Name:_____

Math 403 - Test #2 - Review Questions

These questions certainly do not cover everything that could appear on the test, but should at least give you an idea of the types of questions to expect. I do not have written up for these!

1. All homework questions should always be considered possible test questions.
2. Give the definition of each of the following. You should give the definition used in our textbook or handouts.
   (a) affine transformation
   (b) one-to-one
   (c) onto
   (d) 2 triangles perspective with respect to a point
   (e) 2 triangles perspective with respect to a line
   (f) translation
   (g) central dilatation
   (h) central reflection
   (i) dilatation
   (j) group of transformations
   (k) identity transformation
   (l) inverse transformation
   (m) composition of transformations
3. Give an example of each of the following or explain why it cannot exist.
   (a) A pair of triangles which are perspective with respect to a point (draw a picture).
   (b) A pair of triangles which are perspective with respect to a line (draw a picture).
   (c) An affine transformation with one fixed point.
   (d) An affine transformation which has no inverse.
   (e) An affine transformation which maps the triangle with vertices $(0,0)$, $(1,0)$, $(0,1)$ to the triangle with vertices $(0,0)$, $(2,1)$, $(3,6)$ (keep vertices in the same order).
   (f) An affine transformation which maps the triangle with vertices $(0,0)$, $(1,0)$, $(0,1)$ to the triangle with vertices $(1,1)$, $(2,1)$, $(3,6)$ (keep vertices in the same order).
   (g) Two central dilatations which commute with one another.
   (h) A central dilatation (not the identity) having the property that when composed with itself, gives the identity.
   (i) A set of affine transformations which is not a group.
   (j) A set of affine transformations which is a group.

4. Which of the following properties are preserved by all affine transformations?
   (a) straight lines
   (b) angles
   (c) distance
   (d) centroids
   (e) midpoints of segments
   (f) triangles
   (g) parallel lines
   (h) rectangles
   (i) two triangles perspective with respect to a point
5. Given a specific translation or central dilatation f and a specific geometric object T, such as a triangle, draw a sketch of $f(T)$.
6. Give the statements of Ceva's Theorem, Menelaus' Theorem and Desargues' Theorem and illustrate with sketches.
7. Given any affine transformation f and any triangle $\triangle XYZ$, let $X' = f(X), Y' = f(Y), Z' = f(Z)$. Let G denote the centroid of $\triangle XYZ$. Prove that the centroid of $\triangle X'Y'Z'$ is $f(G)$.
8. True or False?
   (a) Two central dilatations always commute.
   (b) Two central dilatations having the same center always commute.
   (c) The inverse of a translation is a translation.
   (d) The inverse of an affine transformation is an affine transformation.
   (e) Given two parallelograms, there exists an affine transformation taking one to the other.
   (f) It is possible for the composition of two central dilatations to be a translation.
   (g) Given a point P and a triangle $\triangle ABC$, there are infinitely many other triangles $\triangle A'B'C'$ having the property that $\triangle ABC$ and $\triangle A'B'C'$ are perspective with respect to point P.
9. Prove that the composition of two translations is a translation.
10. Prove that given two points A and C, there is a unique translation taking A to C.