

Ratios and Scale Drawings

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Objectives:

- Students will create scaled drawings using the Morgantown High School Mohigan symbol.
- Students will use ratios to transform a symbol from a postcard to notebook paper (8 ½ x 11).
- Students will use ratios to transform a symbol from a postcard to print paper.

CSO's:

Geometry:

G.3.9 investigate measures of angles and lengths of segments to determine the existence of triangles (triangle inequality) and the order of sides and unknown side lengths or angles and inaccessible heights and distances, construct scaled drawings, and derive the basis for the trigonometric ratios.

G.3.18 using transformational geometry, create a reflection, translation, rotation, glide reflection and dilation of a figure; and apply transformations and use symmetry to analyze mathematical situations.

Applied Math I:

AM1.2.1 solve practical problems involving computation using estimation.

AM1.2.5 evaluate algebraic expressions using grouping symbols, order of operations and properties of real numbers with justification of steps.

10th Grade CSO's:

10.1.1 Solve computational and practical problems using properties of numbers, order of operations, computation, estimation with decimals, fractions, integers, and mixed numbers, including ratio, proportion, and percents.

10.2.4 Evaluate and simplify algebraic expressions using: grouping symbols, order of operations, properties of real numbers with justification of steps, and law of exponents.

10.3.3 Investigate similar figures and apply proportions in problem solving situations.

10.4.2 Estimate, measure, and perform operations involving length, mass, and capacity using customary and metric units.

10.4.3 Use appropriate tools to measure geometric figures.

Performance Descriptors:

- **Distinguished:** The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard. The student solves complex ratios in a practical manner. The student is able to justify the positions and spacing of the emblem in the scaled drawing. The student is able to rationalize an accurate measurement for the grids to use in the scale model and final draft.
- **Above Mastery:** The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard. The student

is able to solve ratios in a practical manner. The student is able to justify the positions of objects in specific boxes. The student is able to reproduce the grid from the model to the scaled drawing.

- **Mastery:** The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard. The student is able to solve ratios. The student is able to position the objects in the correct spaces/boxes. The student is able to create grids on both the model and final draft.
- **Partial Mastery:** The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/omissions. Performance needs further development. The student is unable to correctly space the objects based on the model into the final draft. The student tries to free-hand the drawings without looking for mathematical reasoning. The student is unable to create two accurate grids.
- **Novice:** The student demonstrates substantial need for the development of fundamental knowledge and skills characterized by fragmented and incomplete performance. Performance needs considerable development. Student free-hands most of their drawing. The student can not make an accurate grid.

Web resources:

<http://regentsprep.org/Regents/math/scale/PracScale.htm> This site presents practice with ratios to determine respective dimensions. Links are available to practice scale drawings with both a lesson and a teacher resource.

<http://www.geology.wise.edu/~museum/hughes/DinoDraw.html> This site presents a lesson on making a life-size drawing of a dinosaur skull (may expand to include the entire body). A list of suggested materials for the project is presented. Student questions relative to the study of the dinosaur head are included. Examples of completed drawing are included. Specific instruction for displaying completed projects are also included.

<Http://www.classroominc.org/products/simulations/lessonplans/activities/gmpc/parada2.html> A site presents a lesson on scale drawings of land. Objectives include finding area of shapes, construction and interpreting scale drawing, calculating cost of harvest. Lesson is presented to groups of students for project completion. Available are content standards relative to scale drawing. Of note is an extended lesson activity involving designing and drawing to scale individual student offices.

Materials:

Ratio Worksheet for Practice
Scale Model Worksheet
Postcards with Mohigan emblems
Blank Paper (8 ½ x 11)
Rulers
Colored Pencils
Print Paper

Procedures:

Day 1:

- Review the concepts of ratios with the students
- Students will recognize a ratio.

- Students will be able to write a ratio.
- Students will complete a worksheet on ratios.

Day 2:

Daily Objectives:

- Students will construct grids on emblem.
- Students will double the size of the emblem from their paper to a graph paper.

Procedures:

1. Students will be given the supplies to make their grids.
2. The teacher will demonstrate to the students how to make a grid. Students are then asked to create grids on the emblem paper that are 1 cm by 1 cm.
3. Students are then to measure the grid marks on the graph paper to determine length.
 - i. (Grids are .5 cm by .5 cm)
4. Students are then to be asked how many squares on the graph paper match one on their emblem grids.
5. Students are asked to find how many squares it would take to double size of the emblem.
 - i. (The students will decide that it is a four by four block of squares.)
6. Students will mark these blocks off on their grid paper. This will serve as a visual to reproduce the emblem square by square.
7. Students will then double the emblem from their paper to the graph paper.

Day 3:

Objectives for the day:

- Students will cooperate in groups to finish a large scale drawing of the Mohigan emblem.
- Students will create their own grids based on group consensus.

Procedures:

1. Students will be asked to form groups of no more than four.
2. The students will be given another copy of the emblem, a large sheet of paper, ruler, and colored pencils.
3. The students are told that they today are to decide how large to make their grids. They also have the opportunity to decide how large their final product must be, however, it must encompass at least one-half of the paper that they were given.
4. There will be no further instruction in order to assess the students on their knowledge of the task at hand.

Assessment:

- 25% participation in the project
- 25% grids on emblems (2 days)
- 25% ratio worksheet
- 25% scaled versions of the emblem