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Some properties of triangles or rectangles attached to sides of a triangle

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Abstract. In this paper, we introduce the properties of a triangle with a similar triangle or a rectangle attached to each side. We also discover some concurrent points.

Keywords. triangle geometry, remarkable point, Euclidean geometry.

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1. Introduction

In papers [1, 2] the problems of rectangles or squares attached to the sides of a triangle are studied. In the recent publications, Nikolaos Dergiades and Floor van Lamoen study the more general case in which the attached rectangles are not necessarily similar [3]. In this paper, we introduce the more general problems in which the the attached triangles are only similar and some concurrent points.

2. Contents

Theorem 2.1. *Given a triangle ABC. Three arbitrary rectangulars $ABDE$, $BCMN, CAGF$ are constructed on three sides having the same orientation (outer or inner orientation). Then three lines passing through the midpoints of ND, MF, GE perpendicularly to CA, AB, BC respectively are concurrent.*
- When $DB/DA = GA/AC = MC/CB$ we have the theorem of altitudes.

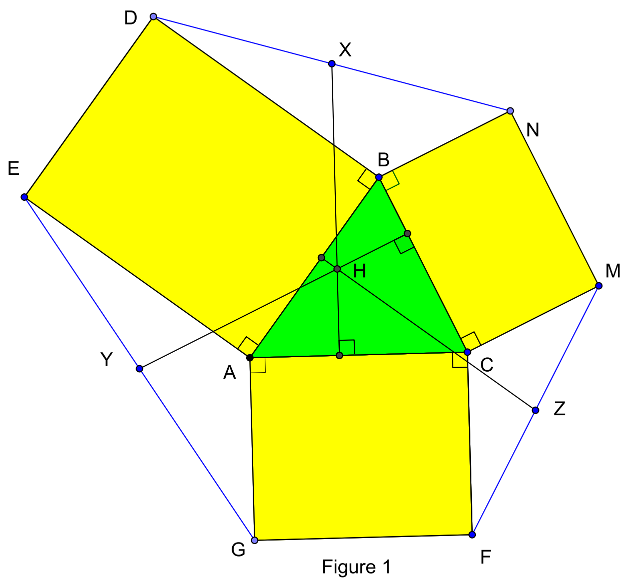

Figure 1

Theorem 2.2. *Given a triangle ABC. Three arbitrary rectangulars $ABDE$, $BCMN$, $CAGF$ are constructed on three sides having the same orientation (outer or inner orientation) (outside or inside orientation). Then three lines passing through three nine-point centers of triangles BND, AEG, CFM perpendicularly to ND, EG, FM respectively are concurrent.*

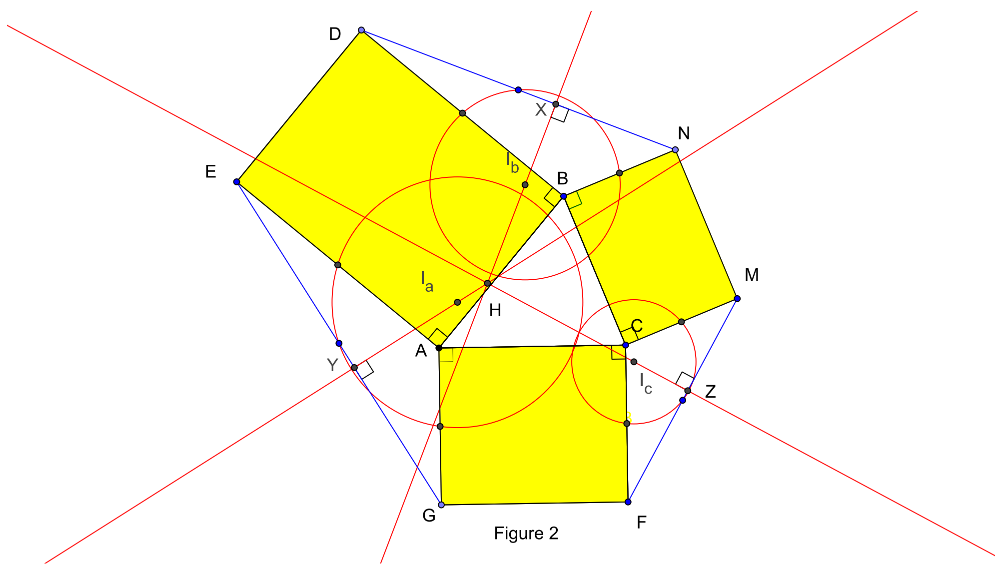

Figure 2

Theorem 2.3. *Given a triangle ABC. Three arbitrary rectangulars $ABDE$, $BCMN$, $CAGF$ are constructed on three sides having the same orientation (outer or inner orientation). Then three lines passing through three nine-point centers of triangles BND, AEG, CFM perpendicularly to AC, CB, BA respectively are concurrent.*

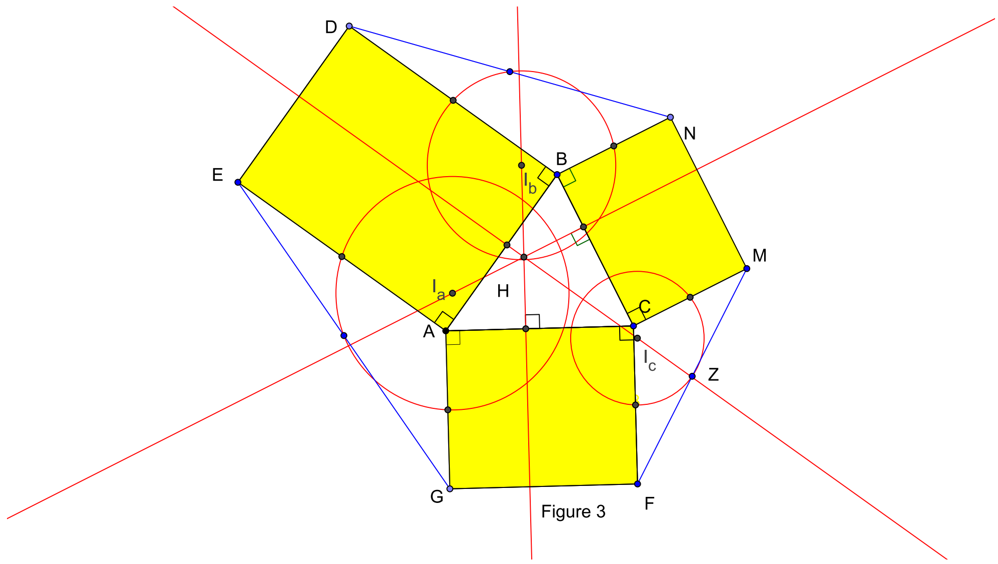

Figure 3

Theorem 2.4. *Given a triangle ABC. Three similar rectangulars $ABDE, BCIJ$, $CAFG$ are constructed on three sides having the same orientation (outer or inner orientation). Three similar rectangulars $DJMN, FEPQ, GISR$ are constructed on three segments DJ, FE, GI having the same orientation of three first rectangulars. Prove that three lines connecting the centers of rectangulars $DJMN, FEPQ$, $GISR$ perpendicularly to AC, CB, BA respectively are concurrent.*

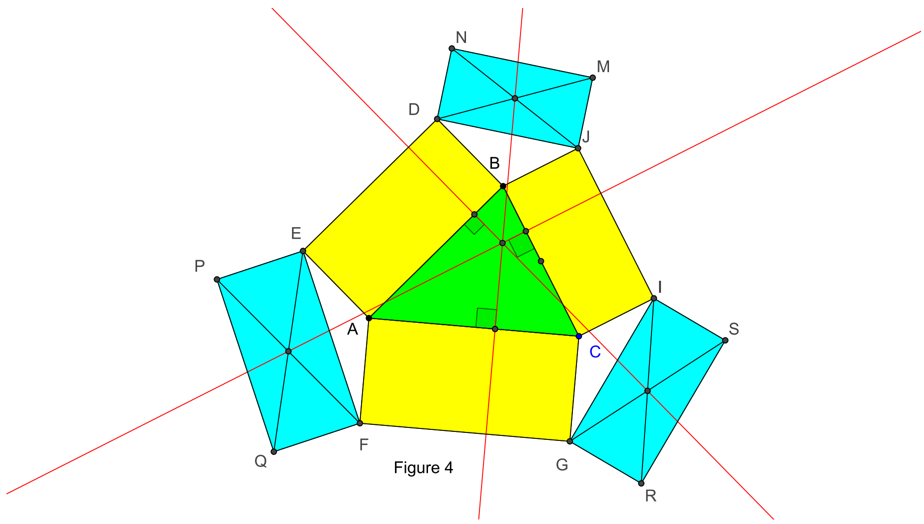

Figure 4

Theorem 2.5 (The generalization of theorem 1)**.** *Given a triangle ABC. Six arbitrary triangles $ABD, BAE, CBN, BCM, ACF, CAG$ are constructed on three sides having the same orientation (outer or inner orientation). Then three lines passing through the midpoints of ND, MF, GE perpendicularly to CA, AB, BC respectively are concurrent. - When $ABDE, BCMN, CAGF$ are rectangulars we have theorem 1.*

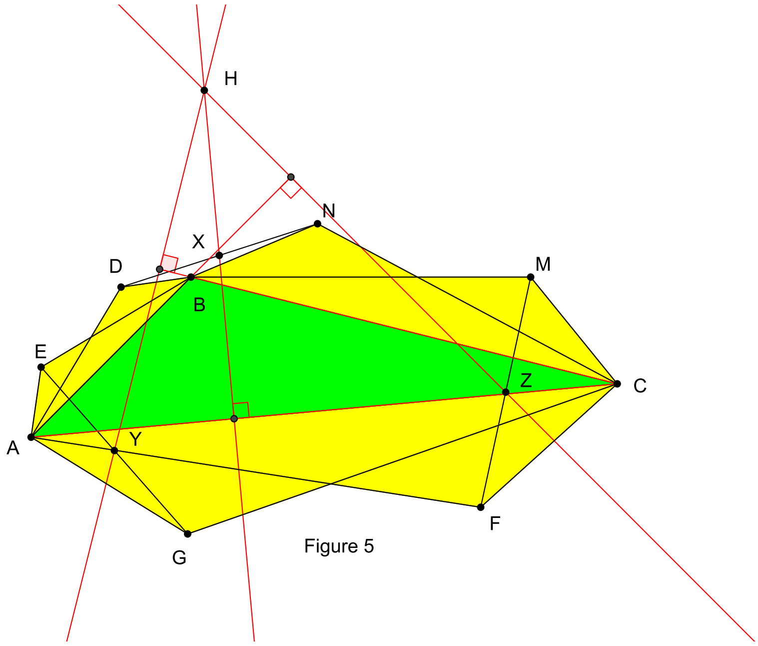

Figure 5

Theorem 2.6. *Given a triangle ABC. Six arbitrary triangles ABD, BAE, CBN, BCM, ACF, CAG are constructed on three sides having the same orientation (outer or inner orientation). Then three lines passing through the midpoints of ND, MF, GE perpendicularly to ND, MF, GE respectively are concurrent.*

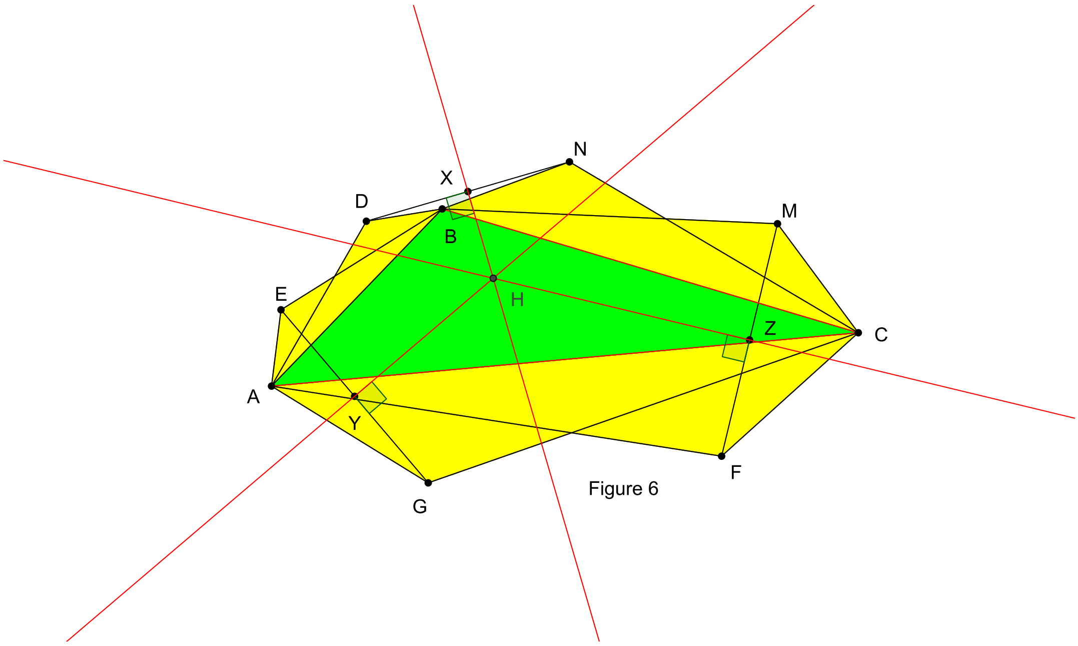

Figure 6

Theorem 2.7. *Given a triangle ABC. Six arbitrary triangles ABD, BAE, CBN, BCM, ACF, CAG are constructed on three sides having the same orientation (outer or inner orientation). Then three lines passing through B, C, A perpendicularly to ND, MF, GE respectively are concurrent.*

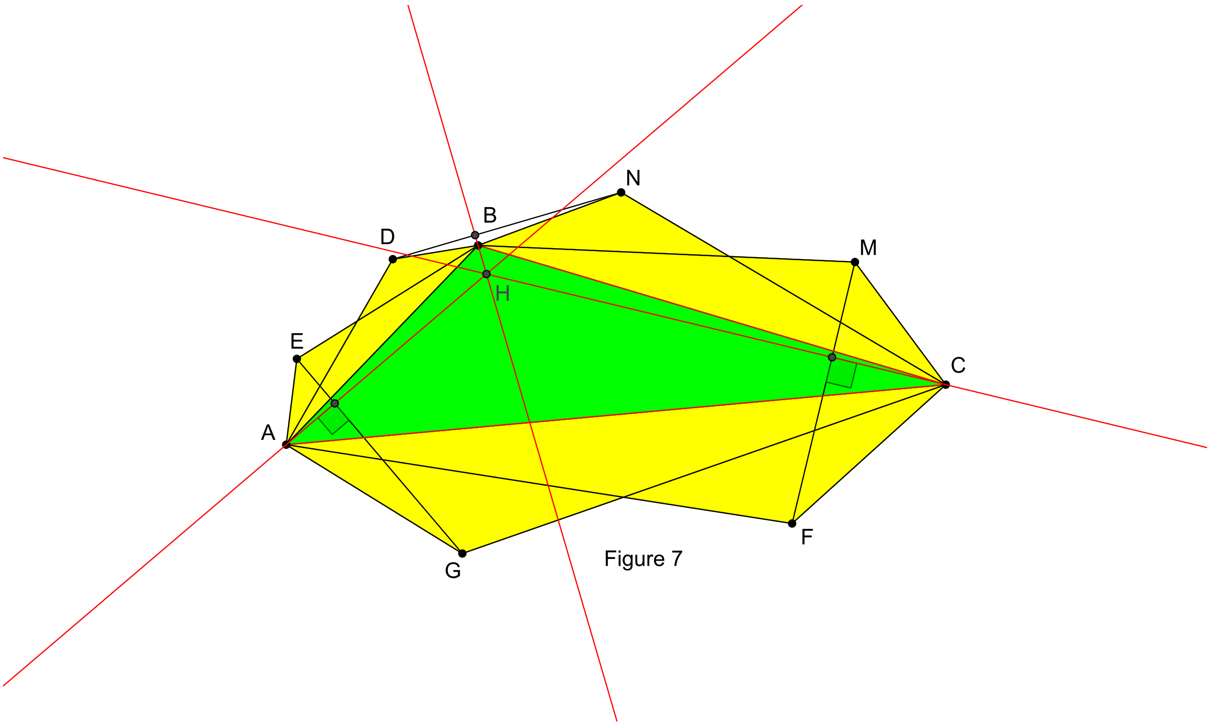

Figure 7

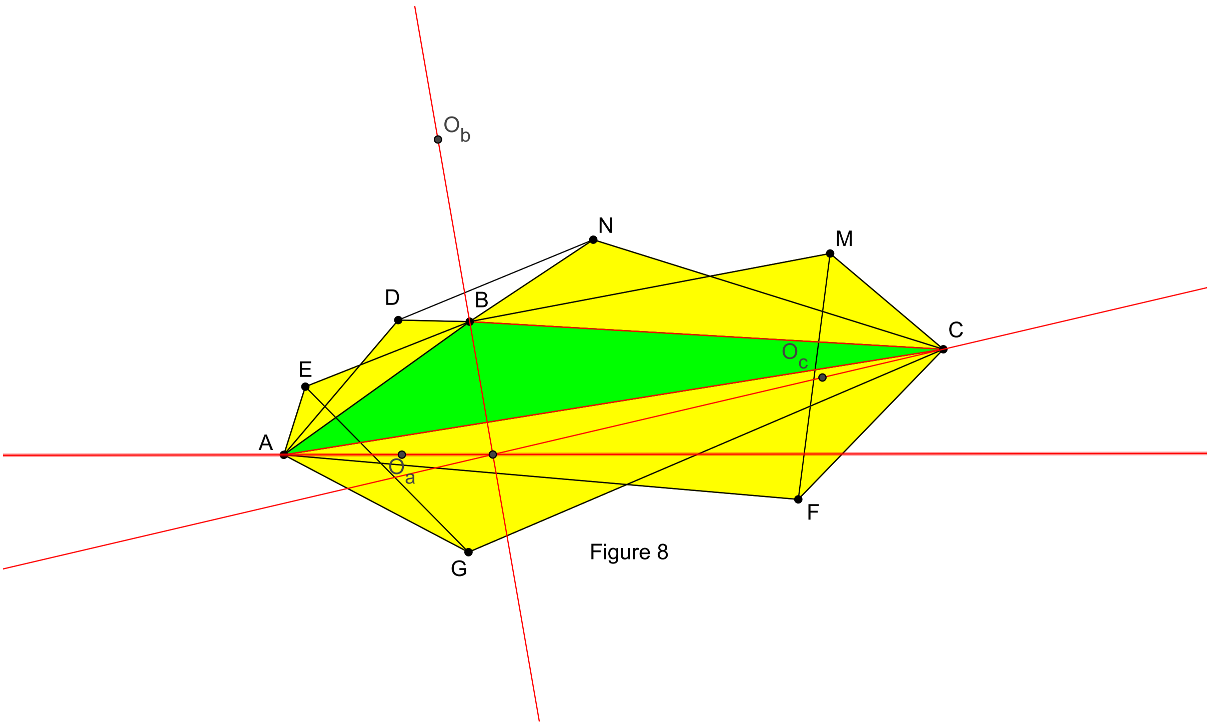

Figure 8

Theorem 2.8. *Given a triangle ABC. Six arbitrary triangles $ABD, BAE, CBN,$ BCM, ACF, CAG are constructed on three sides having the same orientation* *(outer or inner orientation). Then three lines passing through B, C, A and the circumcenter of triangles BND, AEG, CFM respectively are concurrent.*

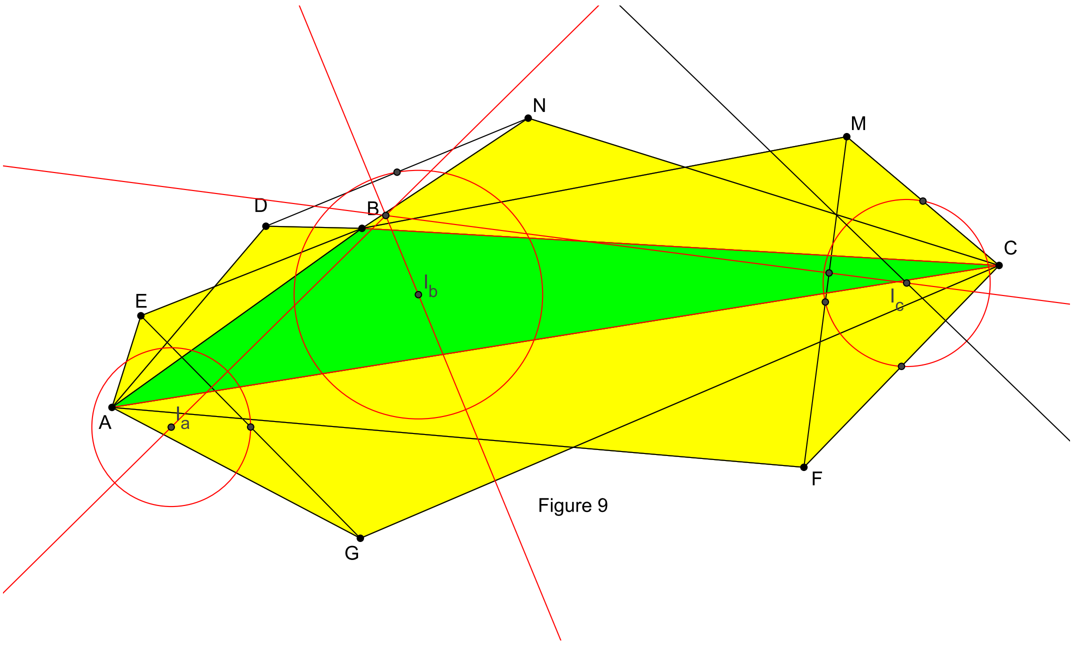

Figure 9

Theorem 2.9. *Given a triangle ABC. Six arbitrary triangles $ABD, BAE, CBN, BCM, ACF, CAG$ are constructed on three sides having the same orientation (outer or inner orientation). Then three lines passing through the nine-point centers of triangles BND, AEG, CFM respectively perpendicularly to ND, EG, FM are concurrent.*

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