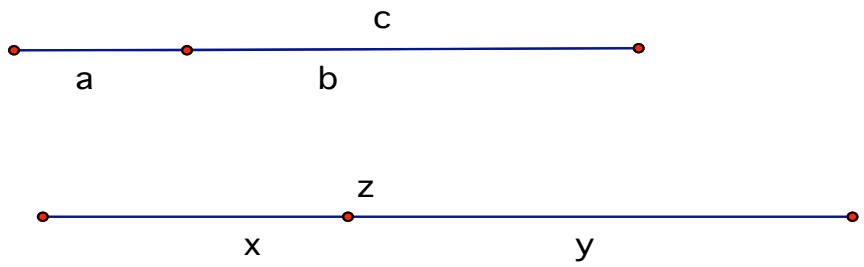
Math 5200/7200
Notes to supplement class presentation
13 October 2008

This was not a homework review day (saved for 15 OCT), but will do SAS similarity proof.

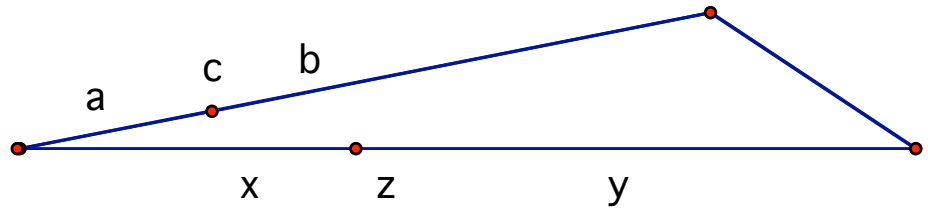
TERMINOLOGY REVIEW related to proportion
Consider 2 segments each divided into 2 pieces. What does it mean that they're divided in the same proportion?



proportionally, this says

$$\frac{b}{a} = \frac{y}{x}$$

we have seen this with the theorems about diagonals of trapezoids and with similar triangles, such as when using SAS similarity. If these segments are two legs of similar triangles, for example, we have:



and we can say $\frac{c}{a} = \frac{z}{x}$.

Since c = a+b and z = x+y we can substitute and find:

$$\frac{c}{a} = \frac{z}{x} \Rightarrow \frac{a+b}{a} = \frac{x+y}{x} \Rightarrow 1 + \frac{b}{a} = 1 + \frac{y}{x} \Rightarrow \frac{a}{b} = \frac{y}{x}$$

we need to be careful and be sure to compare corresponding pieces.

Some information on the proof:
We are going to start with pieces of same segments and extend this to sides of triangles.
Remember what we have to work with from the axioms and basic theorem groups: all but similarity theorems and Pythagoras.
We can use: isosceles triangles, parallels, congruence, and area.

We went through some of the work on the Euclid's Elements page (Book VI, Prop 2)

Dr. McCrory has posted the proof, and I am not going to go through that.

Dr. McCrory also referred to this particular proposition as the Proportional Size Theorem, and pointed out a few times that the results are based on use of area. In particular, the fact that the area of a triangle is independent of which base you choose/use when calculating area.

INFORMATION FOR EXAM ON 22 October:

Wednesday will be a review of the week's homework.

There will be a new assignment due Friday—the last before the exam.

There will be practice problems over the weekend.

Be careful when working outlined proofs and supplying reasons—steps may involve more than one axiom or theorem. The work is done. We just need to explain it (*i.e.*, provide the reasons for the steps of the proof).

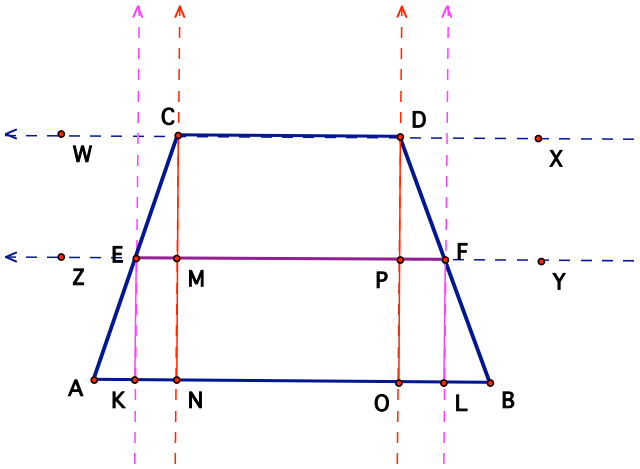
15 October 2008

Homework 12 review

Since last time, posted on the website:
Proof of SAS
Proof of Straight Angle Theorem
Existence of parallels (in Michelle's notes)

And all the materials from the basic theorems is now available online.

Considering question 1: The line joining the midpoints of the nonparallel sides of a trapezoid is parallel to the parallel sides and equal in length to half their sum. (I assume the trapezoid is not a parallelogram. What happens if it is a parallelogram?)



Outline of proof:
Drop perpendiculars from the upper vertices to the base and from the midpoints of the legs to the base. Use Angle Angle to prove AKE similar to ANC and the same on the other side of the trapezoid. Use the similarity ratio of 2:1.
We will have a rectangle, MNOP and can work with the facts about rectangles. We also have rectangle EKLF and can again use what we know about rectangles to ultimately find parallel lines and show that EF is parallel to CD and consequently AB. (We went back and used the proof showing that opposite sides of parallelograms are parallel.)
After a lot of work, we showed that we use the diagonals of EKFL and work again with properties of rectangles which finishes up the parallel part of the proof. We finally looked at the relations from the similar triangles along with rectangle information to show that KN and OL are each _ of the base of their respective triangles and we added each of these to NO, from the lower base that is congruent to CD. Doing the algebra gave us that the midsegment is the average of the bases of a trapezoid.

Mary Catherine did a much simpler proof by constructing the diagonalso f the trapezoid and working with the midpoints of the sides of the trapezoid. She looked at _ the trapezoid at a time, shoed that the segment using the midsegment created 2 similar

triangles by SAS, proving that the midsegment was parallel to the base and setting up the proportion to find the length of the entire midsegment when she put the 2 halves of the trapezoid back together. It used the existence of parallel theorem and took much less work than the earlier proof. By going back to first causes and the axioms, it led to a much simpler proof using only parallel lines and SAS similarity.

MORE COMMENTS FROM DR. McCRORY:
A list of useful theorems we can use will be posted.

On the exam, he won't be as picky as on the homework—we won't be restricted to axioms. The most important thing is making logically correct arguments based on what we know and have proved in class

You need to be able to state exactly what theorem you are using, not just "by problem 3".

A Criterion for simple proofs: they use fewer construction lines.

17 October 2008

Homework 12 problem 3—there will be a problem like this on the test.
Solving strategy: when given steps of the proof to provide reasons.
In this case we have a diagram to help visualize…

Rules to be aware of:
*Only have to give geometric reasons, not algebraic ones. For instance, in going from step 5 to step 6 it is valid to list the reason as “by step 5” or “by algebra and step 5”. If using previous reasons, just state “by step…” or “steps”…list all the steps related to the algebraic manipulation.

Go through the proof and mark the figure to keep track of what you have already used/proved.

Note: Proofs are easier to read if you name angles and do any “bookkeeping” work off to the side.

Be careful reading and labeling.

Have a strategy to deal with problems of this nature.

From Homework 13, Problem 4
Note: the problem is more advanced than the one from Homework 12 because it is not as broken down and there is no diagram provided. In addition, it incorporates a “tricky” use of symmetry.

It is ok when a proof uses an argument repeatedly, say to show multiple similar triangles at the vertices of a triangle, to state something to the effect of “by similar argument and with appropriate change of labeling, we can show….”

Final notes:
Work the practice problems

This is not a practice test.

Try to work proofs with basic facts.

Good luck