

Alabama Journal of Mathematics Activities

Mathematical Safari

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1. Introduction

Lucy Lee, a geometry teacher at Daphne High School, presented this activity at a workshop during this past Summer's meeting of the South Alabama Council of Teachers of Mathematics. We thought the idea was so good that we asked her if we could share it with all the readers of the *Alabama Journal of Mathematics*, and Lucy agreed.

In the **Mathematical Safari**, teams of two to five students search their environment for specific mathematical (mostly geometric) objects and forms. This is a structured exercise in perception and identification. The students will observe, identify, describe, and report on certain mathematical forms outside of their classrooms.

This activity is designed to meet the following two standards, specified by the NCTM, in the *Principles and Standards for School Mathematics*:

- Geometry
- Connections.

Mathematical Safari can also be used to assess the following geometry objectives from the *Alabama Course of Study*:

- Apply the definition and theorems pertaining to perpendicular lines.
- Describe and use relationships between pairs of angles.
- Classify triangles according to their components.
- Identify polyhedra.
- Describe and identify parts of circles.

2. List of Materials

Each team will need the following: a clipboard; a pencil; a set of instructions (including a map); a score sheet (see below); a grease pencil or a "sharpie;" a Polaroid camera with film; and a plastic bag in which to keep the pictures.

3. Group Guidelines and Scoring Rules

- (1) Each team will be given the materials listed above. Plan to carry an extra pencil or an extra "sharpie" in case the one given to the group is lost. Each member of the team should read the score sheet so that he/she will be familiar with the kinds of objects for which the team is searching.
- (2) All photos must be taken of objects located outdoors. The map will show the "legal territory" in which the team may shoot its pictures; this will be outlined in red. In no instance may the team go outside of the legal territory, as this will disqualify the team. Please take care not to disturb any other classes in school, and do not enter the yards of school neighbors. The penalty is disqualification and referral to the appropriate authorities.
- (3) There is a time limit. The team must turn in all of its materials at the designated meeting place by the deadline; at that time the team's packet of photos will be scored. A penalty of 3 points will be assessed for each minute the team is late in turning in its materials. In addition, the first team to finish will earn a bonus of 3 points.
- (4) The camera will count down to indicate how many shots remain. Thus, if the camera reads "6," then the team has taken 4 shots. If it is needed for a given shot, the flash will work automatically. The Polaroid camera works best in the range of 2 to 20 feet from the desired object, so plan distances carefully. Only clear and recognizable features will count. If an object is of questionable clarity in a photo, a non-mathematics teacher may be asked to help judge the photo for scoring purposes.
- (5) As the team reviews the list of possible photos on the score sheet, select ten categories. The team may submit only

one photo for each category, and only one item in each photo can be used to determine the score for that photo. The team will have to plan its shots wisely to maximize its score! Within a category, the team will be awarded 1, or 2, or 3 points for manmade objects; the score will double to 2, or 4, or 6 points for natural objects.

- (6) LABELING GUIDELINES. Follow these instructions carefully to make sure the team's packet of photos is scored accurately.
- (a) On the map, mark the location of each photo, #1, #2, ..., #10. Also mark #1, #2, ..., #10 correspondingly on the front of each photo. The grease pencil will write easily on the photos. This will identify the order and location of each photo.
 - (b) On each photo, use the grease pencil to highlight or outline the object to be scored.
 - (c) On each photo, use the grease pencil to label the category from the score sheet, A through R, and the item number within that category, 1, or 2, or 3. For instance, a photo may be labeled as B-3 or N-2.
 - (d) Arrange the team's photos in alphabetical order (by categories) when the packet of photos is turned in to be scored, and at that time, have the team's score sheet ready to be marked. The team's score will be the total of the points awarded for each photo, plus or minus the bonus or penalty points.
- (7) More specific instructions concerning the operations of the particular model camera that the students are using should be given. If there are any malfunctions of the camera, or if the film packet seems to be defective, report back for replacements.
- (8) WORK TOGETHER.

Mathematical Safari Score Sheet

Team Members: _____

YOU HAVE 10 SHOTS IN YOUR FILM PACK, SO YOU MUST SELECT 10 CATEGORIES. YOU MAY SUBMIT ONLY ONE PHOTO FOR ANY SINGLE CATEGORY, WITH ONE ITEM FROM EACH CATEGORY TO COUNT TOWARD YOUR SCORE. THERE ARE 18 CATEGORIES, PLUS A SPECIAL "CHALLENGE" SHOT. A SCORE OF 1, 2, OR 3 POINTS WILL APPLY TO "MAN-MADE" OBJECTS. FOR "NATURAL OBJECTS, THE SCORE WILL DOUBLE TO 2, 4, OR 6 POINTS. GOOD LUCK!

Circle N if "Natural" Object

YOUR SCORE CATEGORY, VALUE, AND ITEM DESCRIPTIONS

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|------------|--|
| N _____ A) | <ol style="list-style-type: none"> 1.Parallel lines with a perpendicular transversal 2.Parallel lines with NO transversal 3.Parallel lines with a non-perpendicular transversal |
| N _____ B) | <ol style="list-style-type: none"> 1.Vertical angles formed by two intersecting lines 2.Supplementary adjacent angles formed by intersecting lines or rays 3.Complementary adjacent angles formed by intersecting lines or rays |
| N _____ C) | <ol style="list-style-type: none"> 1.Concentric circles 2.Concentric squares 3.Concentric triangles |
| N _____ D) | <ol style="list-style-type: none"> 1.Extrenally tangent circles 2.Extrenally tangent semicircles 3.Eccentric circles |
| N _____ E) | <ol style="list-style-type: none"> 1.A full circle with NO line segments intersecting it 2.A minor Arc 3.A major arc |
| N _____ F) | <ol style="list-style-type: none"> 1.Alabama license plate with a 3-digit prime number 2.Alabama license plate with a 3-digit number whose digits have a sum >24 3.Alabama license plate with all digits the same |
| N _____ G) | <ol style="list-style-type: none"> 1.Circle with 1 or 2 diameters 2.Circle with 3 to 6 diameters 3.Circle with 7 or more diameters |
| N _____ H) | <ol style="list-style-type: none"> 1.Cylinder 2.Sphere 3.Cone or pyramid |
| N _____ I) | <ol style="list-style-type: none"> 1.Octagon 2.Hexagon 3.Pentagon |
| N _____ J) | <ol style="list-style-type: none"> 1.Irregular trapezoid (with no = angles or = sides) 2.Isosceles trapezoid 3.Trapezoid with 2 right angles |

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- N _____ K) 1.Regular quadrilateral
 2.Equiangular quadrilateral that is not equilateral
 3.Equilateral quadrilateral that is not equiangular
- N _____ L) 1.A 45-45-90 triangle
 2.A 30-60-90 triangle
 3.A 3-4-5 triangle
- N _____ M) 1.Ellipse
 2.Parabola
 3.Hyperbola
- N _____ N) 1.Acute scalene triangle
 2.Equilateral triangle
 3.Obtuse scalene triangle
- N _____ O) 1.Two non-perpendicular, non-bisecting, intersecting line segments
 2.Two perpendicular bisector line segments
 3.Two non-perpendicular, bisecting line segments
- N _____ P) 1.Hexahedron
 2.Tetrahedron
 3.Octahedron
- N _____ Q) 1.Example of bilateral (line) symmetry
 2.Examples of radial (rotational) symmetry
 3.Example of both bilateral AND rotational symmetry
- N _____ R) 1.Tessellation of polygons
 2.Similar polygons (must not have a 1:1 scale factor)
 3.Concave polygon

REMINDER: BE SURE TO LABEL EACH PHOTO WITH ITS SEQUENCE NUMBER (1 THROUGH 10), ITS CATEGORY (A THROUGH R), AND ITS SCORE VALUE (1-2-3 OR 2-4-6). FOR EXAMPLE, PHOTO #4 MAY BE LABELED P-2 IF IT REPRESENTS A TETRAHEDRON. ALSO USE THE GREASE PENCIL TO HIGHLIGHT OR OUTLINE THE ITEM BEING FEATURED. ARRANGE THE PHOTOS IN "ALPHABETICAL ORDER" WHEN YOU ARE READY TO HAVE THEM SCORED. REMEMBER TO HAVE YOUR MAP LABELED WITH THE PHOTO LOCATIONS #1-#10 (+3 BONUS POINTS TO 1ST TEAM DONE.)