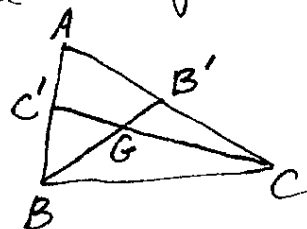


Math 130 Second Midterm  
Fall 2002, H. Wu

1. (20%) A rhombus is a quadrilateral with four congruent sides. Prove that the diagonals of a rhombus are perpendicular to each other.

2. (25%) Assume you know that the line segment joining the midpoints of two sides of a triangle is parallel to the third side and is half the length of the third side.

Prove that if  $\overline{BB'}$  and  $\overline{CC'}$  are medians of  $\triangle ABC$ , then their point of intersection  $G$  satisfies  $|\overline{BG}| = 2|\overline{GB'}|$ ,  $|\overline{CG}| = 2|\overline{GC'}|$ .



3. (30%) Assume you know that an isometry of  $\mathbb{R}^2$  with three distinct <sup>necessarily</sup> fixed points is necessarily the identity map. Prove that every isometry of  $\mathbb{R}^2$  is a bijection.

4. (25%) Given  $\angle AOB$ , where  $O$  is the origin of  $\mathbb{R}^2$ . Let  $\alpha, \beta$  be positive numbers and let  $P = \alpha A + \beta B$ . Prove that  $P$  is in the interior of  $\angle AOB$ . Is the positivity of  $\alpha$  and  $\beta$  really necessary for this conclusion to hold?

