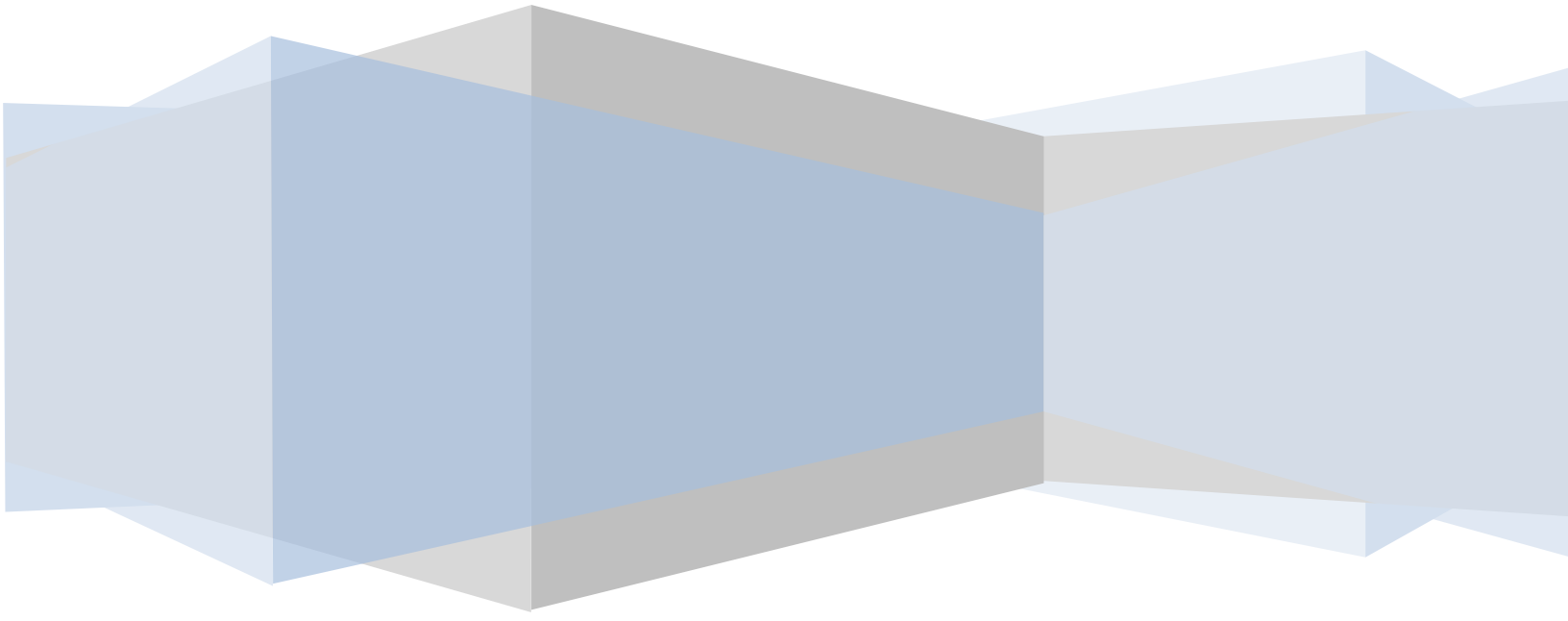
Developing by Key Competences Mathematics Education

University of Cyprus
Department of Education

LEARNING / ASSESSMENT SCENARIOS

Deliverable 7.6 – Products from students specialized in Mathematics Education

Demetra Pitta-Pantazi, Constantinos Christou,
Maria Kattou, Marios Pittalis, Paraskevi Sophocleous



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Lifelong Learning Programme

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LEARNING/ASSESSMENT SCENARIO 1: ANALYZING DATA

Androulla Adamou, Marina Kenti & Rafaella Alexandrou

Introduction

3rd grade

Mathematical strands: Algebra and Numbers

Lesson duration: 40 minutes

LEARNING GOALS

Students will be able to:

N.2.3: Represent natural numbers until 10 000, using Dienes cubes, abacus, applets, words and symbols.

N.2.11: Represent problems of addition, subtraction, multiplication, perfect and imperfect division, using Dienes cubes, abacus, applets, words and symbols.

N.2.4: Design graphs to represent numerical relationships.

A.2.8: Investigate and represent numerical stories and situations, using variables, drawings, graphs and equations.

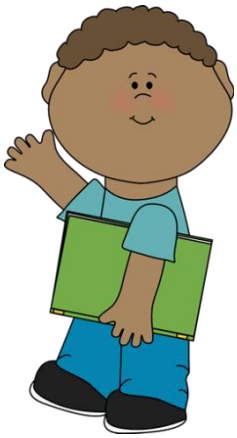
S.P.2.1: Organize and present data in frequency charts (bar chart, pie chart and linear graph).

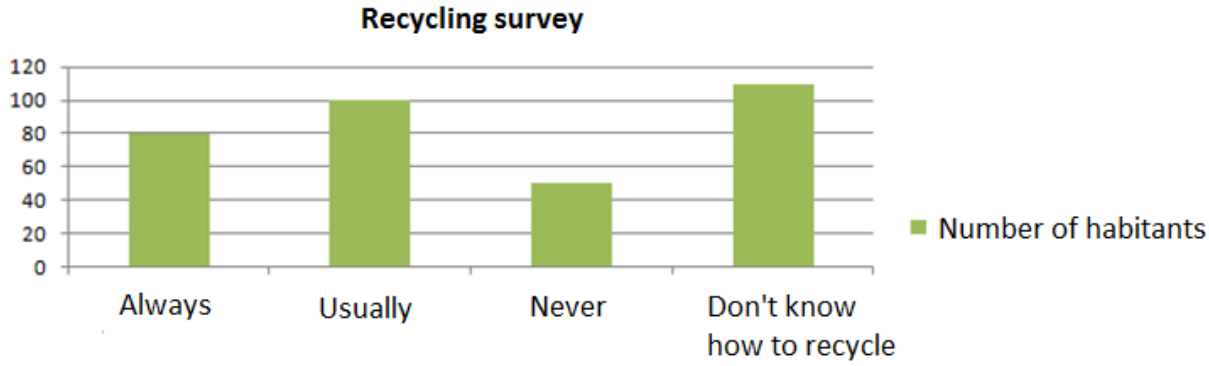
MATHEMATICAL PRACTICES

- Make sense of problems and persevere in solving them
- Use appropriate tools strategically
- Construct viable arguments and critique the reasoning of others
- Reason abstractly and quantitatively

Activity 1

World Environment Day is celebrated every year on 5th of June. For this reason, the community of Geri conducted a survey about recycling and published the results in the community's newspaper. Hercules presented a bar graph that shows the results of the study to his classmates.





✓ What conclusions can be drawn from the above graph?

- ✓ Compare the number of habitants who always recycle to these who never recycle. **Write a mathematical sentence.**

  ……

- ✓ Compare the number of habitants who never recycle to these who don't know how to recycle. **Write a mathematical sentence.**

  ……

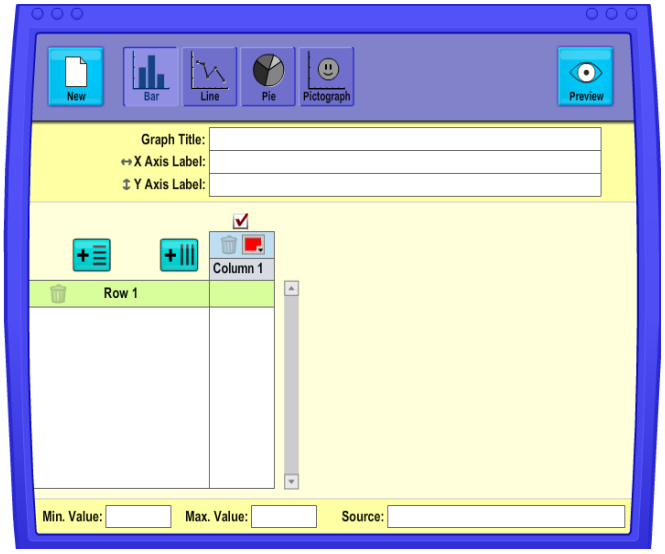
- ✓ How many persons participated in this study? **Write a mathematical sentence.**

  ……

Activity 2

Hercules interviewed some of his classmates. Can you help him organize the interviews' data? Use the following applet and design a bar graph that presents the results of his study.

http://illuminations.nctm.org/Activity.aspx?id=4098



- ✓ Select the "Bar" option.
- ✓ Write the title of your graph.
- ✓ Assign the minimum and maximum value of your graph in the "Min. Value" and "Max. Value" cells.
- ✓ Enter all data and choose "Preview" option to view your graph.
- ✓ Compare your graph to your partner's graph.

1. How many of the participants answered "always"?
   ……
2. How many of the participants answered "never"?
   ……
3. How many of the participants answered "rare"?
   ……
4. How many of the participants answered "sometimes"?
   ……
5. How many of the participants answered "I can't remember"?
   ……
6. How many were all the participants of the study?
   ……

The next day, Hercules interviewed 10 more people. Five of them answered "always" and the rest of them "never".

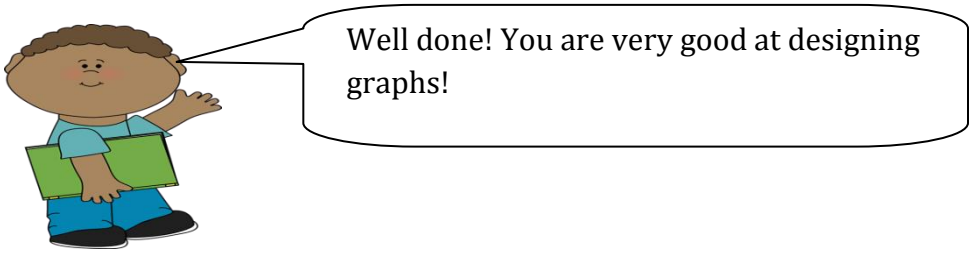
- ✓ How will the graph looks like now? Explain your thoughts by writing a mathematical sentence.

  ……
  ……

- ✓ Compare the two graphs, by stating their similarities and differences.

  ……
  ……

- ✓ Enter the new data and design the new graph.
- ✓ Confirm your answers, through your new graph.

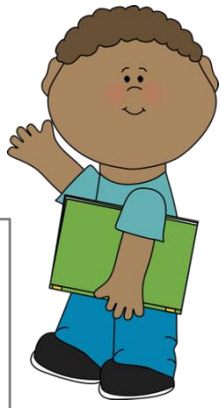


- ✓ In the following site, you can find the data collected by Hercules. It is your duty to organize them appropriately.

  http://www.kidsmathgamesonline.com/numbers/mathdata.html

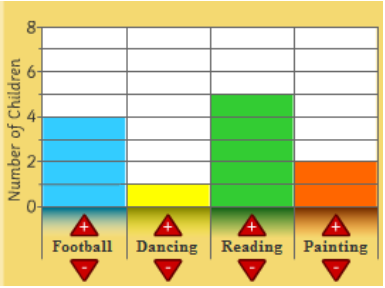
Activity 3

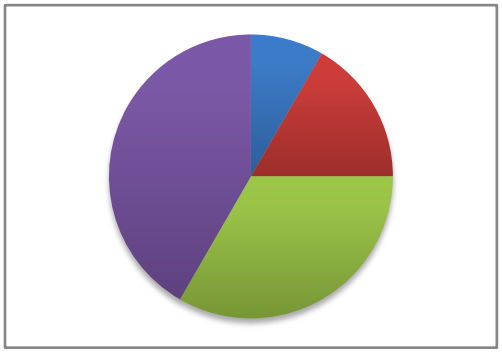
Can you think which slice of the pie chart below corresponds to each bar of the bar graph? **Do not take into consideration the colors of the graphs!!** Discuss your ideas with your classmates



What is your favourite hobby?

Hobby	Total
Football	4
Dancing	1
Reading	5
Painting	2





LEARNING/ASSESSMENT SCENARIO 2: COMPARING QUADRILATERALS

Androulla Adamou, Marina Kenti & Rafaella Alexandrou

Introduction

6th grade

Mathematical strand: Geometry

Lesson duration: 40 minutes

LEARNING GOALS

G.1.3: Investigate and understand basic properties of two-dimensional figures (triangle, square, parallelogram, rectangle and circle).

G.2.4: Investigate and describe basic elements and properties of two-dimensional figures (triangle, square, parallelogram, rectangle and circle).

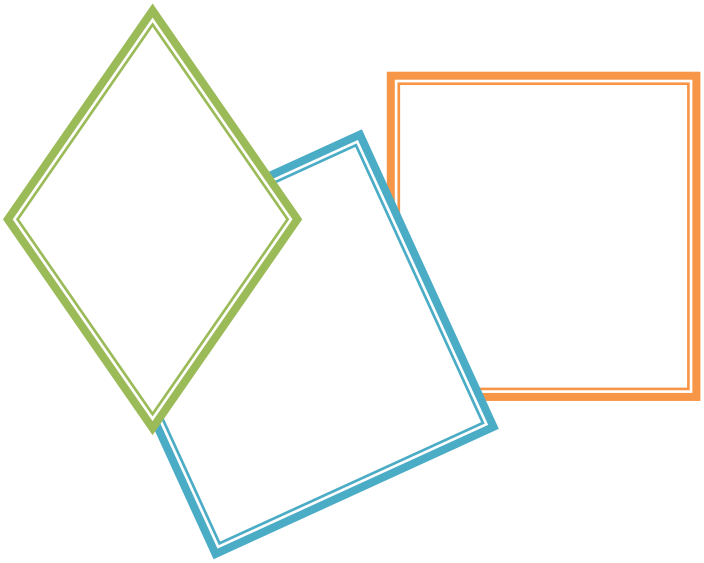
G.3.2: Analyze, classify and construct two-dimensional figures, based on their properties, using various tools and software programs.

G.2.5: Recognize different types of parallelograms and explain their similarities and differences.

MATHEMATICAL PRACTICES

- Make sense of problems and persevere in solving them
- Construct viable arguments and critique the reasoning of others
- Attend to precision
- Look for and express regularity in repeated reasoning

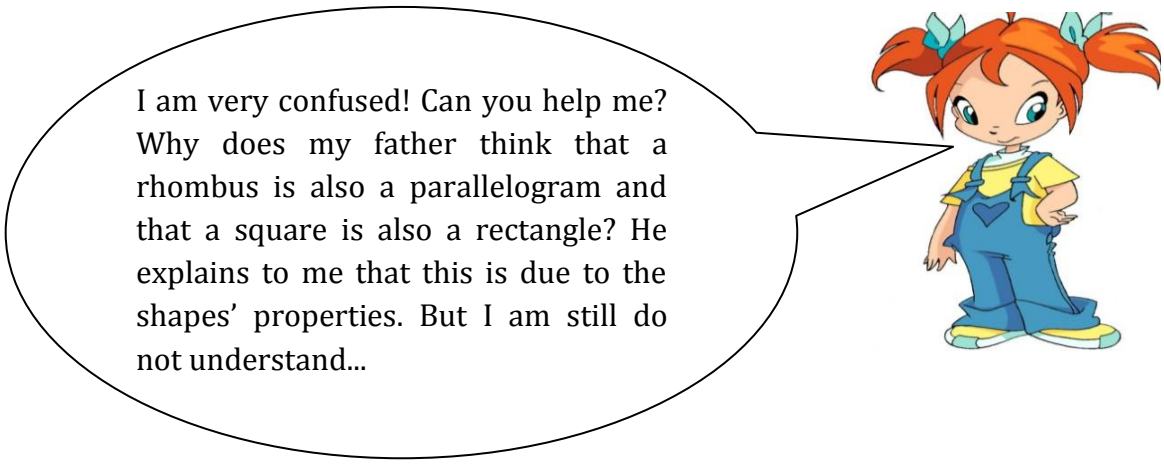
Activity 1



Daddy! I told you to buy two rectangular and one parallelogram frames. Why did you buy a rhombus frame and two square frames?

Lydia! I think you are confused! I didn't make any mistake... **A rhombus is a parallelogram and a square is a rectangle too**!

✓ Do you agree with Lydia or her father? Explain your thoughts.



Activity 2

Complete the table below with the properties related to quadrilaterals' sides, using Geogebra.

SHAPES	**PROPERTIES RELATED TO SIDES**	
	Common properties with other shapes	**Additional properties (if there are any)**
Parallelogram	Example: The opposite sides are equal and parallel.	
Rectangle		
Rhombus		
Square		

✓ What conclusions can be drawn from the above table? Write them down.

✓ Compare your conclusions to your partner's conclusions.

Activity 3

Complete the table below with the properties related to quadrilaterals' angles, using Geogebra.

SHAPES	PROPERTIES RELATED TO ANGLES	
	Common properties with other shapes	**Additional properties (if there are any)**
Parallelogram		
Rectangle		
Rhombus		
Square		

✓ What conclusions can be drawn from the table above? Write them down.

✓ Can you find any similarities between the two tables?

✓ Compare your conclusions to your partner's conclusions.

Activity 4

Predict quadrilaterals' properties related to their diagonals. Explain your thoughts.

✓ Explore the figures given in the Geogebra file and complete the table below.

Activity 5

SHAPES	PROPERTIES RELATED TO DIAGONALS	
	Common properties with other shapes	**Additional properties (if there are any)**
Parallelogram		
Rectangle		
Rhombus		
Square		

✓ What conclusions can be drawn from the table above? Are there any similarities between the last two tables you have completed?

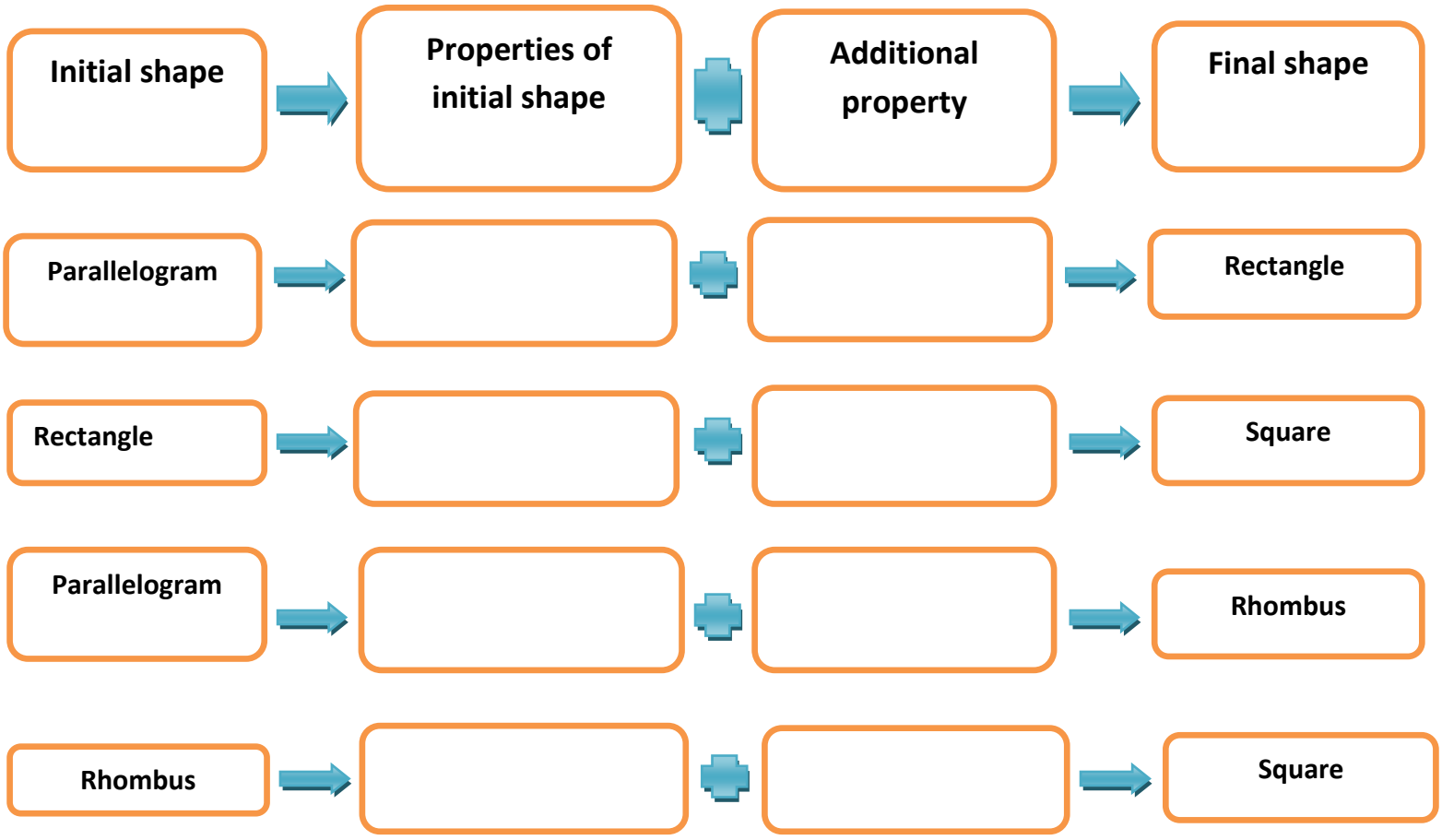
✓ Compare your conclusions to your partner's conclusions.

Activity 6

✓ Complete the following table using information from the above tables.

SHAPES	ALL PROPERTIES	
	Common properties with other shapes	**Additional properties (if there are any)**
Parallelogram		
Rectangle		
Rhombus		
Square		

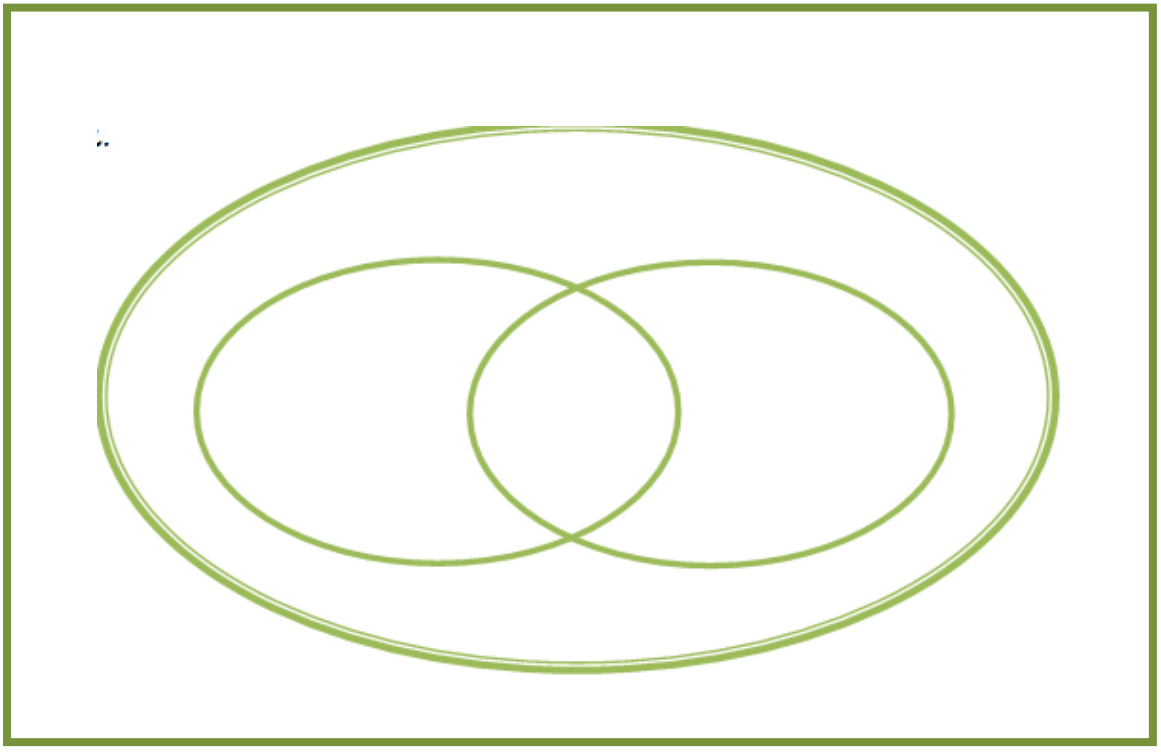
✓ Based on the table above, complete the following diagram, by describing the properties of the "initial" shape and the additional property that characterizes the "final" shape.



- Rectangle is a special case of ……
- Square is a special case of …… and ……
- Rhombus is a special case of parallelogram, because
  ……
- Parallelogram is a special case of quadrilaterals, because
  ……

Activity 7

Bravo! Now you have to complete the following Venn diagram, using the words: quadrilaterals, parallelograms, rectangles, rhombus and squares.



Well done! Discuss your ideas with your classmates.

LEARNING/ASSESSMENT SCENARIO 3: COMPOSING AND DECOMPOSING SHAPES

Androulla Adamou, Marina Kenti & Rafaella Alexandrou

Introduction

6th grade

Mathematical strand: Geometry

Lesson Duration: 40 minutes

LEARNING GOALS

G.2.4: Investigate, describe and name basic elements and properties of two-dimensional figures and circle.

G.3.2: Analyze, classify and design two-dimensional figures based on their properties, using various tools and software programs.

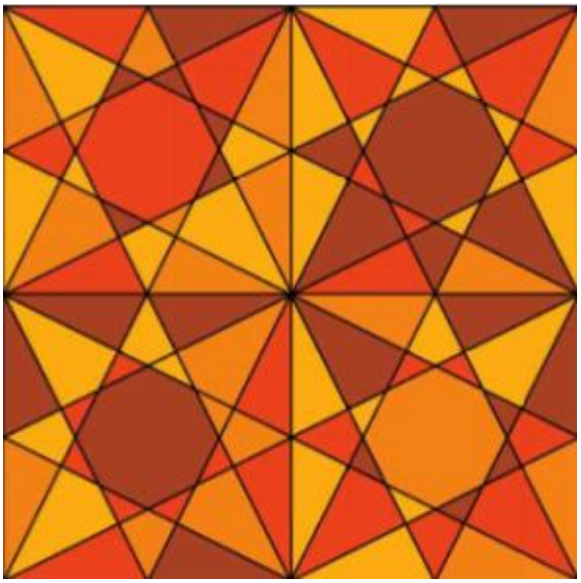
MATHEMATICAL PRACTICES

- Make sense of problems and persevere in solving them
- Construct viable arguments and critique the reasoning of others
- Attend to precision

Activity 1

After working for hours, Goofy managed to design the cover page of a textbook. What do you believe the textbook is about?

The textbook's cover page



Theme of the textbook:

……

……

What figures are there on the cover page?

……

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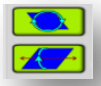
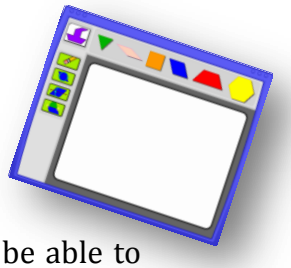
Activity 2

- Click the link: http://illuminations.nctm.org/Activity.aspx?id=3577
- Use the pattern figures shown on the top of the screen and compose as many new figures as possible.
- Pattern figures can be rotated, by clicking the buttons  .
- Press your keyboard's *Print Screen* key, to capture the new figures.
- In case you make a mistake, click the button  .



Caution: It is important to precisely use the existing figures, in order to be able to compose new ones.

✓ **Call your teacher when you are ready!**

Activity 3

Let's investigate two-dimensional figures!

In how many different ways can you compose a trapezium (red figure), using the existing figures of the applet?

.....

.....

How many triangles are needed to create a hexagon (yellow figure)? Make a prediction and write it down. The applet may be helpful to you!

- **Discuss your results with your partner!**

✓ How many triangles of different sizes can you compose? One point is earned for each triangle!

Write down the number of points you earned.

Activity 4

✓ Click  to choose a pattern.

✓ Which figures are needed to create the selected pattern?

✓ Confirm your answer using the applet.

✓ Can you find a different way to create the selected pattern?

Into how many different figures can a square be decomposed? Niki decomposed the square into 7 smaller figures, but I would like to investigate if she has right!

✓ Write down your ideas and then use the applet to confirm your answer.

.....

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Activity 5

- ✓ Click the site http://www.crickweb.co.uk/ks1numeracy.html#tangram
- ✓ Press the button **«Other shape»**, until a square appears on the right side of the screen, as shown in the picture below.
- ✓ Try to combine all figures on the bottom of the screen, to create a square.
- ✓ You can rotate the figures, by clicking the circle of every figure.
- ✓ Caution: It is important to be precise in the way you use the figures.
- ✓ If you make a mistake, press reset

- ✓ If you want to confirm your answer press **Solution.**

Call your teacher when you are ready!

Was Niki's answer correct? Explain your opinion.

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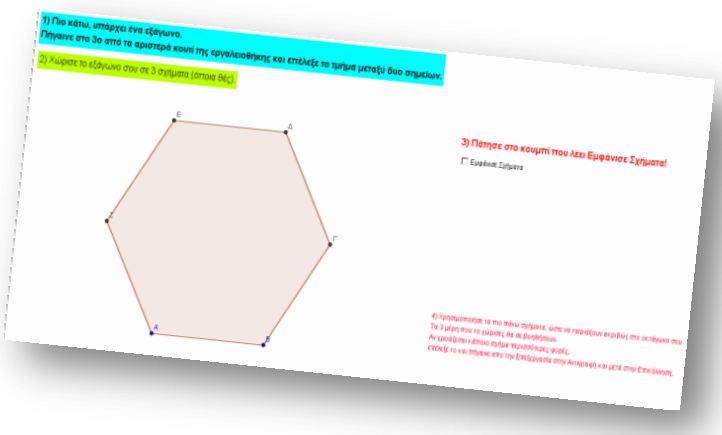
- ✓ Discuss the results with your partner!

Activity 6

- ✓ Open the file below to practice more. Follow the provided guides!

Σελίδα Εργασίας.ggb



✓ Is there any figure that was not used? If yes, which figure is it and why? Justify your reasoning.

	…… …… …… ……	

Activity 7

Goofy needs your help!!! He should create a drawing using geometrical figures. He has the opportunity to choose a drawing between 4 options: a swan, a human, a bird and a house.

✓ Click http://photodentro.edu.gr/lor/r/8521/4437?locale=el
✓ Select the button "Οδηγίες". Decide on the figure you desire to design, by clicking the button "**Επόμενο**" and "**Προηγούμενο**".
✓ Use the given figures to compose a new figure.
✓ If you need help, press the button "**Βοήθεια**".

- ✓ Niki claims that if the square wasn't among the available options, she would not be able to create the desired figure (house). Do you agree with her? Explain your thoughts!

.....

.....

Well done! Discuss your ideas with your classmates.