1	2	3	Total

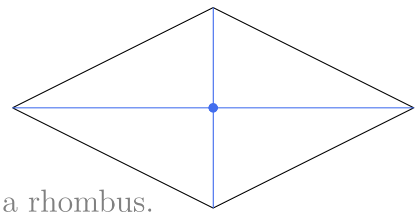
Names ____________________________________

Math 202 Section 4 **QUIZ 6** SOLUTIONS **Feb 22, 2008**

Show your work in all problems.

1. Hand in your Escher-like design with the quiz sheet.

2. Find the symmetries in the following designs. For rotation symmetries mark the center, for (glide) reflections, mark the axis. If there are many, mark for one of them, and tell how many symmetries.



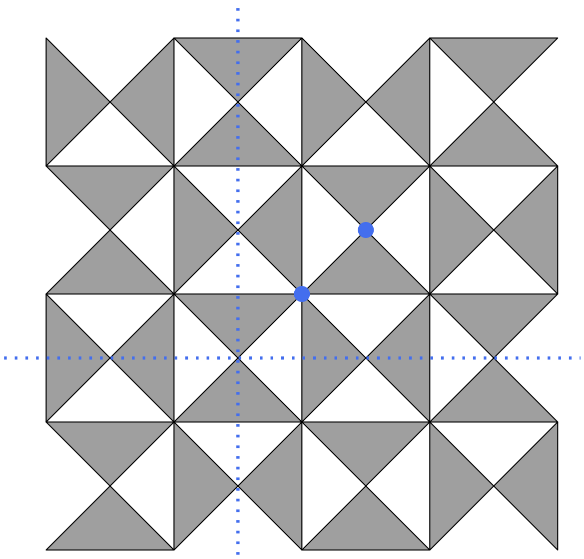
This is a rhombus.

Translation symmetry: none

Rotation symmetry: 2-fold

Reflection symmetry: along diagonals

Glide-reflection symmetry: none



This pattern continues forever in all directions.

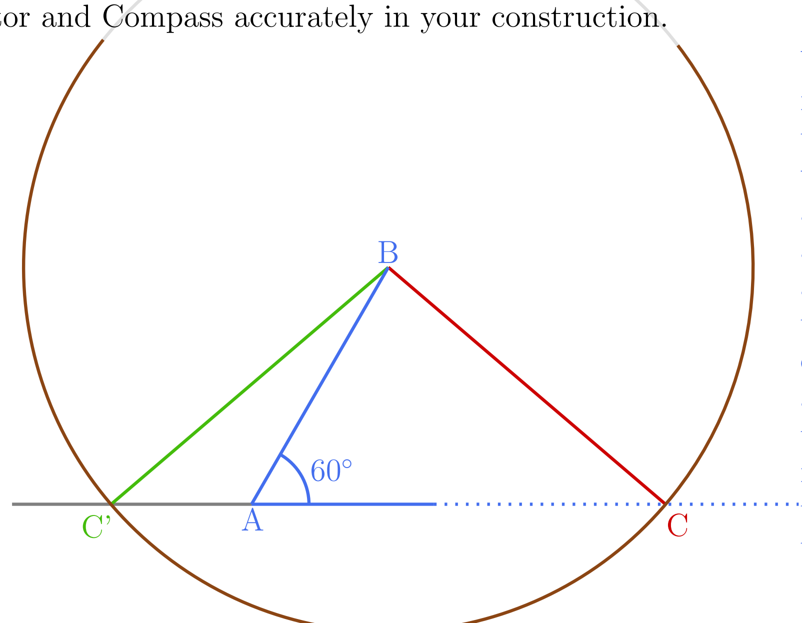
Translation symmetry: yes, two units left/right/up/down, also diagonal

Rotation symmetry: 4-fold centered at any intersection point where 4 dark triangles meet and 2-fold centered at points where two dark triangles meet

Reflection symmetry: along lines parallel to the two dotted lines one unit apart from eachother

Glide-reflection symmetry: along same axes for reflection, with 2 units translations in that direction

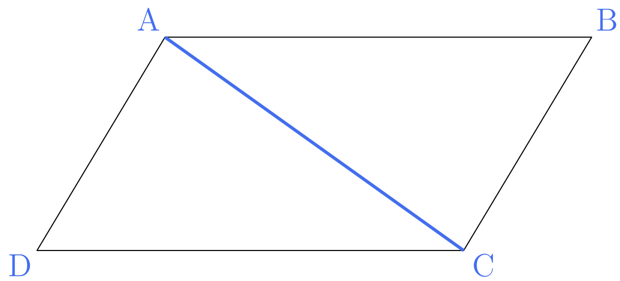
3. (a) We have seen Angle - Side - Side is not a congruence relation in general. How about the following: Triangle P and Triangle Q have the same three numbers: 60 degrees angle followed by a 15 inch side followed by a 20 inch side. Using a construction, show if they have to be congruent or not. Briefly explain why.
Use Ruler, Protractor and Compass accurately in your construction.



We start with two rays making 60° angle, extend one ray to 15 inches. The next side will be 20 inches long, and all possible endpoints makes a circle of radius 20 centered at B. The circle intersects the first ray at two points one of which wouldn't create a triangle with 60° angle at the requested corner, so there is only one possible triangle that can be constructed with this data.

(problems 3 b and 3 c is on the back of the sheet)

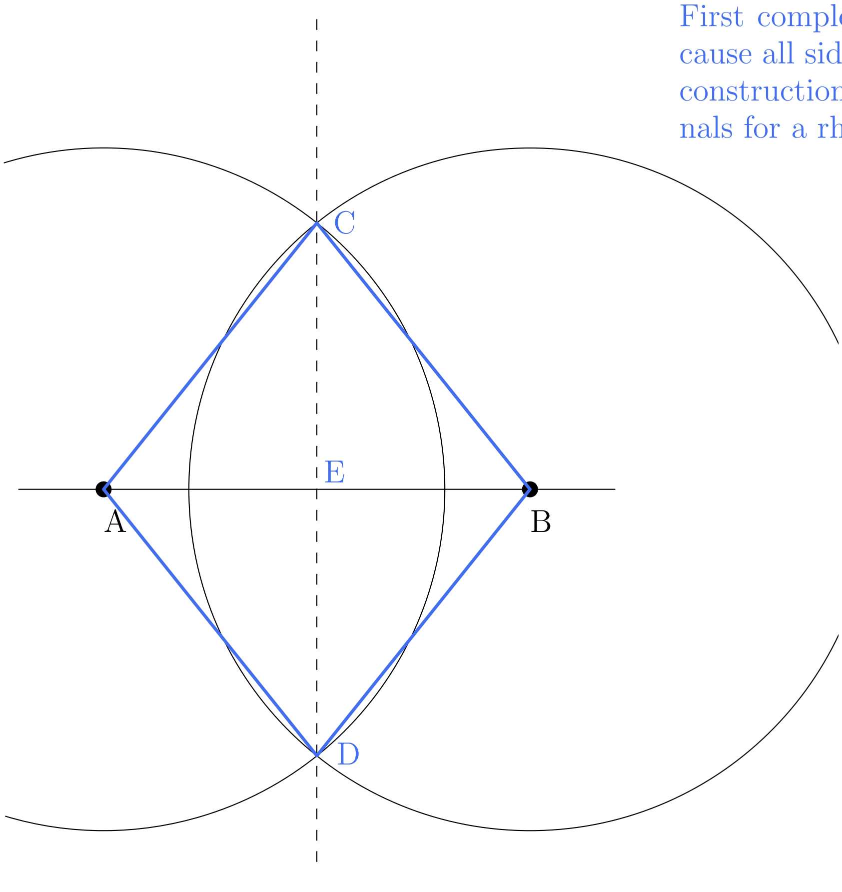
3. (b) A *parallelogram* is a quadrilateral for which opposite sides are parallel.
Note that this definition does not tell that the opposite sides have same length. Using a suitable triangle congruence, show that for parallelograms, the opposite sides have the same length. (Hint: draw a diagonal. You can use parallel postulate and vertical angle theorem. Label vertices of triangles.)



$\angle CAB = \angle ACD$	Parallel postulate
$\angle ACB = \angle DAC$	Parallel postulate
$\Delta BCA \cong \Delta DAC$	ASA: $\angle CAB = \angle ACD$, $AC = CA$, $\angle ACB = \angle DAC$
$AB = CD, BC = DA$	

3. (c) Using triangle congruences, show that the perpendicular bisector construction indeed produces a line perpendicular to a given one.

First complete ACBD to a rhombus. It is a rhombus because all sides are radii for circles of same length radius by construction. So what we want to show is that the diagonals for a rhombus are perpendicular.



$\angle ACD = \angle ACD$	ΔACD is isosceles
$\Delta ACD \cong \Delta BCD$	SSS: $AC = BC$, $CD = CD, DA = DB$
$\angle ACD = \angle BCD$	
$\angle EAC = \angle EBC$	ΔACB is isosceles
$\Delta ACE \cong \Delta BCE$	ASA: $\angle EAC = \angle EBC$, $AC = BC$, $\angle ACE = \angle BCE$
$\angle CEA = \angle CEB$	
$\angle CEA + \angle CEB = 180$	$\angle AEB = 180°$
$\angle CEA = 90°$	two of them makes $180°$