COLOURFUL NUMBERS

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Lesson plan: Regular Polygons

School:
Primary School in Nowa Sarzyna, Poland

Subject:
Mathematics

Topic:
Regular Polygons

Class:
8th grade

Teacher:
Anna Wasiuta

Duration:
45 minutes

Curriculum:
in accordance with the curriculum approved by MEN (The Ministry of National Education)

It is assumed that the students:
- already know the notion of regular polygons
- already know the most important characteristics of a square, rectangle, rhombus, parallelogram, trapezium, recognise axisymmetric figures and indicate the axis of symmetry of the figures.

Lesson aim:
After the lesson the students will be able to:
- recognise regular polygons and give their names
- calculate the measure of angle of a regular pentagon and hexagon
- determine the axis of symmetry of a regular triangle, quadrangle, pentagon and hexagon
- determine the diagonals of a regular quadrangle, pentagon and hexagon
- uses the characteristics of regular polygons in order to solve math problems
- calculate the measure of angle of any regular polygon
- give the number of the axis of symmetry of any regular polygon
- give the number of diagonals of any regular polygon

The methods:
the practical method, the communicative method, the problem method.

Teaching aids:
a blackboard, an interactive whiteboard, a computer, multimedia, tablets, smartphones, a quiz (QUIZIZZ.com, learningaps.org), computer games.

Coursebook:
Helena Lewicka, Marianna Kowalczyk „Matematyka wokół nas. Klasa 8"

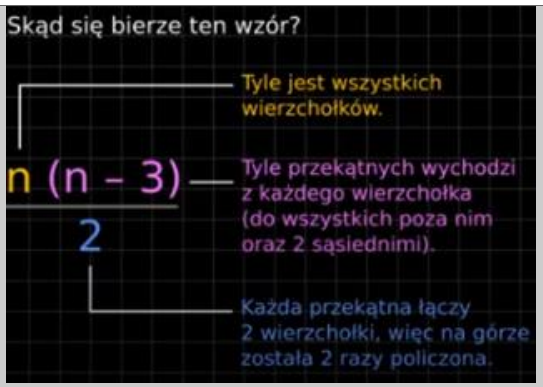
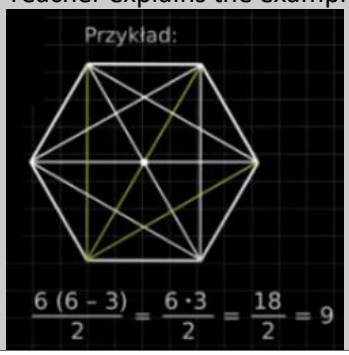
Lesson procedures:

Time	Lesson procedures	Anticipated student activity	Remarks after lessons
08:55	Greeting the students, checking the attendance and homework. Short revision of the material from previous lessons.		
	I turn on the interactive whiteboard and start showing a Powerpoint presentation. I write the topic of the lesson on the blackboard. **SLIDE 1: Regular polygons** Teacher tells students about the topic of the lesson: "Today we will be talking about regular polygons. You should remember regular polygons from previous classes. So, what is a regular polygon?"	The students answer: A regular polygon has got sides of the same length and angles of the same measure	
	SLIDE 2: How many regular polygons are there? They can have many sides, but not less than three. How many regular solids are there? It seems there should be any number of them but in fact there are only five of them. The person who first noticed this fact was Plato so these solids are called Platonic solids.	Students answer the questions	
	SLIDES 3-4 There are a few polygons drawn on a geoboard, some of them have different colours. What do you think, what differentiates theses polygons from the other ones? Each yellow figure has got sides of the same length. Can you see any other differences? Let's take a look at their angles, each figures has got internal angles of the same measure. The blue figures, however, have got internal angles of different measure. These yellow polygons are called regular polygons.	Students answer the questions	
	SLIDE 5 **Definition:** Regular polygons are those which have all sides of the same length and all internal angles of the	Students answer: - a regular pentagon and a regular hexagon	

	same measure. The name of different types of regular polygons reflects the number of their sides. What about this figure? (I'm pointing at a square) This obviously is a square but at the same time it is a regular quadrangle. Teacher asks students: How do you call these two figures? (I'm pointing at a regular pentagon and hexagon)		
	SLIDE 6-7 ***(practice)*** *How do we check if a given polygon is a regular polygon?* *We have to try if:* *-all its sides are of the same length* *- all its internal angles are the same* *Is it enough to check one of the aforementioned properties?* *Let's check!* *Let's have a look at a rectangle. Is it a regular polygon?* *- all its internal angles are of the same measure but* *-not all its sides are of the same length* *Therefore, a rectangle is not a regular polygon because not all the conditions have been met.* *However, there is one type of rectangle which is also a regular polygon. It is a square.* *What about a rhombus then? Is it a regular polygon? Let's have a look at the conditions:* - *we can see that the internal angles are of different measure. Therefore, a rhombus is not a regular polygon*		T directs SS, offering hints
	SLIDE 8 **(TASK 1 – individual work)** I give students the following instructions: There are 12 figures drawn on the board. Indicate the ones which are regular polygons and say why you think so. Teacher asks individual students to describe each figure.	(Students do the task individually)	
	SLIDE 9 The solution of the maths problem is presented on the board by the teacher. Teacher rewards students. The solution of the problem:		

	- a square, a regular octagon, an equilateral triangle, which, at the same time, is a regular triangle.		
	SLIDE 10 Teacher describes an example of a task which might be included in a maths contest. **TASK 2** The cusps of an octagon divide the sides of a square into three equal parts. Is this octagon a regular one? **Teacher explains:** There is a square. Inside the square there is an octagon. The cusps of the internal figure divide the sides of the external figure into three equal parts. We mark the green side as "y". We mark the other lengths of "y". Now, we know 4 lengths of the sides of this octagon, which is marked as "y". We can also determine the length of the other, white sides. There are 4 triangles. What type of triangles are they? They are isosceles triangles because they have 2 sides of the "y" length. They are also rectangular triangles. Therefore, we can determine the length of the hypotenuse. Then, in our octagon, the sides are of different length and that is why it is not a regular octagon. Now, on to the second part of our lesson.		
	SLIDE 11 **„The internal angle of a regular polygon"**		
	SLIDE 12 In the picture you can see three regular polygons. What are the measures of the internal angle in each of these polygons? Let's start from an equilateral triangle What about a square? What about the measure of the internal angle in a regular pentagon? Tell me, is there a way to calculate it? We will check it by using some of the properties of regular polygons.		
	SLIDE 13 For every regular polygon we can draw a circle which goes through all its cusps (see the figure [picture]). Now, we've got circles but we have also got their centres. Now, we will lead the radii to the cusps of these polygons. Let's take a look at the regular pentagon.		

	SLIDE 14 – 15 - The radii divide a pentagon into 5 triangles. One of them is marked with a violet colour. It is an isosceles triangle because its two sides are the radii of the circle. - What about the other triangles? They are also isosceles triangles. All these triangles have the same sides and the same base, which is a side of a regular pentagon. - According to the "side-side-side" rule, all these triangles are congruent so their angles are of the same measure. - Here, (I'm pointing to the centre of the circle) there is a round angle (360 degrees). We divide it into 5 angles of the same measure and mark it as alpha (α). - What is the measure of the α angle? – let's take a look at the figure (picture). (Now, I read the information shown in the figure) We know that the angles located near the base of the isosceles triangle are equal so we mark them as beta (β). Notice that the internal angle in a pentagon equals 2 x β. In order to determine β we need to use the fact that the sum of all angles in a triangle is 180 degrees. The answer: the measure of the internal angle in a pentagon is 108 degrees. Now, we will concentrate on calculating the number of diagonals in a regular polygon.	Students listen carefully and take notes.	
	SLIDE 16 **"The number of diagonals in a regular polygon."** *There are regular polygons on the board. We can also see the number of their diagonals.* *As you can see, the number of diagonals rises with the number of sides. There are methods of determining the number of diagonals for regular polygons with large numbers of sides.*	Students take notes	
	SLIDE 17 **Teacher explains the slide:** The number of diagonals in a regular polygon can be calculated by using the following formula:		

	 n- the number of all the cusps (n-3) – the number of diagonals coming out from each cusp 2 – each diagonal connects 2 cusps Teacher explains the example: 		
	SLIDE 18 Students do the exercise (individual work). Teacher describes the longest diagonal of a regular hexagon. **REMEMBER!** The longest diagonal of a regular hexagon with its side marked as “a” , has the length marked as “2a”.	Students complete the task individually	
	SLIDE 19 Let’s think about the number of the axes of symmetry of regular polygons. Is there any quick formula to calculate this number. Teacher asks students: 1. What does the phrase “axis of symmetry” mean? 2. Which figure can be called axisymmetric? Teacher presents an example using a sheet of paper: In the middle of the sheet there is a geometric figure. We fold the sheet in half. The fold forms	Students answer: the axis of symmetry divides the figure into two congruent parts and the figure which has at least one axis of symmetry is a figure axisymmetric.	

	a blue line which divides the figure into even halves. If we fold the sheet again along the blue line, one of its halves will coincide with the other. This type of figure is called axisymmetric and the blue line is called the axis of symmetry. If we fold this sheet in any other way, we won't be able to put one side of this figure on the other.		
	SLIDE 20 - Now, we will determine how many axes of symmetry regular polygons have Teacher asks students: How many axes of symmetry does an equilateral triangle have? What about a square? And a regular pentagon? What is the name of the next figure and how many axes does it have? And what about the last figure? What do you notice when you look at the following numbers: 3,4,5,6,8? Conclusion: Regular polygons have as many axes of symmetry as they have angles (sides)	Students answer: **3** **4** **5** **Regular hexagon 6** **Regular octagon 8** **Numbers are growing.** **Regular polygons have the same number of angles of symmetry and angles (sides).** Students make notes	
	SLIDE 21 **Multiple choice and true/false tasks** Teacher reads questions shown on this slide and students answer them. Correct answers are then shown on the screen.	Students give their answers: Answer. A,D Answer. FPFF	
	SLIDE 22 - GAMES & QUIZZES Students log into a website with interactive exercises and do Maths quizzes and games on their smartphones and tablets. - Quiz - Game ("Who wants to be a millionaire") The results are shown on the screen. Winners get prizes.	Students use their smartphones to log into certain websites to do a quiz. There are prizes for the winners.	
	SLIDE 23 Teacher asks students to give examples of regular polygons in nature. Then, he/she displays them on the screen.	Students answer the questions.	
	SLIDE 24 Teacher reads the caption on the last slide: "Mathematics is like dust, it's everywhere and that's a fact." Thank you for your attention made by Anna Wasiuta		

09:40	Teacher summarizes the lesson and sets the homework	Students answer teacher's questions and write down the homework	
	Teacher says goodbye to students and thanks them for their attention Made by Anna Wasiuta		