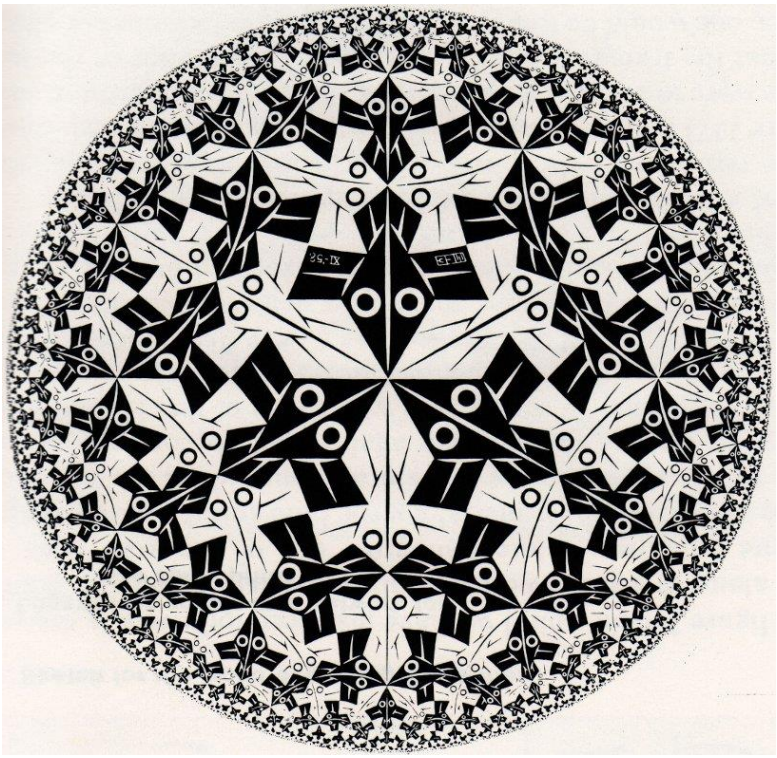
OAME 2015

Great Ideas for Teaching

Junior Geometry



Without Geometry, life would be pointless.

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Polydrons

How many different nets for a cube can you find?

How many different nets for a square-based pyramid can you find?

How many different nets for an open-top box can you find?

The World's Cheapest Manipulative

Which pattern blocks have angles bigger than a right angle? Use your paper right angle or a carpenter's square to identify right angles around the classroom.

Angle Measurer

Make an angle a bit bigger than a right angle.

Make an angle a lot smaller than a right angle.

Make an angle that is half a right angle. How can you be sure if you are correct?

Identify as many right angles as you can in some 3-dimensional solids.

Make an angle that is about 60°.

Make an angle that is about 120°.

Make an angle that is a bit less than 180°. Estimate its size.

Geoboards

Make a shape with three right angles.

Make a shape with four acute angles.

Make a quadrilateral with four acute angles

A shape has six sides and two 90° angles. What could it look like?

Make an irregular shape with three pairs of parallel sides.

Exploring Symmetry

>star quilt activity

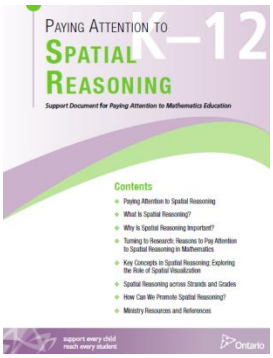
Using 2, 3, or 4 colours, make a symmetrical design.

Pattern Design Template (7 Beads Column)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2																				
3																				
4																				
5																				
6																				
7																				

What symmetry can you see in M.C. Escher's work above?

Spatial Reasoning



"The relation between spatial ability and mathematics is so well established that it no longer makes sense to ask whether they are related."

(Mix & Cheng, 2012)

A key concept of Spatial Reasoning is *spatial visualization* or 'solving problems with the mind's eye'.

>block building

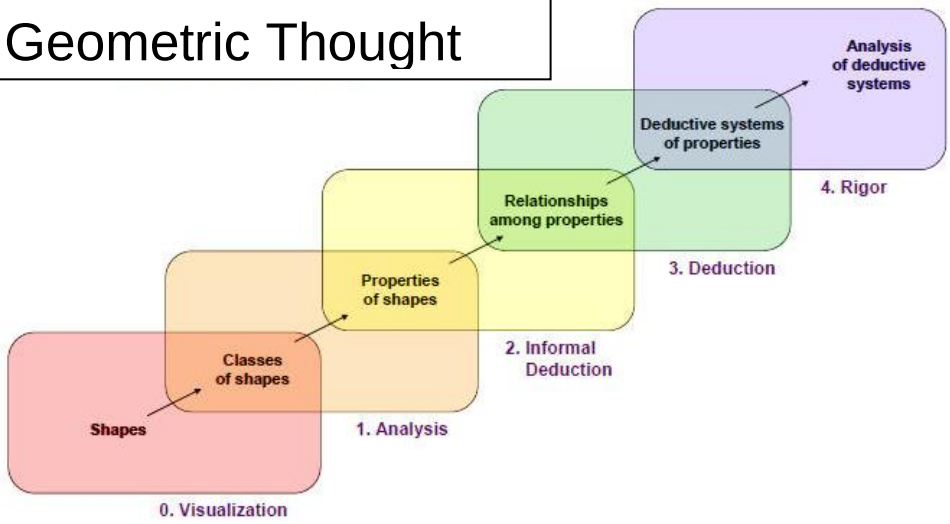
Paper folding

Use paper folding to convince me that you know how many lines of symmetry a parallelogram has.

Fold a piece of paper in half vertically, then in half again horizontally. Make a hole in each of the top two corners. What will it look like unfolded?

Fold a piece of paper in half vertically, then in half again horizontally. Cut off one of the corners and predict what you will see when you unfold it.

The van Hiele Model of Geometric Thought



Level	Indicators: What the student can do?	Activities to help students
0: Visualization (or Visual)	Recognise 2-D and 3-D shapes as a whole but cannot describe their properties or have trouble decomposing/recomposing shapes.	Playing with shapes, tangram puzzles, sorting activities
1: Analysis (or Descriptive)	Shapes can be grouped based on their common properties (e.g. all rectangles have four sides and four right angles) but might not see the relationships between these properties (e.g. for an equilateral triangle, the three equal sides necessarily imply three equal angles)	Hands-on activities that are designed to get students to focus on certain properties e.g. sorting and resorting shapes according to a single attribute; reveal a shape a bit at a time and ask students to picture in their mind's eye what it is; how are these shapes the same/different?
2: Informal Deduction (or Relational)	Students see the properties and are beginning to make relationships between the properties and can classify shapes hierarchically but might have trouble with formal proofs	Activities to help students see the connections between the properties. Always/sometimes/never true?)
3: Deduction	Students make conclusions about abstract geometric principles based on Euclidean-type proofs. *This represents thinking required in secondary and post-secondary geometry courses.*	Open-ended problems that will require a mixture of concrete and abstract thinking.
4: Rigor	Non-Euclidian geometry anyone?	Find examples of parallel lines that meet and triangles whose angles sum to more than 180°.

The model emphasises that students should experience ***Phases of Learning*** at each level. Firstly, teacher ***Inquiry*** is used to see what the students already know and this is followed by ***Directed Orientation*** (short tasks designed to force cognitive dissonance). This is followed by ***Explication*** where students have the opportunity to exchange ideas and ***Free Orientation*** where students have further tasks to test these ideas. Finally, teachers synthesise or ***Integrate*** this new knowledge.

The model emphasises that students should not skip any levels.