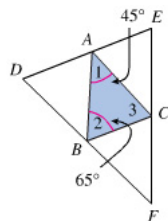


University of South Carolina
Math 222: Math for Elementary Educators II
Instructor: Austin Mohr
Section 002
Fall 2010

Quiz 1

Due Tuesday, September 28

1. Give a short answer to each of the following and explain your reasoning. Use pictures if it helps to convey your thoughts.
 - a. Can skew lines have a point in common? Can skew lines be parallel?
 - b. Is it possible to locate four points in a plane such that the number of lines determined by the points is not exactly 1, 4, or 6?
 - c. Is it possible to locate four points in three-dimensional space such that the number of planes determined by the points is not exactly 1 or 4?
2. Draw a picture for each of the possibilities described below. Draw from multiple perspectives or elaborate with words it helps clarify your three-dimensional drawings.
 - a. All four possibilities for curves that are simple/not simple, closed/not closed
 - b. All four possibilities for curves that are convex/concave, polygonal/not polygonal
 - c. All four possibilities for surfaces that are simple/not simple, closed/not closed
 - d. All four possibilities for surfaces that are convex/concave, polyhedral/not polyhedral
3. In the following picture, $\overleftrightarrow{DE} \parallel \overleftrightarrow{BC}$, $\overleftrightarrow{EF} \parallel \overleftrightarrow{AB}$, and $\overleftrightarrow{DF} \parallel \overleftrightarrow{AC}$. Find the measure of all missing angles. Show your work.



4. Using only the basic definitions of each shape, decide whether the following statements are true or false. If a statement is true, explain why it is true. If it is false, give a counterexample (with explanation) showing it is false.
 - a. Every obtuse triangle is scalene.
 - b. Every parallelogram is a trapezoid.
 - c. No rhombus is a kite.
 - d. If a quadrilateral is both a rectangle and a rhombus, then it is a square.
5. A *failbox* is a quadrilateral whose interior angles are all congruent. The failbox fails because it is actually just another way to define rectangle.
 - a. Show that every failbox is a rectangle.
 - b. Show that every rectangle is a failbox.
6. A *uniform polyhedron* is any polyhedron whose faces are regular polygons (not necessarily all of the same type) and have the same number of each type of face meeting at every vertex. For example, a soccer ball is a uniform polyhedron, since all the faces are either regular pentagons or regular hexagons and there is always one pentagon and two hexagons meeting at any vertex.
 - a. When is a prism a uniform polyhedron? (Note: Don't forget to consider right and oblique.)
 - b. When is a pyramid a uniform polyhedron? (Note: Don't forget to consider right and oblique.)
 - c. How many uniform polyhedra could there be using only triangles and pentagons?
7. Read the article at <http://tinyurl.com/vanhiele> on the van Hiele Levels of Geometric Understanding. Briefly summarize the first three levels of reasoning (Visualization, Analysis, and Abstraction). Why might teaching at the wrong level be ineffective? How can you assess whether you are teaching at the correct level?

Extra Credit

- A. Construct some regular polyhedra using a pattern like the one at http://www.korthalsaltes.com/index.html#platonic_solids. You may make as few or as many as you like using whatever materials you like. The more effort you put into your creations, the more credit it's worth.

Hints

- 1a.** For the first question, notice that, if two lines have a point in common, you can name both lines using the common point. For the second question, consider a pair of perpendicular planes.
 - 1b.** Two points uniquely determine a line.
 - 1c.** Three points uniquely determine a plane.
- 2.** Look up the meanings of all these words, then look for examples fitting each possibility in sections 9.2 and 9.4 of the text.
- 3.** Start by finding the missing angle in the blue triangle. Next, pick a pair of parallel lines and work with the transversals. Can you find any other angles in the transversal having the same measure as angles you already know?
- 4.** Look at the lattices we drew in class (they're also in the text in section 9.2).
- 5a.** If all the angles of a quadrilateral are congruent, how big are they? Knowing that, use transversals to reason that the opposite sides are parallel.
- 5b.** A rectangle has one right angle and opposite sides are parallel. Use transversals to reason about the rest of the angles.
- 6a.** First decide if it's okay for the prism to be right or oblique. Next, think about what kinds of faces satisfy both prisms and uniform polyhedra.
- 6b.** First decide if it's okay for the pyramid to be right or oblique. Next, think about what kinds of faces satisfy both pyramids and uniform polyhedra.
- 6c.** Mimic what we did in class to determine that there are only five regular polyhedra. The difference here is that you have to consider cases like "one triangle, two pentagons".
- 7.** Just read the article and let me know what you think about it. There's no correct answer for this one.