

## Assignment 8

### Oral questions

1. Review the proof of Thales' theorem and point out the instance(s) where we use Euclid's fifth postulate, or an equivalent statement. Assume then that Thales' theorem is true. Explain why this implies the existence of a triangle with zero defect.
2. Let  $O$  be the center of a circle and  $A$  and  $B$  two points on the circle. Let  $M$  be the midpoint of the line segment  $AB$ . Prove in neutral geometry that the line  $OM$  is perpendicular to  $AB$ . (Hint: Corresponding angles of congruent triangles are congruent.)
3. Given  $A * B * C$  on a line and a point  $D$  not on the line such that  $DC \perp AC$ . Prove that  $AD > BD > CD$ . (Use Lemma 7.6 from our notes.)

### Questions to be answered in writing

1. Use the existence of a midpoint of a line segment to prove that there is an angle bisector.
2. Let  $ABDC$  be a quadrilateral whose base angles  $\angle A$  and  $\angle B$  are right angles. Prove that if  $AC < BD$  then  $\angle D < \angle C$ . (Hint: Choose  $E$  between  $B$  and  $D$  on the line  $BD$  such that  $AC = BE$ . Apply Theorem 7.9 (i) and the weak exterior angle theorem. You are allowed to use without proof the fact that  $E$  is interior to  $\angle ACD$ .)