Hints 7-8

7.2. Apply affine transformation to take the triangle to some very nice triangle, for which the statement will be almost evident.

7.3. Apply affine transformation to map three vertices of the pentagon to the vertices of the regular pentagon. Use the fact that affine maps preserve parallelism to conclude about the images of the other points. (You will probably also need some continuity argument).

7.4. (a) One way is to drop perpendiculars from A, B and C to the line EF and use similar right triangles.

For another solution consider a composition of 3 homothecies: first sending B to C and preserving D, second sending C to A and preserving E, and the last sending A to B and preserving F.

(b) Apply the sine law to three different triangle you can find in the picture. (This would also solve the Euclidean version in part (a)).

8.3. If it is not clear how to find the cross-ratio of points on the infinite line, we could first send the infinite line to any other nicer line.

Another option would be to recall that the cross-ratio of points in $\mathbb{RP}^2$ is the cross-ratio of the corresponding lines in $\mathbb{R}^3$.