Math 161 Modern Geometry Practice Homework

(1) Show that two hyperbolic lines cannot have more than one common perpendicular.
(2) Prove that the summit is always larger than the base in a Saccheri quadrilateral.
(3) Draw a cevian line for a triangle $\triangle ABC$. Prove that the angle defect (π radians minus the sum of the angles in the triangle) is equal to the sum of the defects of the two sub-triangles created by the cevian line.
(4) Prove that two Saccheri quadrilaterals with congruent summits and summit angles must be congruent.
Hint: suppose not and show that you can construct a rectangle.
(5) Let l and m intersect at O at an acute angle. Let $A, B \neq O$ be points on l and drop perpendiculars to m from A and B, intersecting m at A', B'. If $OA < OB$, show that $AA' < BB'$.
(6) Prove that two Saccheri quadrilaterals with equal bases and equal summit angles must be congruent.
Hint: suppose not and show that you can construct a quadrilateral with angles summing to $360°$.
(7) The point $P = (1, 1)$ is rotated through angle $\pi/6$ about the point $(2, 3)$ and then translated in the direction of $(1, 2)$ through a distance of 3 units. Find the coordinates of the resulting point.
(8) Identify the product, f, of a reflection in the line $y = x - 1$, the rotation by angle π about (1, 1) and a glide in the y-axis through vector $(1, 2)$.
(9) Identify the product of the reflection in the line $y = x + 3$ followed by the glide in the line $-x + y = 2$ through vector $(1, 1)$.