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Geometry Applications on Gingerbread Houses Study Guide

GEOMETRY APPLICATIONS ON GINGERBREAD HOUSES

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Goals and Objectives

The primary objective of this geometric activity is to design, construct, and decorate gingerbread houses while learning about mathematical concepts. The houses were constructed with the purpose of teaching students that geometry is seen in every aspect of this world. By constructing the gingerbread houses, students learned to apply different Geometric properties.

Students were able to find the area and perimeter of the walls, area of triangles, and the area of the roofs made by rectangles. In addition, students found the different slopes of the roofs of the houses and finalized the project by calculating the total surface area of those gingerbread houses.

This study guide contains four lesson plans that are associated with the Next Generation State Standards that are related with the activity students participated in during the 2013-2014 school year.

Key Vocabulary

Acute angle: An angle whose measure is greater than 0^o and less than 90^o.

Angle: The union of two rays with a common endpoint**.**

Bisect: To divide into two congruent parts.

Consecutive Sides: Also called adjacent sides.

Diagonals: A line segment connecting two nonconsecutive vertices of a polygon or polyhedron.

Isosceles Trapezoid: A trapezoid with congruent legs.

Kite: A quadrilateral with exactly two pairs of adjacent congruent sides.

Lateral area: The surface area of a solid excluding the base(s).

Midpoint of a segment: The point of a segment that divides it into two congruent segments.

Obtuse angle: An angle whose measure is greater than 90^o and less than 180^o degrees.

Opposite angles: When two lines intersect, four angles are formed. The angles that are exactly opposite to each other are called opposite angles.

Opposite sides: (o a quadrilateral), two sides that do not share a vertex.

Parallel Lines: Coplanar lines that do not intersect.

Parallelogram: A quadrilateral with both pairs of opposite sides parallel.

Perpendicular: Figures that intersect to form right angles.

Pythagorean triplets: Integers a, b, and c such that $c^2 = a^2 + b^2$.

Quadrilateral: A polygon with exactly four sides and four angles.

Rectangle: A parallelogram with four right angles.

Right angle: An angle that measures exactly 90^o.

Rhombus: A parallelogram with four congruent sides.

Slope: The ratio of the vertical change of a line to the horizontal change of the line.

Square: A rectangle with four congruent sides or a rhombus with four right angles.

Surface area: The total area of all the surfaces of a three-dimensional figure.

Trapezoid: A quadrilateral with exactly one pair of opposite sides parallel.

Venn diagram: A Venn diagram showing the relationships among some quadrilaterals.

Volume: The number of cubic units in a three dimensional figure.

LESSONS

AND

ACTIVITIES

January

Special Quadrilaterals and its properties
Benchmarks: MA.912.G.3.1, MA.912.G.3.2

Objective:
Students will:

Be able to distinguish between parallelograms, rectangles, rhombuses, and squares.

Learning Targets/Skills

- To learn that parallelograms have two pairs of opposite sides; both pairs of opposite sides are parallel; and diagonals bisect each other.
- Understand that a rectangle is a parallelogram with four right angles and congruent diagonals.
- Understand that a rhombus is a parallelogram with four congruent sides and perpendicular diagonals.
- Understand that a square is a parallelogram with four congruent sides and four congruent right angles.
- Know that a trapezoid has both pairs of opposite sides parallel.
- Explain the special properties of the right and isosceles trapezoids.
- Know that the kite is a quadrilateral with two pairs of consecutive sides congruent; diagonals are perpendicular; one diagonal is bisected; one pair of opposite angles is bisected.
- Use Venn diagrams to associate all types of quadrilaterals.

Materials:

Properties of the special quadrilaterals chart

Paper

Pencils

Scissors

Tape

Construction paper

LCD projector, camera reader, smart board, etc.

Procedures (Math)

Anticipation Set

Think/Pair/Share Activity

The teacher will ask the following questions?

1. Which of the following properties is shared by parallelograms and squares?

   A. both pairs of opposite sides are parallel

   B. adjacent sides are congruent

   C. the diagonals are perpendicular

   D. each diagonal bisects two angles

2. If a quadrilateral has exactly two right angles, then the quadrilateral must be a

   A. Square

   B. Rectangle

   C. Rhombus

   D. trapezoid

Students will answer questions in their notebook. After 2 minutes, each student will be able to share his/her answer.

As a group, students will be able to draw the geometric figures to figure out the properties of the Geometric figures in the lesson.

Instructional Activities

The teacher will facilitate the special quadrilateral chart to students. Students will work in pairs and will draw special quadrilateral figures on a construction paper. After students draw the figures on the construction paper, students will use a pair of scissors to cut the diagram and post the figures on their own papers. By using the special quadrilateral chart, students will compare and construct the different properties among all the special quadrilaterals.

The teacher will ask students about the properties of each special quadrilateral. The student and the teacher will discuss the different properties of each special quadrilateral.

Closure: Have students discuss with their partners the differences and similarities of the properties among each special quadrilateral.

Assessment: Once students have explored the different quadrilateral properties, students will write a summary about the different properties of quadrilaterals. After students complete the assignment, students will submit the assignment to the teacher so that it could be graded.

Special Quadrilateral Chart

Property	Trapezoid	Parallelogram	Rectangle	Rhombus	Square	Kite
Exactly one pair of opposite sides are parallel	X					
Both pairs of opposite sides are parallel		X	X	X	X	
Exactly two pairs of adjacent sides are congruent						X
Has four congruent sides				X	X	
Both pairs of opposite sides are congruent		X	X	X	X	
A diagonal divides it into two congruent triangles		X	X	X	X	
The diagonals bisect each other		X	X	X	X	
The diagonals are congruent			X		X	
The diagonals are perpendicular				X	X	X
Each diagonal bisect two angles				X	X	
Has four right angles			X		X	

February

Measurement

Benchmark: MA.912.G.7.5

Objective

Students will use formulas to find the measurement of the gingerbread houses.

Materials

Measurement exercise sheet

Ruler

Color pencils

Calculator

Reference sheet formulas

Procedure

The teacher will start describing the different shapes and their corresponding formulas. The students will be able to use the reference sheet and copy the formulas needed to complete the assignment.

Instructional Activity:

Provide students the measurement exercise sheet to start measuringt the different parts of the gingerbread house.

Closure:

Students will compare their calculations with other students. The teacher will ask the students to explain the differences amongst perimeter and area of shapes that make up the gingerbread house.

Assessment:

Students are asked to write the connection between the area and perimeter of the shapes that formed the gingerbread houses.

MEASUREMENT EXERCISE SHEET

Find the measurements for each of the followings parts of the gingerbread house

Part of the House	Perimeter
Front House	__________________
Floor	__________________
One roof panel	__________________
End of the house	__________________

Part of the House	Area
Front House	__________________
Floor	__________________
One roof panel	__________________
End of the house	__________________

Questions:

1. How did you measure the perimeter? What formula did you use?

2. How did you measure the area? What formula did you use?

3. State the difference between perimeter and area.

4. Find the volume of the house by multiplying the area of the base of the house by the height of the house.

5. Describe the difference between area and volume.

March

The Pythagorean Theorem and Its Converse
Benchmark: MA.912.G.5.1

Objectives:

Students will

- Identify the components of a right triangle.
- Prove the Pythagorean Theorem.
- Use the Pythagorean Theorem to find missing sides of a right triangle.
- Apply the Pythagorean Theorem and its converse to solve problems.

Materials

- Straws
- Scissors
- BLM 10: Centimeter grid paper
- Markers
- LCD projector

Procedures

Anticipation set:

Students will use pieces of straws to create triangles (5 minutes)

Instructional Activities:

Students will be able to use hands on activities by using manipulative to understand the concepts of the Pythagorean Theorem. Students will use centimeter grid paper and straws to attempt to build triangles with the given side lengths. They then identify each triangle created as acute, obtuse or right. It is important that students use the grid paper as a guide to determine whether the triangles contain a right angle instead of simply guessing about the existence of the acute or obtuse angle. Students will measure and cut the length of the straw they need in order to complete the assignment.

Activity Sheet

Use each of the following sets of triangle side lengths to build triangles using the manipulative (straws) provided by the teacher

Step 1: Cut manipulative into 5 cm, 6 cm, 12 cm, 13 cm, and 15 cm lengths.

Step 2: Build each triangle on centimeter grid paper.

Step 3: Identify each triangle as right, acute or obtuse.

Step 4: Complete the table.

Triangle side lengths	**Type of triangle**	c^2	$a^2 + b^2$
5, 12, 13			
6, 6, 12			
5, 6, 12			
5, 12, 15			
5, 12, 12			
6, 12, 13			
6, 12, 15			

Essential questions

- How can you prove the Pythagorean Theorem?
- What does the converse of the Pythagorean Theorem prove?
- What is the difference between a leg and the hypotenuse of a right triangle?
- How do you find the length of the hypotenuse given the lengths of both the legs of a right triangle?

Closure

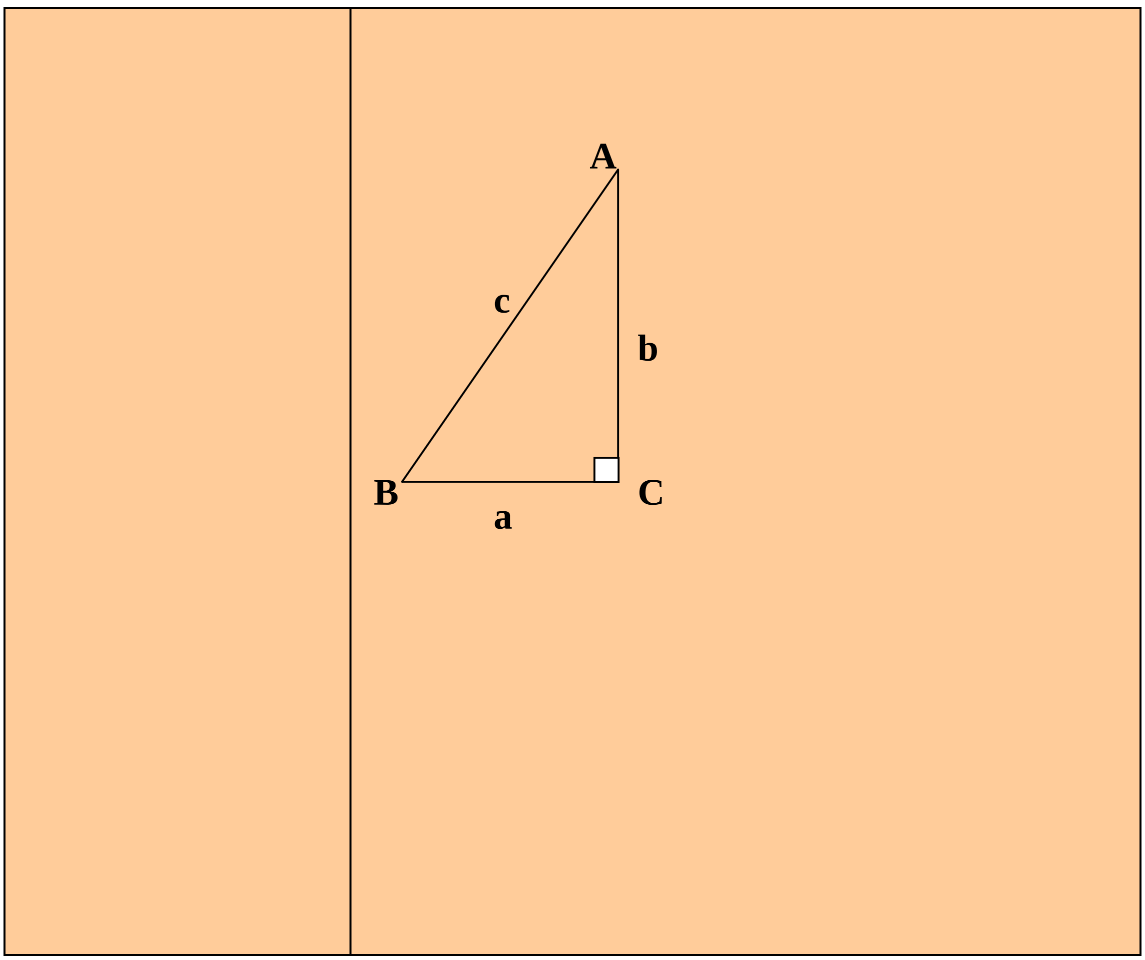
Students conjecture about the relationship between the lengths of the sides of a triangle and the type of triangle. Some students may find it easier to identify the type of triangle if the relationship is indicated with c^2 on the left. If $c^2 > a^2 + b^2$, the triangle is obtuse. If $c^2 < a^2 + b^2$, the triangle is acute. If $c^2 = a^2 + b^2$, the triangle is right.

Assessment:

Students should apply the relationships determined by the converse of the Pythagorean Theorem to determine the type of triangle indicated by the given side lengths. While it is possible to create triangles from all the side lengths given, students should be reminded to check for existence of a triangle before applying the converse of the Pythagorean Theorem.

Look for a pattern If $c^2 = a^2 + b^2$, the triangle is a right triangle. If $c^2 > a^2 + b^2$, the triangle is obtuse. If $c^2 < a^2 + b^2$, the triangle is acute
a. 12, 34, 37 $144 + 1156 < 1369$ Obtuse; $12^2 + 34^2 < 37^2$ b. Right; $3^2 + 4^2 = 5^2$ c. Acute; $20^2, \sqrt{42}^2 > 21^2$ $400 + 42 > 441$

Students will use this graph as a model to understand the sides of a right triangle


A
c
b
B
C
a

April

Formalizing Relations and Functions by blowing bubbles

Benchmark: MA.912.A.2.3, MA.912.A.2.13

This section of the project is a side activity that will teach students about slopes. Then it will be used to find the slope of the roofs of the gingerbread houses.

Objectives:

Students will:

Construct a line graph by blowing bubbles
Explore the different slopes on the graph by the direction of the lines
Calculating the slope, distance, midpoint of the lines
Identify the domain and the range of the graph
Finding the increasing and decreasing functions of the graph
Applying the vertical line test to determine if there is any relationship between quantities

Materials:
Reference Sheet formulas
Bubble container
Calculators
Graph paper
Smart board
Markers
Rulers
Hat
Paper

Procedure:

Anticipation Set:

Teacher will provide students a handout containing sets of coordinates and will ask the students to label the first coordinate as the x-value and the second coordinate as the y-value. Once students label the coordinates, the teacher will write on the board that the x-value is also called the Domain and the y-value is also called the Range.

Instructional Activities:

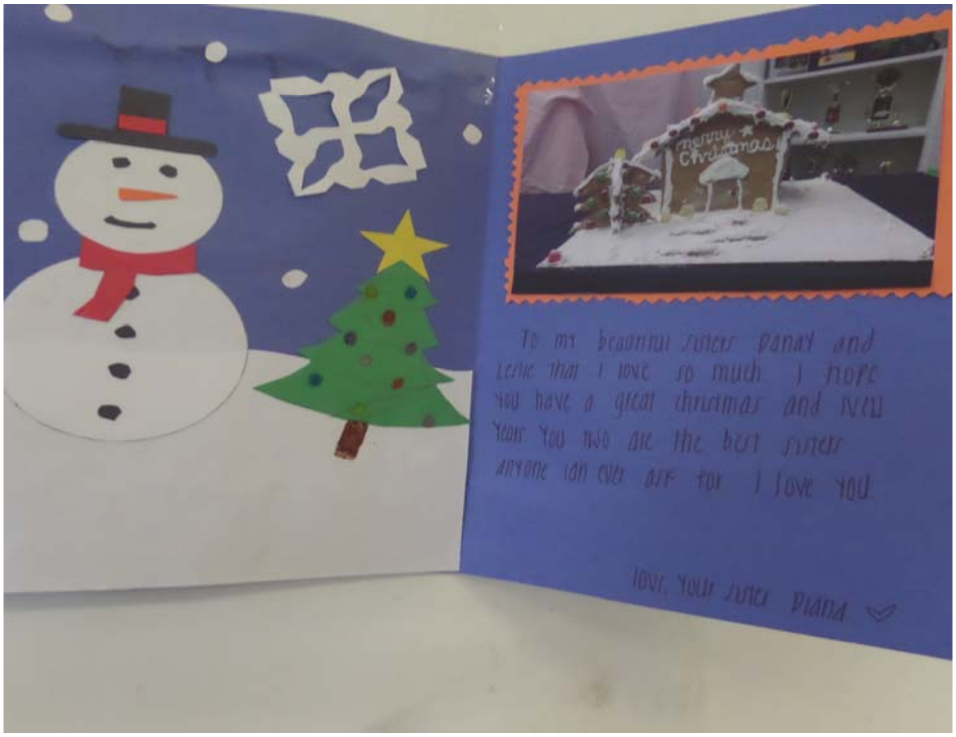
Students will draw a line graph by blowing bubbles. Students will receive a paper containing an x-value and several students will blow bubbles to determine the y-value. The y-value will be the number of seconds it takes the last bubble to reach the floor or pop rounded to the nearest whole number. For example, a student blows bubbles and it takes

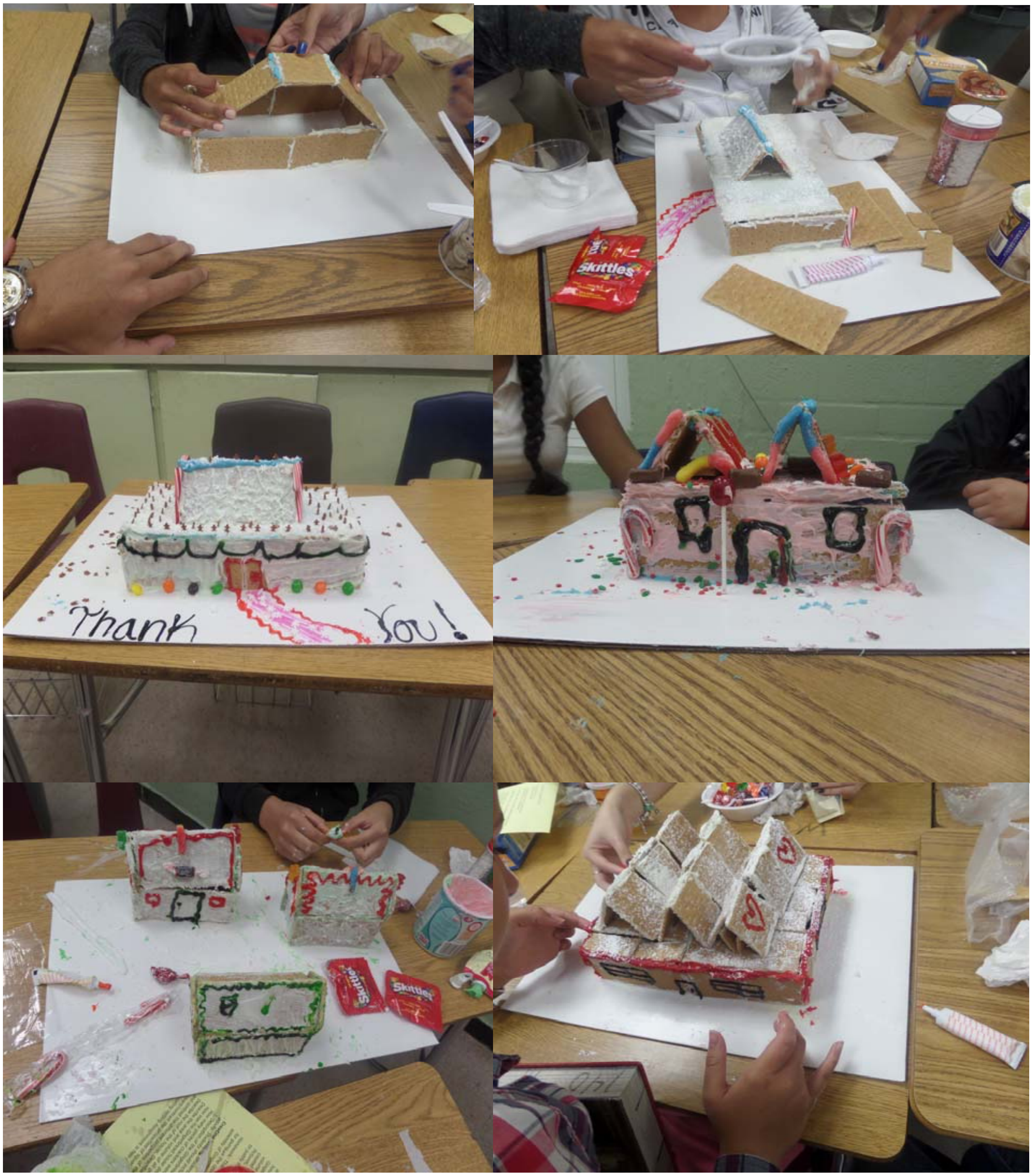
14.2 seconds for the last bubble to pop or reach the floor. The 14.2 will be rounded to 14. That will be the y-axis. The X-axis will come from a random paper that a student draws from a hat. A student draws at random a piece of paper from the hat and opens it. The number is 2. Therefore the coordinate points will be (2, 14). Then the next student will do the same until there are many sets of coordinates on their graphing papers. Students will plot the coordinates on the graph and after students will connect each point with a line to build a line graph. Once students construct a line graph, students will be able to use the vertical line test to determine if the data represents a function.
Also, students will compute the slope and the midpoint of the data using the respective formulas.

Closure:
Students will check their answers and compare their work with other classmates.

Assessment:
Students will display their work on the wall to emphasize the most important concepts learned in this lesson.

STUDENTS' WORK




Thank You!
Skittles


Keebler
Fudge Grahams




Geometry
Honey
Powdered Sugar
Confectioners POWDERED Sugar
CASIO
Skittles
Gummy Bears
Miniatures
Tootsie POPS Miniatures
PAPER NAPKINS

Writing Infusion in the Geometry Class

Student: Elianys Perez
Creating Writing Teacher: Mrs. Diana Hurtado
Geometry Teacher: Ms. Luisa Chica
School Year 2013-2014

Project Summary

It was a beautiful and chilly day on Friday, December 13th when we took a mini field trip that turned out to be a small adventure with my teacher Ms. Chica. We went to the culinary arts class to take some pictures and glance at the gingerbread houses that the prospective chefs constructed. I observed many figures, its shapes, sizes, and its detailed angles and sides. As I proceeded inside the cooking room, I automatically sniffed the fresh aroma of cinnamon, chocolate, and candy.

On the top right hand corner there was this cute petite house that contained many geometrical figures. The delicious tiny house and doors were rectangles, the windows were squares, and the snowman's eyes, nose, and certain body parts were shaped with circles along with the house's doorknob. Lastly, we noticed a decorated pine tree and concluded that it was a cone shape and the snowman's hat was an isosceles trapezoid because the non-parallel sides were congruent. Another realization from our educational adventure was that we noticed the rectangles because they are parallelograms with four right angles totaling 360 degrees. I noticed the circles and the first thing I did was whisper "that figure equals 360 degrees; it has a diameter and a radius." Shortly after, I noticed the squares which are rectangles with four congruent sides or a rhombus with perpendicular diagonals that bisect two angles and their diagonals are congruent similar to the rectangle.

At first, my classmates and I thought the pine tree was a triangle, but after careful observation, we concluded that it was a cone, not a triangle. Moreover, the creamy frosting that covered the roof of the gingerbread house was a trapezoid with exactly one pair of opposite sides parallel and the brownish bottom was a rectangle with diagonals perfectly bisecting each other like the letter L.

Coming on this mini fieldtrip helped me realize that geometry figures are everywhere. From the smallest house to the tallest skyscraper, shapes are all around. We see geometric shapes in building structures, houses, and trees. One can really learn a lot by observing every detail of your surroundings such as its shape, size, degrees and their properties. Ms. Chica introduced us to a wonderful learning experience by teaching us the geometrical shapes with real-life situations rather than the same old text book; not to mention that my class and I got to enjoy the welcoming air of the holidays through the delicious scent of gingerbread houses.

Resources

Springboard CollegeBoard

Geometry End-of-course Everglades K-12

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