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December 12th, 2016
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Conservation of a Parallelogram

Goal: To compliment a lesson which explains the properties of any type of parallelogram.

Objectives: This worksheet should be used as a visual aid when teaching students about the conservation of area in parallelograms. After using this worksheet, students should have a better understanding of how the length of the (non-base) sides in a parallelogram do not impact its overall area. They should be able to recognize that the height is different from the side length and how the base and height alone impact the overall area.

Intended Audience: 6th and 7th Grade Mathematics

Prerequisite Knowledge: An understanding of units, lengths, polygons, and areas. (This is a basic visual representation and should not be used as a stand-alone lesson).

Activity-Only Time Estimate: 15 minutes

Learning Standards:
CCSS.Math.Content.6.G.A.1
CCSS.Math.Content.7.G.B.6

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When might a teacher use this activity?

This activity should be introduced when the students are learning how to find the areas of polygons. This can supplement any lesson that about the area of parallelograms (including rhombuses, squares, and rectangles).

How would this activity introduce and emphasize the lesson?

This activity does not provide students with a means to discover the algebraic equation for the area of parallelograms. It merely allows students to visualize and comprehend that height and side length two different properties when it comes to parallelograms. With the advantage of having an independent base length, this activity allows students to comprehend that height impacts the area of parallelograms when side lengths have zero impact.

Which lesson would this *ideally* compliment?

The ideal lesson that this activity would be included in would be one in which, following this activity, the teacher explains how a parallelogram can be broken up into triangles and rectangles in order to find it's area.

Possible Stumble Blocks

The activity does have a simple limitation that were not fully addressed. The slider which the students use to adjust the base length was not made using Geogebra's slider tool, so the shapes can be over stretched (covering text). Also the position of the shapes were not created dependent of each other, so when the base length is too large, they will overlap. This can be avoided easily, by not over extending the slider. However, the only way to fully avoid this limitation would be to recreate the entire activity using the slider tool, and to make sure that the position of the shapes are all dependent of each other when doing so.

Suggestions for turning this activity into a lesson:

Give students the opportunity to play around with this activity and to make observations. Below are suggested questions to ask them, both aloud and in worksheet format. Ideally, the teacher should allow the class to reach the consensus that height is the main impactor (when the base is dependent). A more detailed lecture should follow. Also consider creating a separate worksheet that allows them to practice this skill.

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Sample questions to ask the students:

Questions	Answers
What are all of the sides of the square equal to?	The base length.
What are all of the sides of the rhombus equal to?	The base length.
Are the areas of the square and the rhombus the same?	No (unless the rhombus is equiangular).
What is the difference between the rhombus and the square?	The angles./The rhombus is slanted.
Are the side lengths of the parallelogram equal to the base?	No (again, unless it is equiangular).
Are the areas of the square and the parallelogram the same?	Yes.
What's the same between the square and the parallelogram?	Their height.
What's different between the square and the parallelogram?	Their side lengths/angles.
Are the areas of the rhombus and the parallelogram the same?	No (unless the rhombus is equiangular).
What's the same between the rhombus and the parallelogram?	They're both slanted.
What's different between the rhombus and the parallelogram?	The height./The side lengths. (unless the rhombus is equiangular)
Are the side lengths of the rectangle equal to the base?	No.
Are the areas of the square and the rectangle the same?	No.
What's the same between the square and the rectangle?	The height./The side lengths.
What's the same between the square and the rectangle?	They're both equiangular.
Are the areas of the rhombus and the rectangle the same?	Yes.
What's the same between the rhombus and the rectangle?	The height (unless the rhombus is equiangular).
What's difference between the rhombus and the rectangle?	The side lengths/angles.
Are the areas of the rectangle and the parallelogram the same?	No (unless the rhombus is equiangular).
What is the same between the rectangle and the parallelogram?	Height/side length/angles.
What is the same between the rectangle and the parallelogram?	Only the base length (unless the rhombus is equiangular).

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Sample Activity Worksheet

Please use the computer activity to answer these following questions. You CAN move the shapes around to help. (Try to not overstretch the slider for the base length, because the shapes may become too big and may be too confusing to observe). Feel free to jot down any observations that you make along the way.

[Definition of Exclusive: full and complete]

Observations:

Do the **side lengths** of any of these shapes EXCLUSIVELY affect it's area? If not, give an example that you see showing that TWO SHAPES can have the same side length and different areas.
A rhombus and a square have the same side lengths and different areas.

Does the **slant** of any of these shapes EXCLUSIVELY affect it's area? If not, give an example that you see showing that TWO SHAPES can have the same angles and different areas.
A rectangle and a square. (Or a rhombus and a parallelogram if they're both slanted at the same angle—not 90^{o}).

Does the **height** of any of these shapes EXCLUSIVELY affect it's area? If not, give an example that you see showing that TWO SHAPES can have the same height and different areas.
Yes.

Based on what you have observed during this activity, what two properties always determine the area of a parallelogram? (Hint: there is one property that is the same for every shape in this activity…you decide it with a sliding bar at the top!)
Base and Height.

If you are given those two properties, how would you decide to find the area of the parallelogram?
Answers may vary (ideally, during the lesson, they would later learn to multiply base and height to find the area and would understand its conservation).