MTG 3203
Homework 6
October 7, 2009

To begin: Download "hw6-thoughts.gsp" and "hw6.gsp". The first file contains Sketchpad creations of the Shoemaker's knife trisection, the marked straightedge trisection, and steps on how to do the marked straightedge in Sketchpad. Note that NONE of these constructions are stable, because Sketchpad ONLY does regular old C and SE constructions. If you change your angle, you will also have to reposition your trisection device.

1-3) From the book, do problems 3.1 #16, 3.2 #3 and 3.2 #4. I am especially interested in 3.2 #3 e) and 3.2 #4 f).

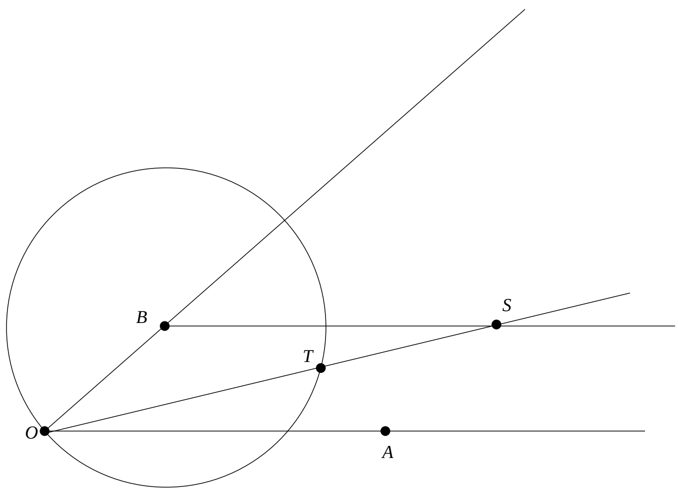
4) Construct a regular pentagon in Sketchpad. There is a place for you to do this in "hw6.gsp".

5) Beginning with a line segment of length one inch, construct a line segment of length $\sqrt[3]{2}$ in Sketchpad. Of course, you will have to do a marked straightedge construction. See "hw6-thoughts.gsp" to see how to do this. There is a place in "hw6.gsp" for you to do this.

6) It's the proof!!

The following is the diagram you get when you do a trisection using a marked straightedge. In the diagram, you may assume $\overrightarrow{BS}$ is parallel to $\overrightarrow{OA}$, and you may assume that $\overline{OB} = \overline{ST}$. Prove that $\angle BOT$ is twice the angle $\angle TOA$, and therefore we have trisected the angle.

Hint 1: To do this properly, you will at least need Useful Theorems 3, 4, and 7.
Hint 2: You should draw the line segment $\overline{BT}$.
Hint 3: You don't need any congruent or similar triangles (in fact, there are none in the picture).
Hint 4: You should start with angle $\angle TOA$, find any angles that may be congruent, and then work from there.



7) We know that it is impossible to square the circle. So, let's square a rectangle instead! In the file "hw6.gsp", one of the pages has a rectangle. Construct a square that has the exact same area as the rectangle. Of course, your construction should be stable, and you should be able to change the size of the rectangle and have the size of the square change appropriately.

8) Jack sent me two ways to trisect an angle. Here is the second way:

(1) Begin with an angle $\angle ABC$.

(2) Draw the line inside the angle that is parallel to $\overrightarrow{BC}$ and is one centimeter away from $\overrightarrow{BC}$ (the "centimeter" could be any unit of measurement - I'm using centimeter because it is easiest).

(3) Draw the line inside the angle that is parallel to $\overrightarrow{BA}$ and is two centimeters away from $\overrightarrow{BA}$ (the important point is that this distance is twice the other distance).

(4) The two drawn lines will intersect at a point, call it D.

(5) The angle $\angle DBC$ is one third of $\angle ABC$.

Of course, this is wrong. Do this construction on a $90°$ angle (in Sketchpad: there is a place for it in "hw6.gsp"), and then prove that $\angle DBC \neq 30°$. (Note: measuring an angle in Sketchpad is not a proof. Show that through your construction, you must be creating an angle that is not $30°$.)