

Integrated Math Assignment
Geometry and Spatial Sense and Visual Art
By: Natasha Gummow and Jenna Underwood
P/J 4
Dr. Jarvis
February 5, 2009.

Grade 4

Strand: Geometry and Spatial Sense

Overall Expectation:

Construct three-dimensional figures, using two dimensional shapes

Specific expectation:

- Draw the lines of symmetry of two-dimensional shapes, through investigation using a variety of tools
- Create and analyze symmetrical designs by reflecting a shape, or shapes, using a variety of tools (e.g., pattern blocks, Mira, geoboard, drawing), and identify the congruent shapes in the designs.

Refined expectation for assignment:

Create and analyze symmetrical designs by reflecting and rotating a shape or shapes, using a variety of tools

Grade 4 –Visual Art

Creative Work and Critical Understanding

Overall Expectations:

Produce two-and-three dimensional works of art that communicate thoughts, feelings, and ideas for specific purposes and to specific audiences.

Specific Expectations:

- Identify elements of design and use appropriately for this grade level when producing and responding to works of art.
- Plan a work of art
- State their preference for a specific work chosen from among several on a similar theme, and defend their choice with reference to their own interests and experience and to the artist's use of the various elements of design (e.g., the artist's repeated use of lines, colours, and shapes create patterns that convey a sense of harmony and formality).

Expectation Refined for this assignment:

Students will state their theme and defend their choice with reference to their own interests and experience when presenting their art work to the class.

Student Activity

Define the following terms: (1 mark each)

13

Euclidean Transformations:

Slides:

Flips:

Turns:

Symmetry:

Rotational Symmetry:

Line

Shape:

Direction:

Size:

Texture:

Transformation:

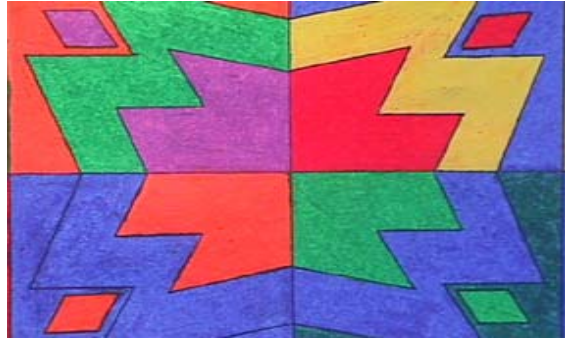
Elements of Line:

Mathematics Thinking, Inquiry, and Problem Solving

Solve or complete the following questions:

12

1. Create a symmetrical design exploring the ELEMENTS of LINE, SHAPE, COLOUR and the PATTERN? **(3 MARKS)** You are only being graded on how you explore the elements of line, shape, colour and the pattern. Here is an example to help you out, remember to be creative by producing your own symmetrical design.



2. Using the activity sheet provided draw the image of Figure A after each transformation. Label each image.
 - a) A reflection in the broken line **(1 MARK)**
 - b) Slide the shape 10 up and 4 squares right **(1 MARK)**
3. One-half of a symmetrical figure is shown on the activity sheet. The broken line is a line of symmetry. Complete the figure. **(2 MARKS)**
4. **Treasure Hunt:** Using the handout provided, find as many objects as you can that demonstrate lines of symmetry. You need to find at least 5 objects **(5 MARKS)**

BONUS: Can you find an object that demonstrates rotational symmetry?

Mathematics Application of Concepts

You have been asked by the local Art Gallery to use your new mathematical knowledge to create a piece of art that presents rotational symmetry. The Art Gallery is looking for a unique design that is perfectly symmetrical, colourful, and appealing to the eye. The Art Gallery has provided the following instructions to begin your magnificent piece of work.

15

Create the following item:

Creating Any Kind of Rotational Symmetrical Design (10 MARKS)

Create any kind of rotational symmetry design or exercise. You must make sure that your design includes 8-point rotational symmetry. One option that is provided for you is listed below. It is entirely up to you how you create your rotational symmetrical design; do keep in mind that it has to be ROTATIONAL symmetry. Be creative!

A Rotation Symmetry Design

STEP 1:

Use a compass to draw a perfect circle, and cut it out

- Fold the circle in half. Be sure to line up your sides evenly.
- Fold your circle in half again and repeat one more time.

OR

- Using a protractor, divide the circle into even pieces using 45 degree angles

REMEMBER: A perfect circle is 360 degrees; if you want eight pieces then you will have to take the 360 and divide it by 8 = 45 degrees

Be sure that the circle is divided into eight pieces

OR

Develop your own procedure to create a piece of art that demonstrate rotational symmetry. Be sure you can explain and demonstrate how you created it to the class.

STEP 2:

Time to be Creative:

- Create a colourful design in one piece of the circle using pencil crayons. Be sure to use many colours and designs to make it original and express thoughts and feeling in your design
- When the design is complete, photocopy it 7 times
- Cut out all the pieces
- Piece together your circle

STEP 3: FINAL PRODUCT (5 MARKS)

Teacher Guide

Mathematic Knowledge and Understanding

Define the following terms: (1 mark each)

13

Euclidean Transformations: result in images that are congruent (matching) to the original object

Slides: a form of Euclidean transformation that moves a shape left, right, up, down, or diagonally without changing the direction in which it faces in any way.

Flips: a form of Euclidean transformation - a flip (or a reflection) can be thought of as the result of picking up a shape and turning it over. The reflection image is the mirror image of the original shape.

Turns: a turn moves a shape in a circle around a turning point a form of Euclidean transformation

Symmetry: The first is an imprecise sense of harmonious or aesthetically-pleasing proportionality and balance; such that it reflects beauty or perfection. The second meaning is a precise and well-defined concept of balance or "patterned self-similarity" that can be demonstrated or proved according to the rules of a formal system: by geometry, through physics or otherwise

Rotational Symmetry: if the shape is turned around its center point, and it fits over a tracing of itself at least once before it has completed a full rotation.

Line: Line can be considered in two ways. The linear marks made with a pen or brush or the edge created when two shapes meet.

Shape: A shape is a self contained defined area of geometric or organic form. A positive shape in a painting automatically creates a negative shape.

Direction: All lines have direction - Horizontal, Vertical or Oblique. Horizontal suggests calmness, stability and tranquility. Vertical gives a feeling of balance, formality and alertness. Oblique suggests movement and action

Size: Size is simply the relationship of the area occupied by one shape to that of another.

Texture: Texture is the surface quality of a shape - rough, smooth, soft hard glossy etc. Texture can be physical (tactile) or visual.
see notes on texture

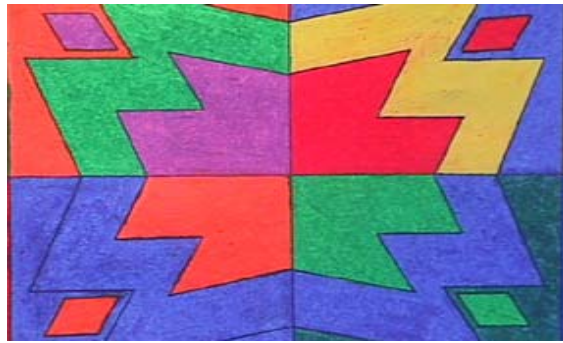
Transformation: A transformation is a one-to-one mapping on a set of points. The most common transformations map the points of the plane onto themselves, in a way which keeps all lengths the same. These transformations are called isometries.

Elements of Line: The **elements** are components or parts which can be isolated and defined in any visual design or work of art. They are the structure of the work, and can carry a wide variety of messages. The elements are: point, line, form, shape and space, movement, color, pattern, and texture.

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STEP 3: FINAL PRODUCT (5 MARKS)

Two exemplars of Rotational Symmetry are demonstrated below:

Exemplar #1 Rotational Symmetry

The first exemplar is nicely decorated, however the lines of symmetry do not line up, therefore leaving the design unsymmetrical. This would be an example of a level two.



Exemplar #2 Rotational Symmetry

The second exemplar is well done. It demonstrates that lines of symmetry are all lined up and therefore it leaves the rotational symmetry symmetrical on all over the circumference of the circle. This would be an example of a level four.



Mathematics Communication

Use Mathematical Language to communicate in the following forms:

Written Description of Your Rotational Symmetry Design (15 MARKS)

Use this page (add additional sheets if necessary) to describe in detail your finished symmetrical design project. For example you should explain in detail how you created your symmetrical design and give details about why you choose the colours that you did and why you had to use certain degrees to create your project piece. Try to use as much mathematical language as possible (i.e., circumference, fractions, etc.)

Our symmetrical design project is symmetrical because there is an imprecise sense of harmonious or aesthetically-pleasing proportionality and balance and it reflects beauty and perfection. This design that we have created also demonstrates rotation. Rotation is a transformation in a plane or in space that describes the motion of a rigid body around a fixed point. A rotation is different from a translation, which has no fixed points, and from a reflection, which "flips" the bodies it is transforming. Rotations are isometries; they leave the distance between any two points unchanged after the transformation. To rotate an object means to turn it around. Every rotation must have a center and an angle. When specifically looking at the rotation symmetry of this design it is important to explain to you that it is an object that looks the same after a certain amount of rotation. With Rotational Symmetry, the shape or image can be rotated and it still looks the same. Rotational symmetry is very similar to the idea of line symmetry. Rotational symmetry refers to the number of times a 2-D shape fits over an image of itself when it is rotated, or the number of times a 3-D shape appears exactly the same during a full rotation. It is stated in the text that the number of ways that a shape fits over its outline is called its order of rotational symmetry. For a circle, like we have focused on, the order of rotational symmetry is infinite, because it fits over its image an infinite number of times as it turn through 360 degrees. As we looked at the line of symmetry we realized that when one half of the shape reflected onto the other half across a line, the line is called the line of symmetry. Shapes can have one or more lines of symmetry and it is said that circles have an infinite number of lines of symmetry. It is also stated that when the shape is symmetrical along the fold line the image of the one side of the shape falls right on top of the other side of the shape.

Verbal Presentation

You will need to present your design to the class. Your presentation should be very brief (3-5 minutes). Display your project and explain to your classmates how you created your design and what you had to do in order to get your symmetrical creation to work. You may want to discuss a few points from your planning

stages before the actual process, or you may want to discuss the process of your symmetrical creation. *Briefly explain the meaning of the design that you have created using thoughts and feelings.*