

Exploring Properties of Rectangles and Parallelograms Using Dynamic Software

Overview:

This Internet Mathematics Excursion is based on an [E-example](#) from the [NCTM Principles and Standards for School Mathematics](#). In this activity, students will use dynamic software to examine the properties of rectangles and parallelograms, and identify what distinguishes a rectangle from a more general parallelogram. Using spatial relationships, they will examine the properties of two- and three-dimensional shapes.



Using the Excursion:

This Internet Mathematics Excursion is a brief mathematics activity. To maximize student learning, certain prerequisites are necessary to use this activity. Thus, it would be appropriate to include this activity as part of a more fully developed Standards-based lesson, but it should not be used as a complete stand-alone lesson.

Mathematical Learning Objective:

While exploring properties of rectangles and parallelograms using dynamic software, the students will:

- identify, compare, and analyze attributes of both shapes through physical and mental manipulation.

NCTM Standards:

[Geometry 3-5](#)
<http://standards.nctm.org/document/chapter5/geom.htm>

[Analyze characteristics](#) and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships:

- identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes.

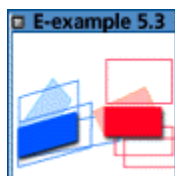
Grade Level:

3-5

Estimated Time:

45 minutes

Web Site:



Exploring Properties of Rectangles and Parallelograms Using Dynamic Software

<http://standards.nctm.org/document/eexamples/chap5/5.3/index.htm>

The interactive applet allows students to manipulate rectangles and parallelograms in order to identify their properties and distinguish

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one shape from another. This i-ME activity is one part of a series titled, *Exploring Properties of Rectangles and Parallelograms Using Dynamic Software*.

Materials :

- Rectangle versus Parallelogram student handout
- Things are Shaping Up student handout

A complete [tutorial](#) for use of the applet, with easy to follow instructions, is provided at the site. It is strongly recommended that teachers go online and become familiar with the program.

Credits:

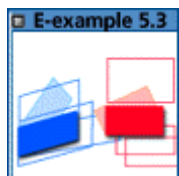
Tom Gorski, NCTM
Barbara Wood, Forefront Curriculum

INITIATING THE EXCURSION

To introduce this excursion, distribute the **Rectangle versus Parallelogram** student activity handout to each member of the class. Ask them to carefully examine the two shapes on the handout and brainstorm their similarities and differences. Elicit oral responses about the attributes unique to both the rectangle and parallelogram. While the class-wide discussion is occurring, students should record the information in the corresponding boxes on the handout.

DEVELOPING THE EXCURSION

1. After the students have recorded the similarities and differences brainstormed by the entire class, divide them into pairs or teams of three. They should work together to categorize the attributes listed on the activity handout into groups. For example: can they categorize or group the shapes' attributes according to length of sides, number of sides, number of angles, measure of angles, etc?
2. Once the teams have categorized the information, distribute the **Things are Shaping Up** activity handout to each student. Explain that the students will manipulate the dynamic rectangles and parallelograms in the interactive applet by dragging the corners (vertices) and sides (edges). They should look at the shapes on the handout and mentally manipulate them before trying the activity online. In small groups, they should share their ideas surrounding this mental exercise. Do they think it will be possible to transform the shape? Will the rectangle retain its attributes? Will the parallelogram retain its attributes?
3. Once they have had the opportunity to think about the manipulation, students will go to the web site and use the interactive applet to recreate the shapes listed on the **Things are Shaping Up** activity handout.



<http://standards.nctm.org/document/eexamples/chap5/5.3/standalone.htm>

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4. As the students successfully re-create each shape, they should record a brief description describing the process they used to attain the goal. The teacher can share each of the teams' solutions and model their problem solving strategies throughout the activity. If students are having difficulty with specific shapes, they can also record the challenges being faced. The key element to this activity is for students to clearly describe the process they use to manipulate the shapes. The following guided questions will encourage student reflection:

Guiding Questions:

- You can rotate or stretch the shapes, but will they retain particular features?
- What is alike about all the figures produced by the dynamic rectangle?
- What is alike about all the figures produced by the dynamic parallelogram?
- What common characteristics do parallelograms and rectangles share?
- How do rectangles differ from other parallelograms?
- Were the students able to recreate the same shape in different ways?

CLOSING

The closing should be structured so that students can review and pull together what they have learned. Include questions or tasks that encourage students to reflect on their work. For example, you could have students consider questions similar to the guiding questions used above or the questions listed below after they have finished the activity. In so doing they will consolidate what they have learned. Furthermore, this will provide an opportunity for you and the students to assess what they have learned and what they still want or need to understand. This will help you plan further instruction.

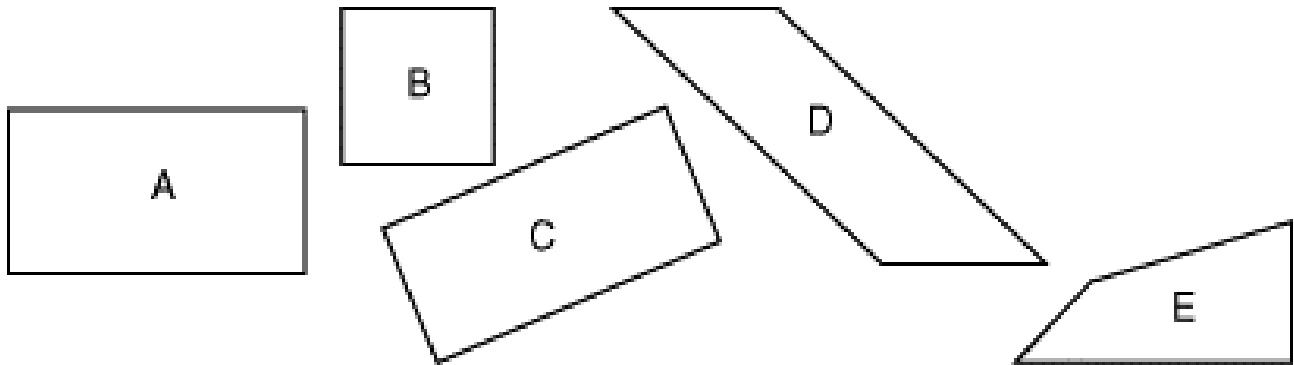
After completing the online activity, encourage students to reflect on the **Things are Shaping Up** activity. You could ask questions like the following:

- What was the first attribute you noticed that was similar between the two shapes?
- What was the first attribute you noticed that was different between the two shapes?
- What attributes stayed true to each shape even through the manipulation process?

EXTENSION/ADAPTATION

This activity can be adapted for a one-computer classroom. For example, one student can “drive the mouse” while the other students in the class take turns providing directions. For instance, Sally says “Click on the lower right corner of the rectangle and slowly slide it upwards.” Encourage the students to think about how they need to manipulate the pieces before they begin moving the pieces.

Things are Shaping Up



Directions:

Go to:

<http://standards.nctm.org/document/eexamples/chap5/5.3/standalone.htm>

1. Predict whether the dynamic rectangle tool can make each figure above. Record your prediction on the RECTANGLE sheet.
2. Use the dynamic rectangle tool to check your prediction. That is, try to duplicate the shape using the dynamic rectangle. Record your work on the RECTANGLE sheet.
3. Predict whether the dynamic parallelogram tool can make each figure above. Record your prediction on the PARALLELOGRAM sheet.
4. Use the dynamic parallelogram tool to check your prediction. That is, try to duplicate the shape using the dynamic parallelogram. Record your work on the PARALLELOGRAM sheet.

RECTANGLE

Predictions and Processes

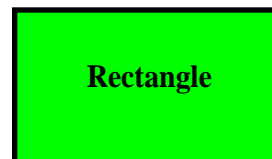
- A) Prediction:
Here is the process I used to try to recreate shape A:
- B) Prediction:
Here is the process I used to try to recreate shape B:
- C) Prediction:
Here is the process I used to try to recreate shape C:
- D) Prediction:
Here is the process I used to try to recreate shape D:
- E) Prediction:
Here is the process I used to try to recreate shape E:

PARALLELOGRAM
Predictions and Processes

- A) Prediction:
Here is the process I used to try to recreate shape A:
- B) Prediction:
Here is the process I used to try to recreate Figure B:
- C) Prediction:
Here is the process I used to try to recreate Figure C:
- D) Prediction:
Here is the process I used to try to recreate Figure D:
- E) Prediction:
Here is the process I used to try to recreate Figure E:

Rectangle vs. Parallelogram

Use this table to compare and contrast the rectangle and the parallelogram.



How are these shapes similar?	How are these shapes different?