage between each city.
- Investigate the map to detect intersecting lines, parallel lines, acute, obtuse, and/or right angles.

Early Finishers:

Give early finishers a picture of another famous landmark (Eiffel tower included) to scrutinize for various geometric patterns and shapes. This allows time to help those who are having difficulty with the map activity.

Assessment:

Use worksheet to determine students' ability to draw line segments, figure mileage, and detect angles from segments drawn.

DAY 3: Looking at famous buildings around the world, students will determine their purpose. Leads to brainstorming for type of building and impoverished, overcrowded area may need.

Say, "Today we are going to look at the populations of the countries where the seven wonders from yesterday are. Which one do you think has the most people?" (Allow for guesses and reasons behind why they think the way they do about certain areas of the world)

- Give cards to small groups of children to look up population information either from the internet or an almanac. If time permits, students may look up the information more than one place and find the median. (Card titles were: Chichen Itza, Christ the Redeemer, Colosseum, Great Wall, Machu Picchu, Petra, Taj Mahal)
- Students will need to find out the country location, square miles, and the population. They will place the information on the card.
- Create an informational graph and a bar graph based on this information found.
- Discuss the results focusing in on the population vs. square miles.
- Students may use calculators to figure out the space per person by dividing the square miles by the number of people.

Say, "The people in India can be extremely wealthy or live in poverty. Briefly show pictures of the wealth and poverty in India. The cities of these countries are very overcrowded." (Students had a working knowledge of the "Caste" system in India from Social Studies).

- Create a class graph showing the population of each of the country's population
- Categorize information about each country on a graph showing the country, the monument, population, square miles of country, and square miles per person (sq. miles/population - use calculators).
- Inspect the decimal numbers that pertain to the sq. miles per person and create a list of the order. Have the students order the numbers on their own before discussing orally.
- Check the answers together.
- Discuss the problems with this type of living condition in relation to the numbers. What other problems might the area have? (healthcare, schools, homeless, lack of food)

Assessment:

Participation in creating class graph and oral discussion participation

DAY 4: Use geometry skills, plan to build a monument in an overcrowded city in India.

Put students into small groups of 2-4 (could work individually depending on time and dynamic)

Say, "The last few days we have looked at several buildings around the world that have a "Wow" factor. Most of these buildings are used for the sole purpose of entertaining tourists. Today, you are going to pick a city in India and create a "Wow" building that would attract people, BUT also serve a purpose to help others. Your architectural statement must be unique in its design. You will need to use a variety of shapes or angles. You will work together to create your design and tomorrow you will try to build it out of the blocks or Legos provided."

- Go over the instructions on the worksheet and answer any questions they may have.
- Brainstorm their city, the recycled or eco-friendly materials to be used to build, and the purpose.
- Plan the monument.
- Work with each group by making suggestions and asking questions as necessary to ensure that the students are thinking globally
- Revise as necessary to ensure that the plans drawn have geometric features that can be explained.
- Follow the rubric plan for dimensions and symmetry

Assessment:

Complete rough draft successfully with partner, design has elements of symmetry

DAY 5: Work with tools to create the design from Day 4, making adjustments as necessary. Pitch concept to class.

Say, "Today you will have 30 minutes to use the building materials provided to create your philanthropic monument. At the end of the time, your group will be sharing with the rest of the class who this building is going to be used for include the purpose, what materials you would like it to be built out of and why, share the geometric structures that make your building unique and why the city commissioner of that city should approve your build."

- Build structure from the Day 4
- Check that the structure is at least 12 stories high (1 inch = 1 story)
- Ensure that it has a perimeter of at least 240 feet (1 inch = 10 feet)
- Make any adjustments necessary
- Practice your pitch
- Present to the class either in person or via video presentation

Assessment:

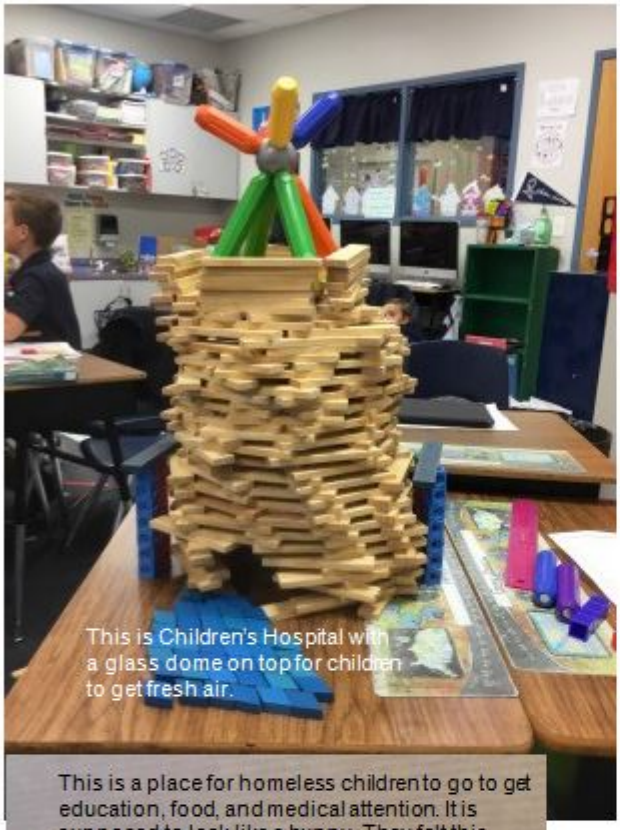
Structure complete within time limit. Identify the elements of geometry on monument. Is able to "sell" the structure through pitch.

Differentiation

Lesson can be differentiated by purposefully pairing students who need help with those who are able, or by allowing students to work alone instead of with a group.

Assessment

Geometry standards and vocabulary will be assessed through the unit test. Other formative assessments as listed in the daily plans.



This is Children's Hospital with a glass dome on top for children to get fresh air.

Homeless Shelter with rooms to sleep in and a place to get education and food.

This is a place for homeless children to go to get education, food, and medical attention. It is supposed to look like a bunny. They felt this symbolized compassion.

Job training center for poor people. It would also have a place for the people to sleep and have offices for them get jobs after.

Extension Activities for Other Subjects

Social Studies

1. Illustrate a map of India focusing on the surrounding landforms. Include a compass rose, a flag, the Arabian Sea, Bay of Bengal, Indian Ocean, Indus River, Ganges River, Himalayan Mountains, the capital, two or more cities, a famous landmark/monument, and a native animal
2. Probe for information to discover traditions, festivals, and other culturally relevant information about India. (www.getEpic.com is a good online free resource for students and teachers to obtain age appropriate books about various topics)
3. Discover facts about Taj Mahal using the website: http://mocomi.com/ taj-mahal/. After previewing this page, students will retell six interesting facts about the monument in their own words (In Google Doc about India or on Worksheet Provided)
4. Examine other homes in India. Identify the disparage between the homes of the wealthy and the impoverished. Discuss the "Caste" system.
5. Compare and Contrast populations in larger cities versus rural areas and the effects it has on the living conditions.
6. Conclude the unit with a tasting feast of Indian food

Language Arts

1. Interpret Idiom expressions (Ex. as the Crow flies, cross that bridge when you come to it, cut corners, far cry from ..., taste of your own medicine, whole nine yards)
2. Read the book the book Save Me A Seat by Sarah Weeks and Gita Varadarajan. This book is about how two boys, Ravi & Joe, become unlikely friends. It is told from the perspective of each boy. Joe is born in American and Ravi has just moved to America from India. It explores family, friendship, bullying, and cultural differences.
3. Read one or more Indian Fables
4. Compose Fables with the setting taking place in India and each of the characters should be animals found in India. Each story had to have a life lesson.

Technology

1. Students will begin to investigate the country of India and create a Keynote or PowerPoint Presentation. Students will be given a list of topics to choose from.
2. Create a trip around India using Google Maps
3. Produce a spreadsheet that shows the difference between actual mileage and "as the crow flies" from information on worksheet completed on Day 2 of math class.
4. Transfer the graphing information from Day 3 into the spreadsheet.

Science

1. Compare and Contrast the weather of India to the region where you live

2. Discover what a Monsoon is and its effects on the people of India
3. Create an irrigation system to keep the rain from entering homes with dirt floors.
4. Inspect a variety of garbage materials and their ability to hold water without leakage to simulate the homes made out of trash

Art

1. Make a picture of the Taj Mahal with geometric lines using charcoal medium and use watercolor to show the effect of how the monument looks different colors based on the time of day.
2. Create an Indian elephant. Inside the elephant, the students will create geometric patterns.
3. Draw the Eiffel Tower with charcoal and learn shading techniques.
4. Create a large drawing of the building that was constructed out of blocks as a visual representation of the model

Physical Education

1. Learn to play games popular in India including but not limited to: Cricket, Uffangali, Lagori or Pithu, Marbles, and Hopscotch
2. Students make up their own games using natural or recycled material to simulate how poorer children must use their imagination to create games using what they have.

Music

1. Listen to a variety of music from India
2. Identify various instruments that are used by the Indian people currently and in the past
3. Create an Indian inspired musical instrument out of recycled materials
4. Explore rhythms as you learn a Bollywood style dance

Extension Activity

Technology Keynote/PowerPoint Presentation Topics for Country Presentation

Slide 1 - Title Slide. Should include your name and an image.

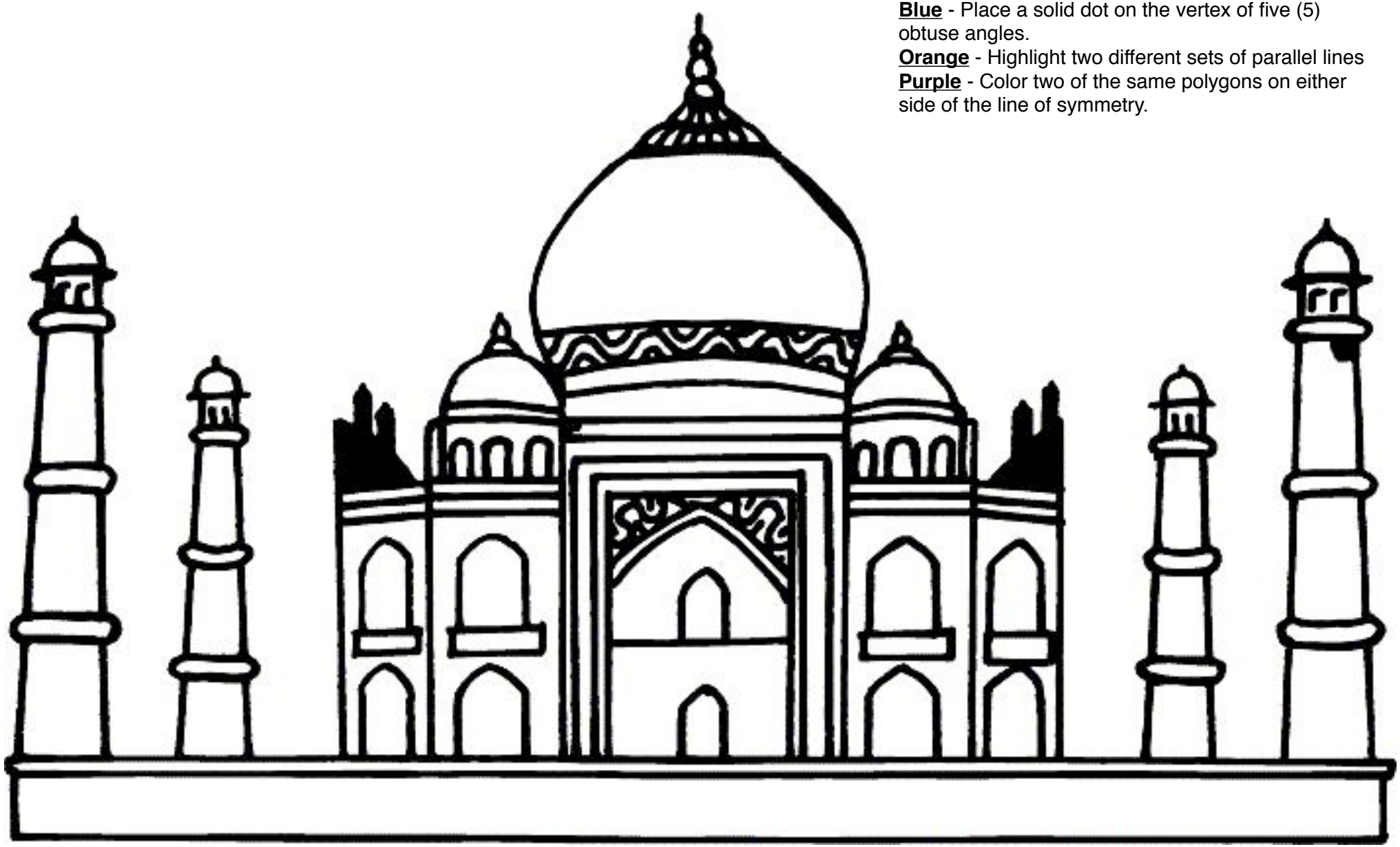
Slide 2 - A map of the country & the number of people that live there.

- How do people make a living? What do they do for fun? Include 1-2 images.
- What is the climate for summer and winter? What do their homes look like? Include 1-2 images.
- Name 2-3 animals that are native to India. Include an image of each. Describe the traditional Indian dress. Include 2-3 images.
- Traditional music - What instruments did they use, and when did they perform it? Include 1-2 images.
- Modern music - How is it different from traditional? Include 1-2 images. Describe traditional Indian art. Include 2-3 images.
- Food - Name 2-3 traditional Indian dishes and describe them. Include 2-3 images.
- History/Government - Give a BRIEF statement regarding the history of India and the current government.
- Manufacturing - Describe the types of manufacturing that are predominant in India. Include 1-2 images.
- Agriculture - How is food grown in India? What crops are most grown? Include 1-2 images.
- Name a town/city to visit in India. What are some of the attractions there? Include 2-3 images.
- Education - How are Indian children educated? How is the same and different from the USA? Include 1-2 images.
- Holidays - Name a major Indian holiday. How is it celebrated and for what reason? Include 1-3 images.
- Interesting facts. Include 1-3 facts (1 per slide) that you found interesting that did not fit into any of the other slides. Include 1-2 images.

Name: _____

Identify the following:

Yellow - Draw the line the main line of symmetry
Red - Circle five (5) Acute angles
Green - Place a square around five (5) right angles
Blue - Place a solid dot on the vertex of five (5) obtuse angles.
Orange - Highlight two different sets of parallel lines
Purple - Color two of the same polygons on either side of the line of symmetry.



Use the website: http://mocomi.com/taj-mahal/ to find out more facts about the Taj Mahal. In your own words, rewrite six facts that you found to be interesting.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

Plan Your Monument Landmark

Specifications

1. Building must be symmetrical
2. Must be at least 12 stories high (1 story = 1 inch)
3. Must possess an observation deck for visitors
4. The perimeter must be at least 240 feet (10 feet = 1 inch)
5. Bonus for using more than one building material and a variety of angles.

What are you going to use to build: _____

Is this material recyclable? _____

For whom is the monument being built? _____

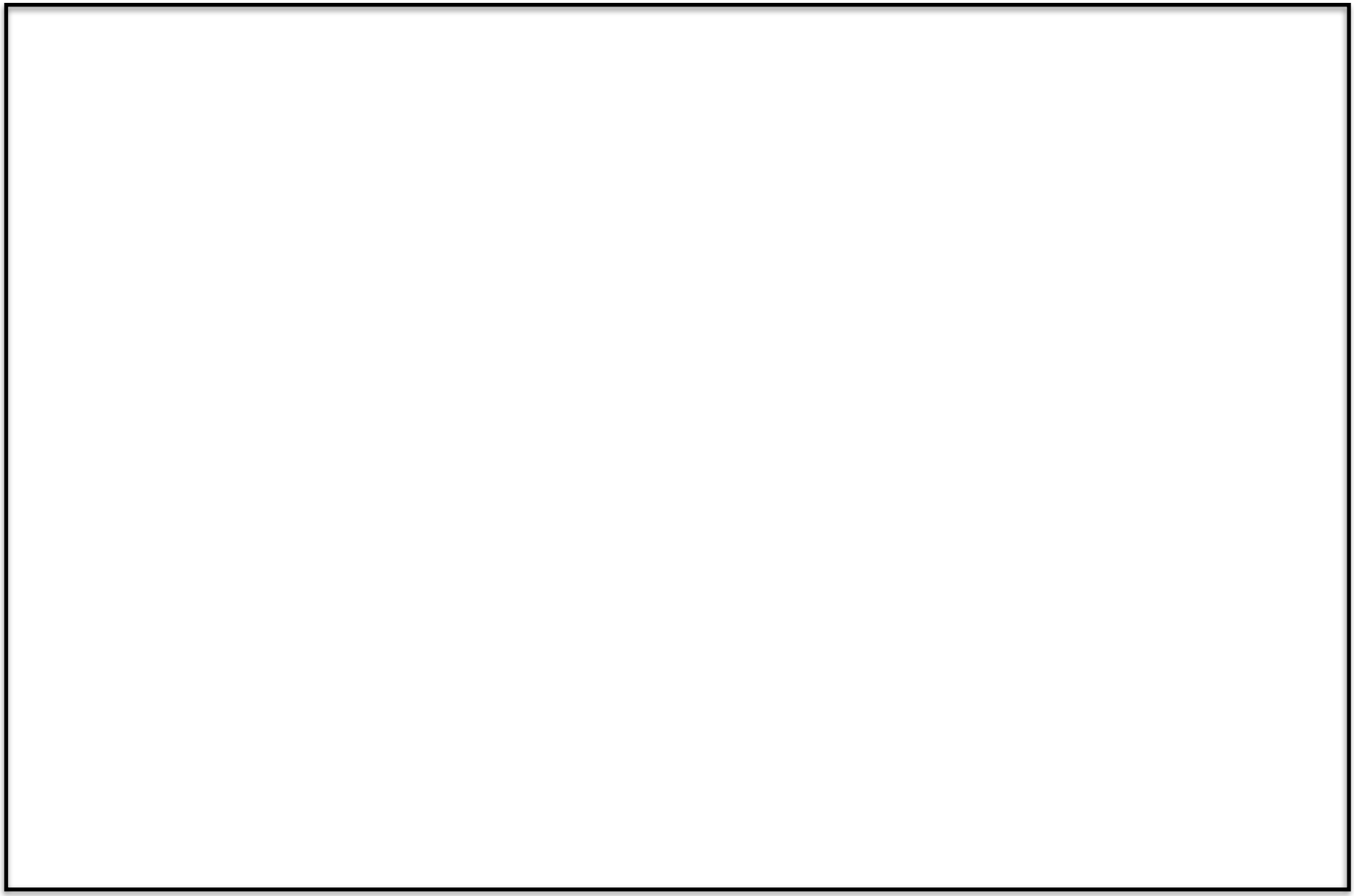
Why? _____

_____

_____

In what city of India would you like to build? _____

Blueprints by: _____



Name: _____

Near what city is the Taj Mahal located? _____

Draw a line segment that shows how far 200 km is on this map.

Pick six cities: km

1. _____ _____
2. _____ _____
3. _____ _____
4. _____ _____
5. _____ _____
6. _____ _____

Connect Agra to these cities using a straight edge ruler.

Do any of these lines intersect?

_____

Are any of the lines parallel?

_____

# of Acute Angles? _____
# of Obtuse Angles _____
# of Right Angles? _____

Name: _____ Distance from Major Cities

“As the Crow Flies” means _____

_____

_____

Is this the same as “Bird’s Eye” view? _____ Explain. _____

_____

_____

Original City	To This City	As the Crow Flies	Actual Distance via Driving Directions	Difference

Technology Keynote/Powerpoint Presentation Rubric

Topics for Country Presentation

Slide 1 - Title Slide. Should include your name and an image.
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