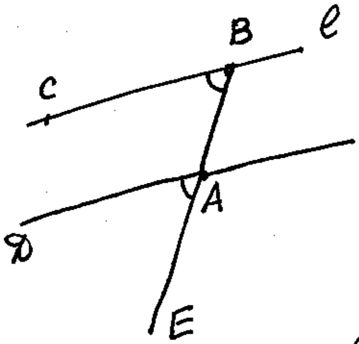
10.5

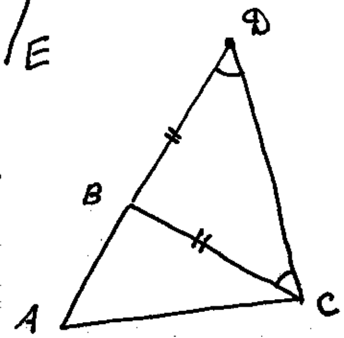


1). Pick up a point $B \in \ell$ and a point $C \in \ell$, line AB

2). Draw a ray $\overrightarrow{AD}$ on the same side of AB as C so that $\angle DAE \cong CBE$

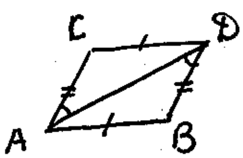
Then $AD \parallel \ell$

10.8



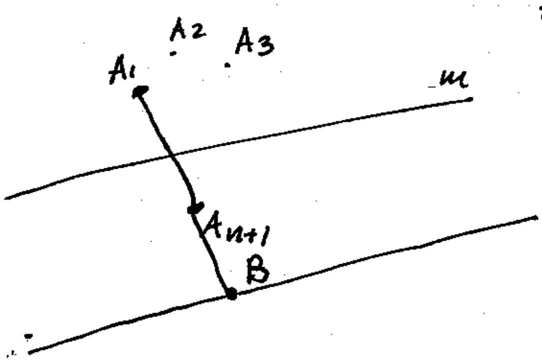
On the side opposite to A find D so that $BD \cong BC$.
Then $BD \cong BC$ and therefore $\angle BDC \cong \angle BCD$. Since A and D are on opposite sides of BC $\overrightarrow{CB}$ is inside $\angle DCA$. Hence $\angle BDC \cong \angle DCB < \angle DCA$.
Then by I.19 $AD > AC$ So $AB + BC > AC$.

10.10.



$\triangle ACD \cong \triangle DBA$ and C & B are on opposite sides of AD. (This is given). So $\angle CAD \cong \angle ADB$
By I.27 $AC \parallel DB$

10.11. Induction on the number n of points. $n=1$ trivial.
Suppose that the statement is true for n points.
Then there is a line m so that $A_1, \ldots, A_n$ are on one side of m. If A_{n+1} is on the same side we are done.
If A_{n+1} is on the opposite side, on the ray opposite to $\overrightarrow{A_{n+1}A_1}$ chose a point B. Let ℓ be a line parallel to m through B



By construction A_1 and A_{n+1} are on the same side of ℓ. All points of the line ℓ are on the same side of m as A_{n+1}
Hence ℓ does not meet segments $A_1A_2, \ldots, A_1A_n$. We obtain that $A_1, \ldots, A_n$ and A_{n+1} are all on the same side of ℓ.

5.17. $\angle D'C'C + \angle D'DC = 2RA$, $\angle B'C'C + \angle B'BC = 2RA$

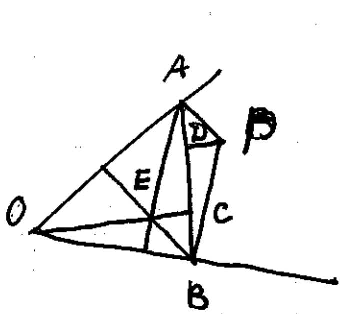
Therefore $\angle B'C'D' = 4RA - \angle D'C'C - \angle B'C'C = \angle B'BC + \angle D'DC$

Similarly $\angle B'A'D' = \angle B'BA + \angle D'DA$

$\angle B'C'D' + \angle B'A'D' = \angle B'BA + \angle B'BC + \angle D'DC + \angle D'DA =$

$= \angle ABC + \angle ADC$ and $A'B'C'D'$ is cyclic.

5.19. (Giulia DeSalvo solution).



Let the altitudes of $\triangle OAB$ meet in E. Then $APBE$ is a parallelogram.

$\triangle AEB \cong \triangle APB$

$EC \cong PD$ and $AD \cong BC$.