

Elementary triangle geometry

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$$z := x + i \cdot y$$

$$\text{Points} := \begin{cases} A := 2 + 2.5 \cdot i \\ B := 7 + 3 \cdot i \\ C := 5 + 6 \cdot i \end{cases}$$

$$\text{Sides} := \begin{cases} a := gL(B, C) \\ b := gL(A, C) \\ c := gL(A, B) \end{cases}$$

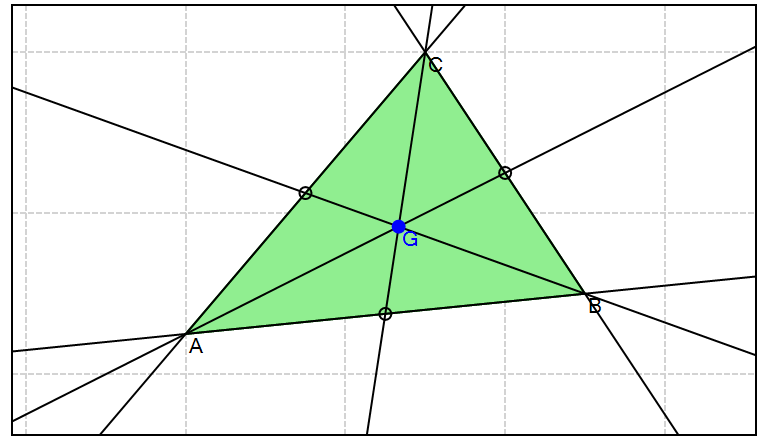
$$\text{MP} := \begin{cases} M_{AB} := 0.5 \cdot (A + B) \\ M_{BC} := 0.5 \cdot (B + C) \\ M_{AC} := 0.5 \cdot (A + C) \end{cases}$$

$$\text{Tr} := \begin{cases} \left[\left[\text{stack}(\text{"polygon"}, [z2xy(\text{Points})], \text{"green"}, \text{"solid"}, 1, \text{"lightgreen"}) \right] \right] \\ \text{eval} \left(\text{augment} \left(z2xy(\text{Points}), [\text{"A"} \text{"B"} \text{"C"}]^T, 8, \text{"black"} \right) \right) \end{cases}$$

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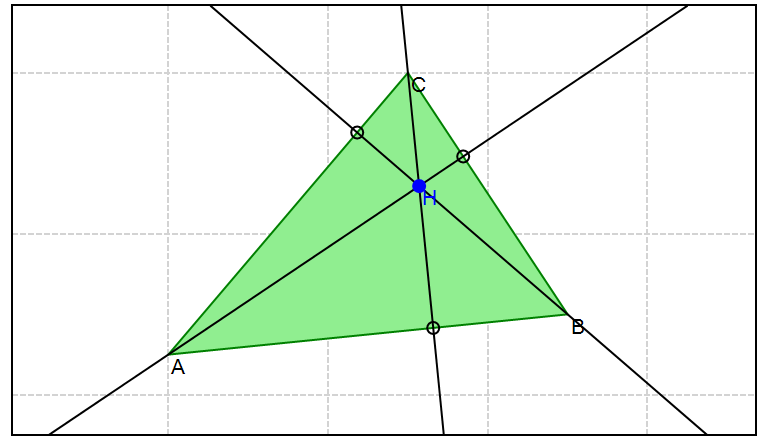
Centroid and medians

$$\begin{aligned} m_l &:= \begin{cases} m_a := gL(M_{AB}, C) \\ m_b := gL(M_{BC}, A) \\ m_c := gL(M_{AC}, B) \end{cases} \\ G &:= \text{eval}(g\cap(m_a, m_b)) \end{aligned}$$



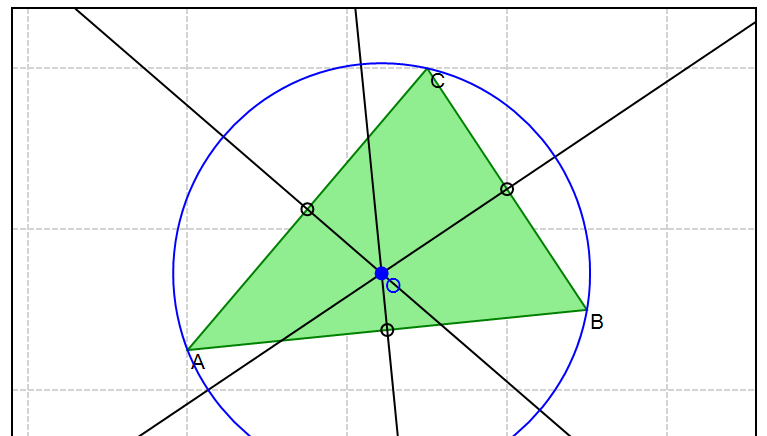
Orthocenter and altitudes

$$\begin{aligned} h_l &:= \begin{cases} h_a := g\perp(a, A) \\ h_b := g\perp(b, B) \\ h_c := g\perp(c, C) \end{cases} \\ H &:= \text{eval}(g\cap(h_a, h_b)) \\ HP &:= \begin{cases} H_a := \text{eval}(g\cap(a, h_a)) \\ H_b := \text{eval}(g\cap(b, h_b)) \\ H_c := \text{eval}(g\cap(c, h_c)) \end{cases} \end{aligned}$$



Circumcenter and perp. bisect.

$$\begin{aligned} \mu_l &:= \begin{cases} \mu_a := g\perp(a, M_{BC}) \\ \mu_b := g\perp(b, M_{AC}) \\ \mu_c := g\perp(c, M_{AB}) \end{cases} \\ O &:= \text{eval}(g\cap(\mu_a, \mu_b)) \\ C_O &:= |O - z| - |O - A| \end{aligned}$$

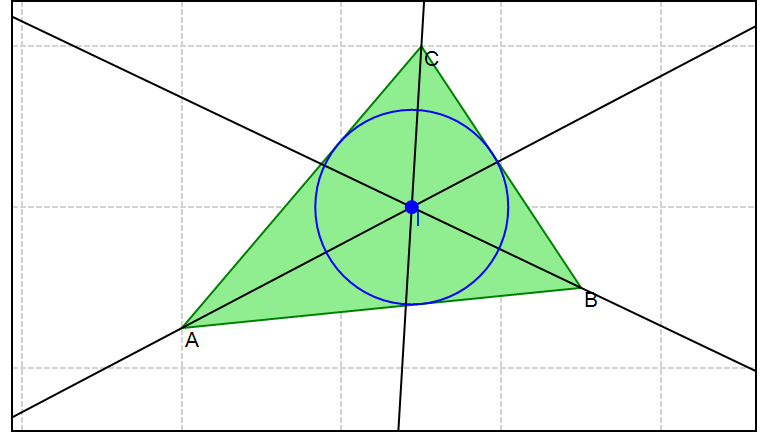


Incenter and angle bisect.

$$\beta_I := \begin{cases} \beta_A := g\beta(b, c) \\ \beta_B := g\beta(a, -c) \\ \beta_C := g\beta(a, b) \end{cases}$$

$$I := \text{eval} \left(g\cap \left(\beta_A, \beta_B \right) \right)$$

$$C_I := |I - z| - |g\delta(a, I)|$$



Excenters and ext. angle bisection.

$$\beta'_I := \begin{cases} \beta'_A := g\beta(b, -c) \\ \beta'_B := g\beta(a, c) \\ \beta'_C := g\beta(a, -b) \end{cases}$$

$$I_A := \text{eval} \left(g\cap \left(\beta'_B, \beta'_C \right) \right)$$

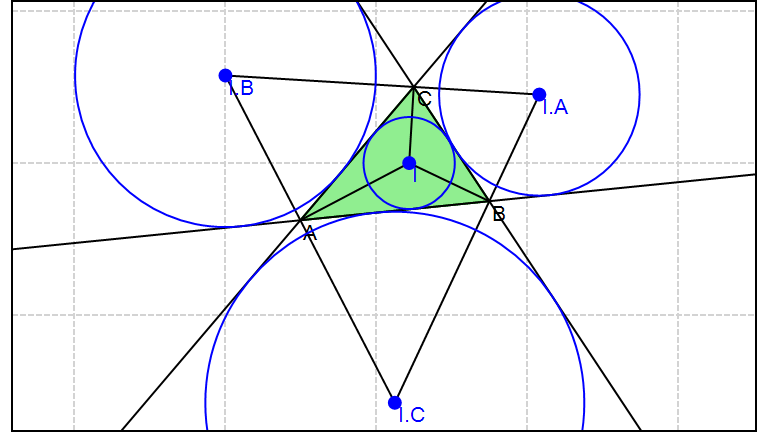
$$C_A := |I_A - z| - |g\delta(a, I_A)|$$

$$I_B := \text{eval} \left(g\cap \left(\beta'_A, \beta'_C \right) \right)$$

$$C_B := |I_B - z| - |g\delta(b, I_B)|$$

$$I_C := \text{eval} \left(g\cap \left(\beta'_A, \beta'_B \right) \right)$$

$$C_C := |I_C - z| - |g\delta(c, I_C)|$$

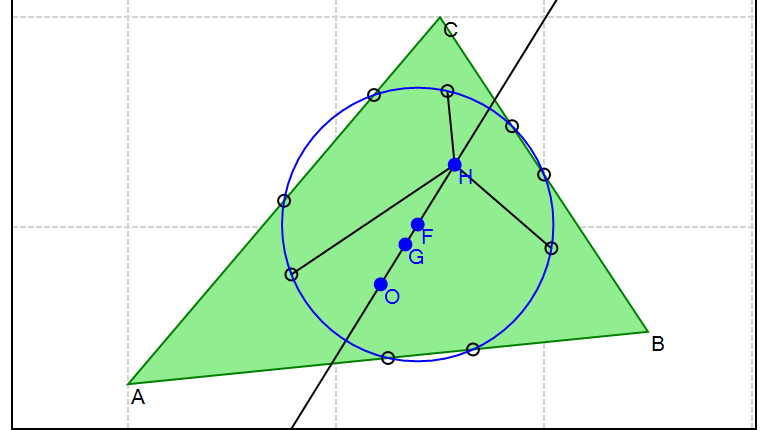


Euler Line & Feuerbach's circle

$$\varepsilon := gL(O, H)$$

$$MH := \begin{cases} M_{AH} := \text{eval}(0.5 \cdot (A + H)) \\ M_{BH} := \text{eval}(0.5 \cdot (B + H)) \\ M_{CH} := \text{eval}(0.5 \cdot (C + H)) \end{cases}$$

$$[F \ r_F] := \text{eval} \left(gC \left(M_{AH}, M_{BH}, M_{CH} \right) \right)$$



- Triangle

Sides

Mid Points

Medians

Centroid

Altitudes

Orthocenter

Altitudes foots

Perp. Bisectors

Circumcenter

Incenter

Ext. A. Bisec.

Euler Line

Feuerbach's C.
- The diagram shows a triangle with vertices labeled A, B, and C. The interior of the triangle is shaded in light green. Several geometric elements are plotted: the three sides of the triangle; the midpoints of each side, marked with small open circles; the medians, which are lines connecting each vertex to the midpoint of the opposite side; the altitudes, which are perpendicular lines from each vertex to the opposite side; the orthocenter (H), the intersection of the altitudes; the circumcenter (O), the intersection of the perpendicular bisectors; the incenter (I), the intersection of the angle bisectors; and the Euler line, which passes through H, G (the centroid), and O. The circumcircle is shown as a blue circle passing through the vertices. The incircle is shown as a smaller blue circle tangent to the sides. The Feuerbach circle is shown as a small blue circle tangent to the sides of the triangle. The diagram is set against a light gray grid.
- Alvaro
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