MAE 301/501 HOMEWORK–8 DUE ON THURSDAY, DECEMBER 2

One goal for this course is for you to develop your skill in effectively communicating mathematics. With this in mind, you should clearly write up your solutions. Solutions with little or no justification will receive little or no credit.

(1) Prove that a rotation is an isometry. That is, prove that the distance between any two points P and Q is equal to the distance between their images $r_{C,\theta}(P)$ and $r_{C,\theta}(Q)$, where $r_{C,\theta}$ denotes the rotation with center C through an angle θ. A complete proof will consider different locations for points P and Q.

(2) Let m, n, and ℓ denote parallel lines. Give a *precise* description of the composition $r_m \circ r_n \circ r_\ell$. Prove your result. Make sure your proof works for any configuration of parallel lines.

(3) Pick some arrangement of four lines in the plane, and determine the result of composing reflections across your four lines. Carefully justify your result.

(4) Pick any four of problems 1 - 10 from the attached excerpt from the NY State Modules, and work out your solutions. Make sure you precisely describe the isometries–rigid motions–where appropriate.

Problem Set

Justify whether the triangles meet the SAS congruence criteria; explicitly state which pairs of sides or angles are congruent and why. If the triangles do meet the SAS congruence criteria, describe the rigid motion(s) that would map one triangle onto the other.
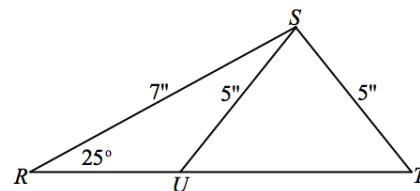
1. Given: $\overline{AB} \parallel \overline{CD}$, and $AB = CD$

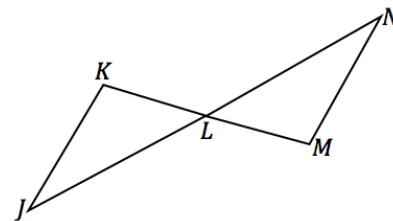   Do $\triangle\, ABD$ and $\triangle\, CDB$ meet the SAS criteria?
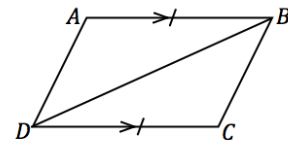
2. Given: $m\angle R = 25°$, $RT = 7"$, $SU = 5"$, and $ST = 5"$

    Do $\triangle\, RSU$ and $\triangle\, RST$ meet the SAS criteria?
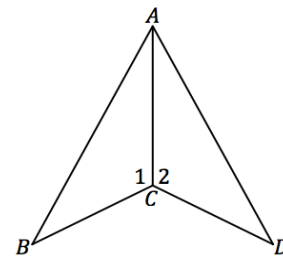
3. Given: $\overline{KM}$ and $\overline{JN}$ bisect each other

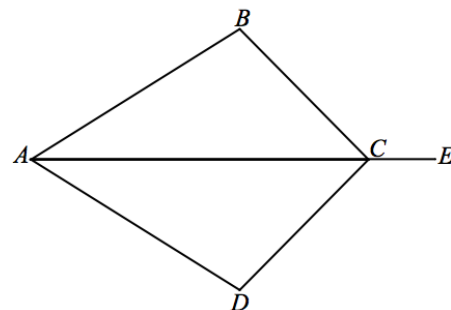   Do $\triangle\, JKL$ and $\triangle\, NML$ meet the SAS criteria?

4. Given: $m\angle 1 = m\angle 2$, and $BC = DC$

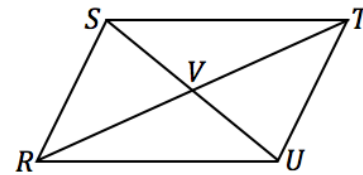   Do $\triangle\, ABC$ and $\triangle\, ADC$ meet the SAS criteria?

5. Given: $\overline{AE}$ bisects angle $\angle BCD$, and $BC = DC$
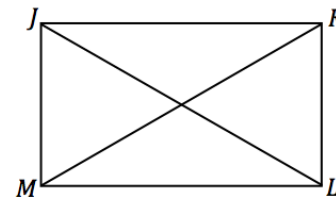
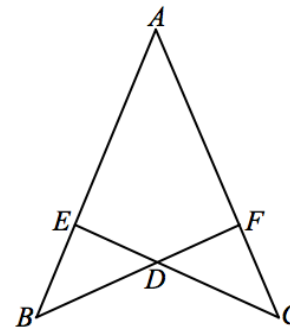   Do $\triangle\, CAB$ and $\triangle\, CAD$ meet the SAS criteria?

6. Given: $\overline{SU}$ and $\overline{RT}$ bisect each other

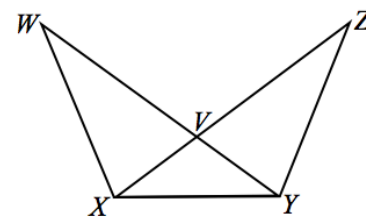   Do $\triangle SVR$ and $\triangle UVT$ meet the SAS criteria?

7. Given: $JM = KL, \overline{JM} \perp \overline{ML}$, and $\overline{KL} \perp \overline{ML}$

   Do $\triangle JML$ and $\triangle KLM$ meet the SAS criteria?

8. Given: $\overline{BF} \perp \overline{AC}$, and $\overline{CE} \perp \overline{AB}$

   Do $\triangle BED$ and $\triangle CFD$ meet the SAS criteria?

9. Given: $m\angle VXY = m\angle VYX$

   Do $\triangle VXW$ and $\triangle VYZ$ meet the SAS criteria?

10. Given: $\triangle RST$ is isosceles, with $RS = RT$, and $SY = TZ$

    Do $\triangle RSY$ and $\triangle RTZ$ meet the SAS criteria?