Geometry for fun

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Figure 1: My avatar :D

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1 Exercise 001

1.1 Problem

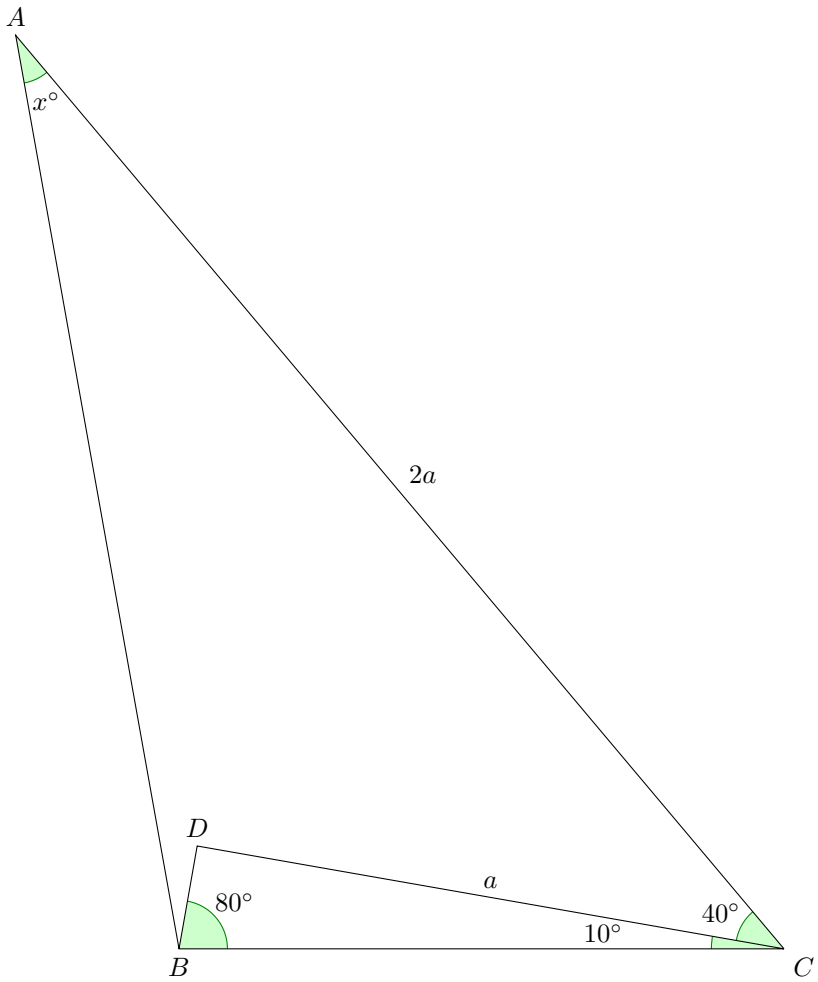

Figure 2: $\overline{DC} = a; \overline{AC} = 2a; \angle C\hat{B}D = 80°; \angle A\hat{C}D = 40°; \angle B\hat{C}D = 10°; \angle B\hat{A}C =?$

1.2 Solution 1

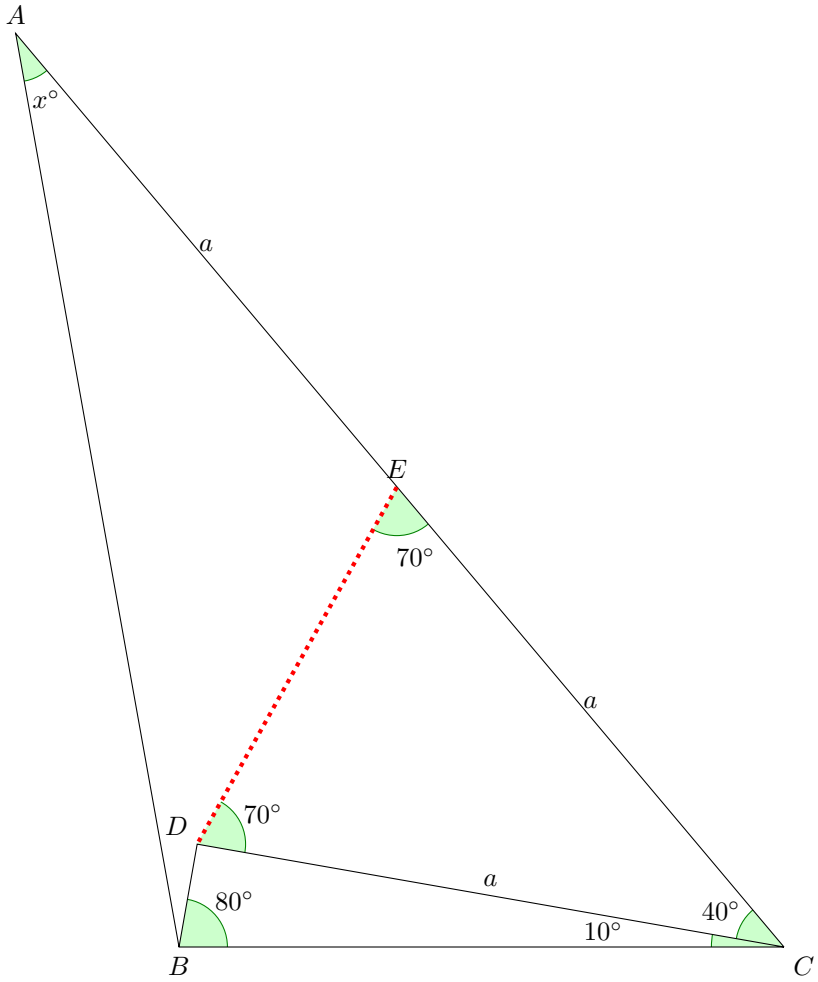

Figure 3: $\overline{CE} = \overline{CD} = \overline{AE} = a; \angle C\hat{E}D = \angle C\hat{D}E = 70°$

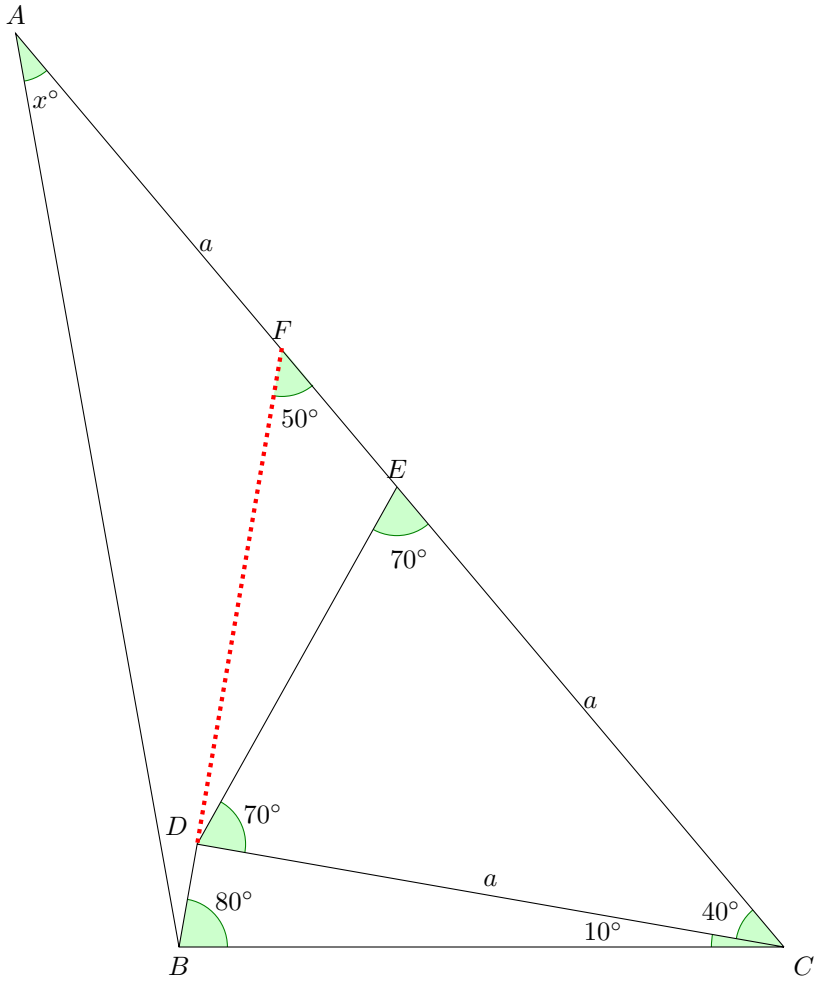

Figure 4: $\angle D\hat{E}C = 50°; \overline{BF} = \overline{BC}$

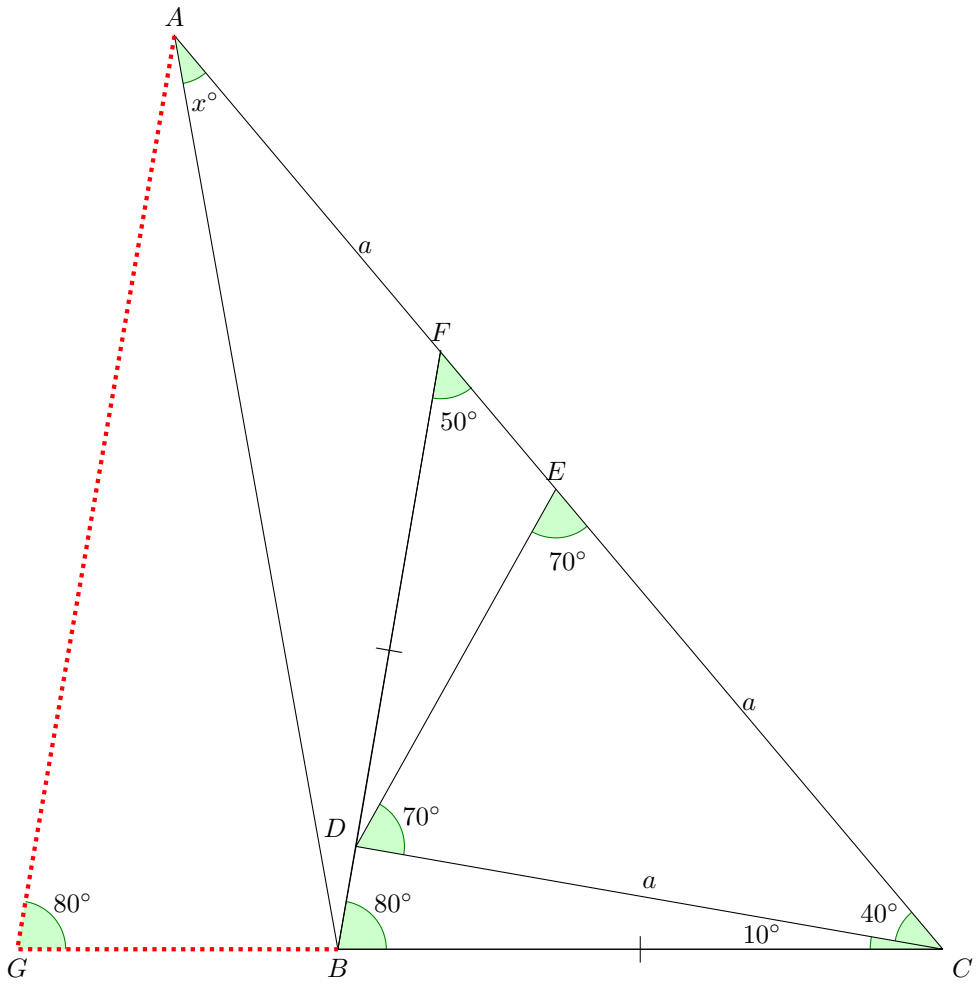

Figure 5: $\overline{GA}//\overline{BF}; \angle B\hat{G}A = \angle F\hat{B}C = 80°; \overline{AG} = \overline{CG}; \triangle FBC \approx \triangle AGC$

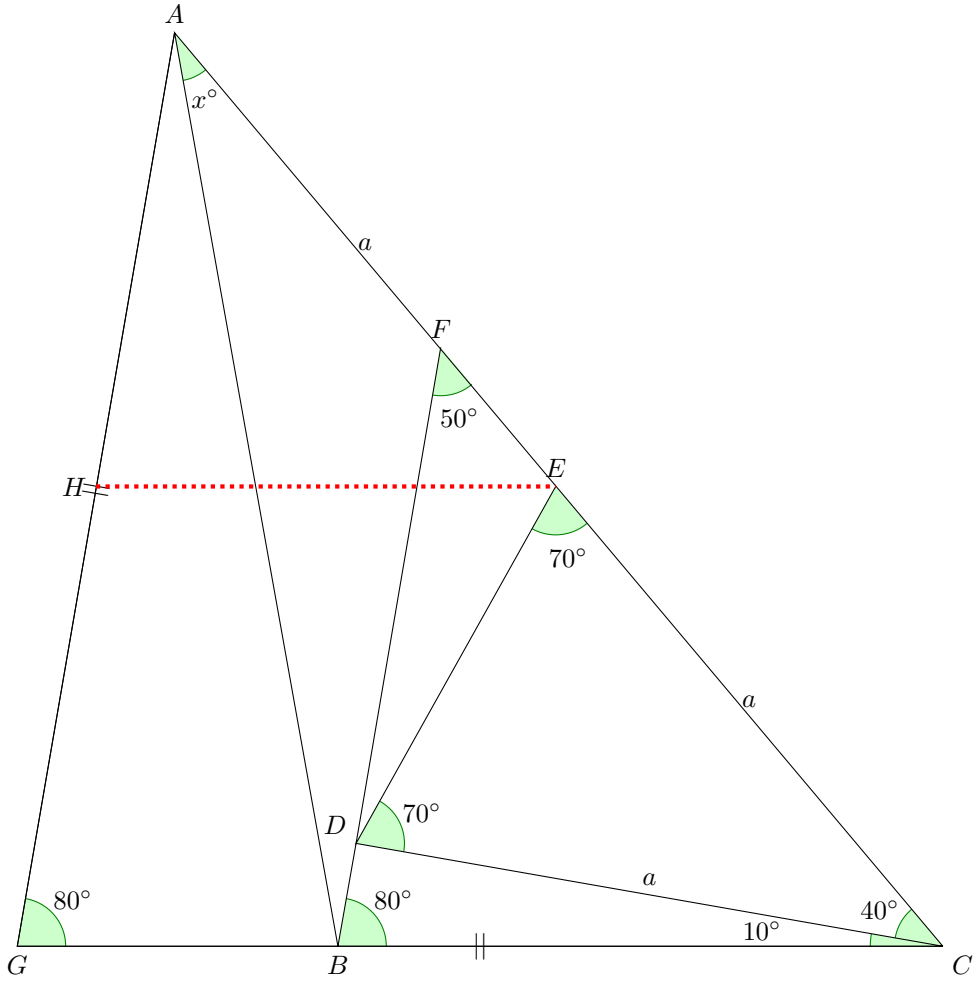

Figure 6: $\overline{HE}//\overline{GC}; \angle A\hat{H}E = 80°; H\hat{A}E = H\hat{E}A = 50°; \overline{GH} = \overline{HE} = \overline{HA}$

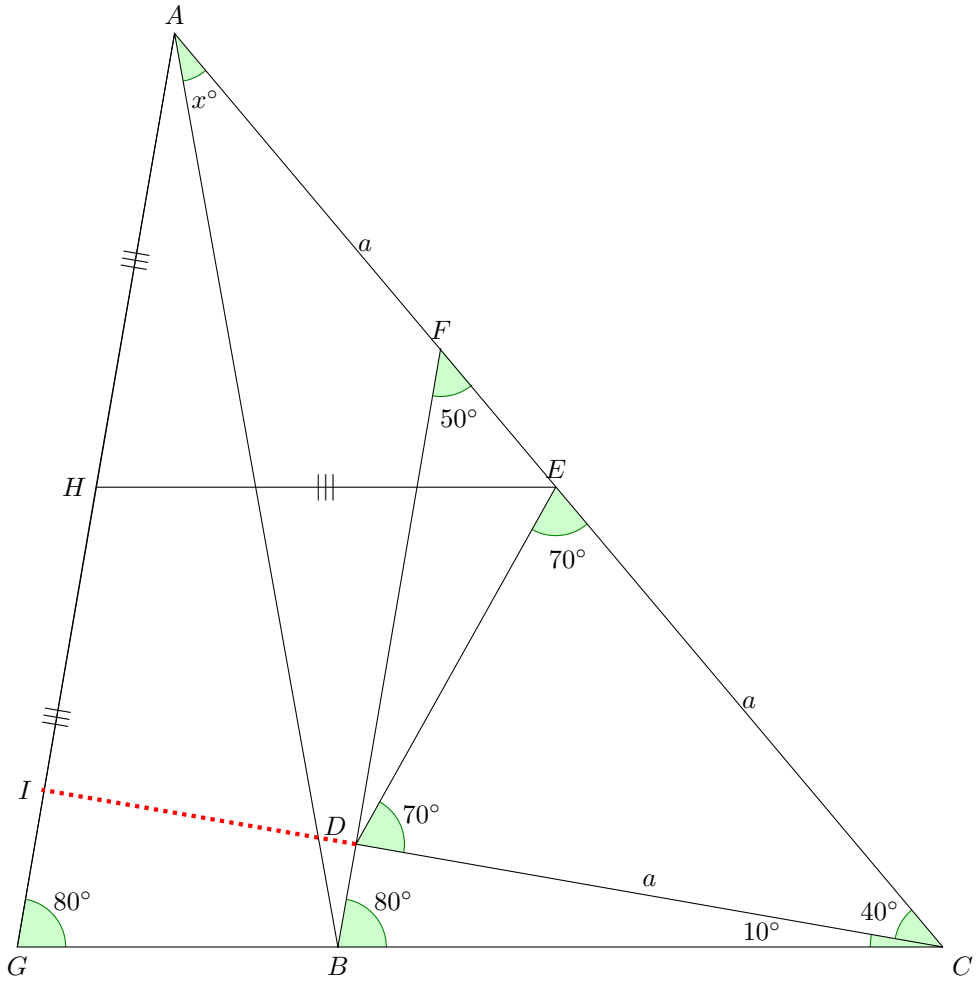

Figure 7: $\angle G\hat{I}C = \angle B\hat{D}C = 90°$

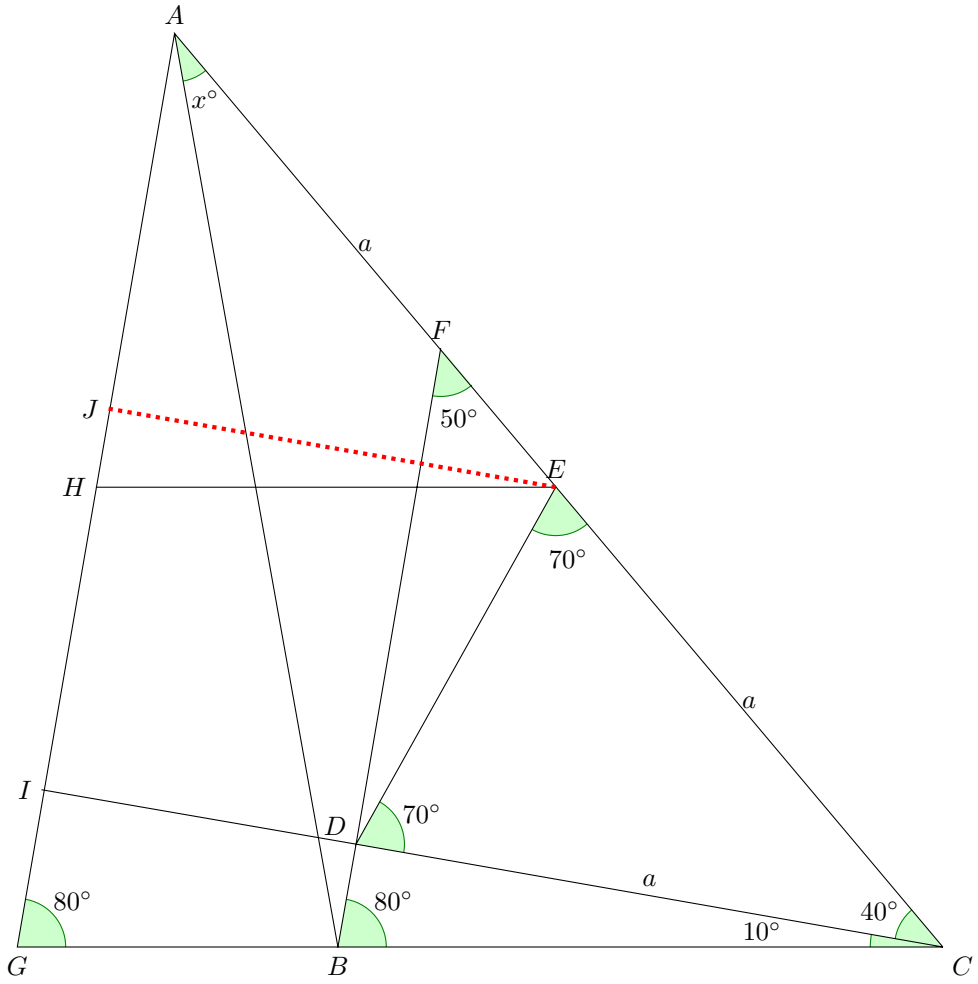

Figure 8: $\triangle HJE \approx \triangle BDC$

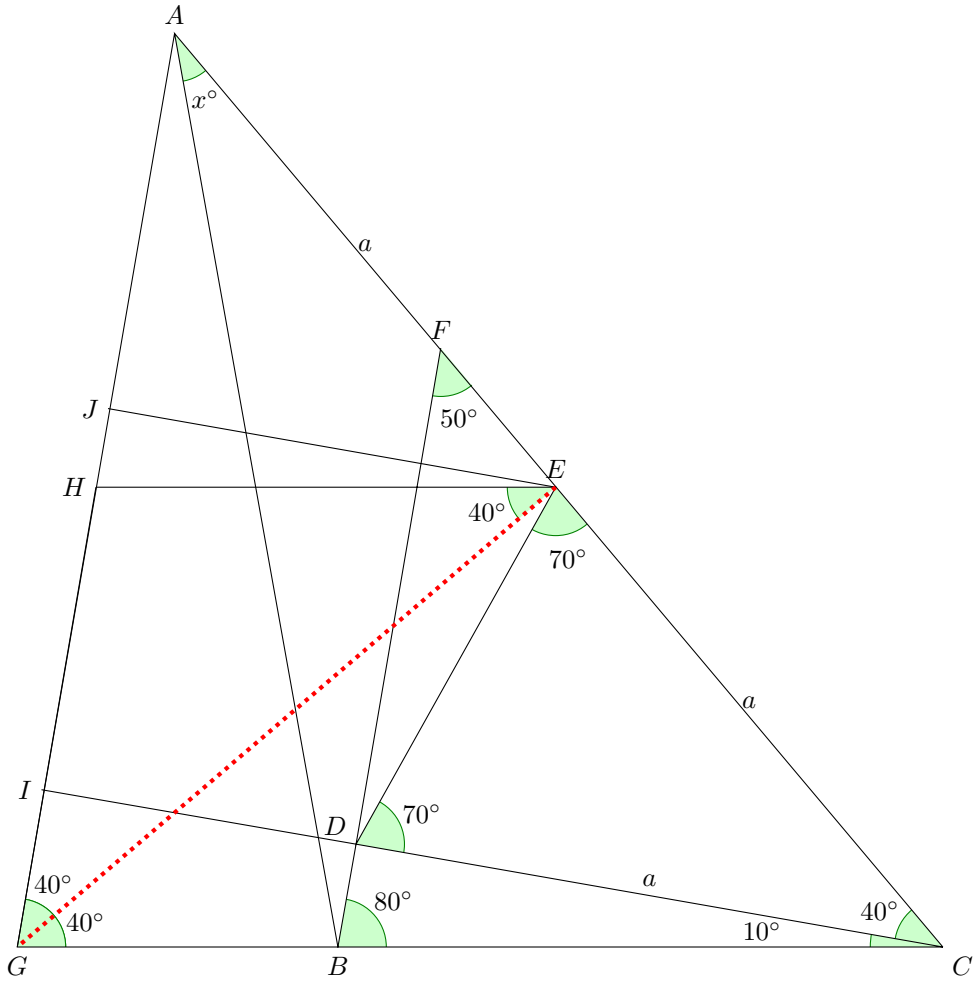

Figure 9: $\overline{GH} = \overline{HE} \therefore \angle H\hat{G}E = \angle H\hat{E}G = 40°$

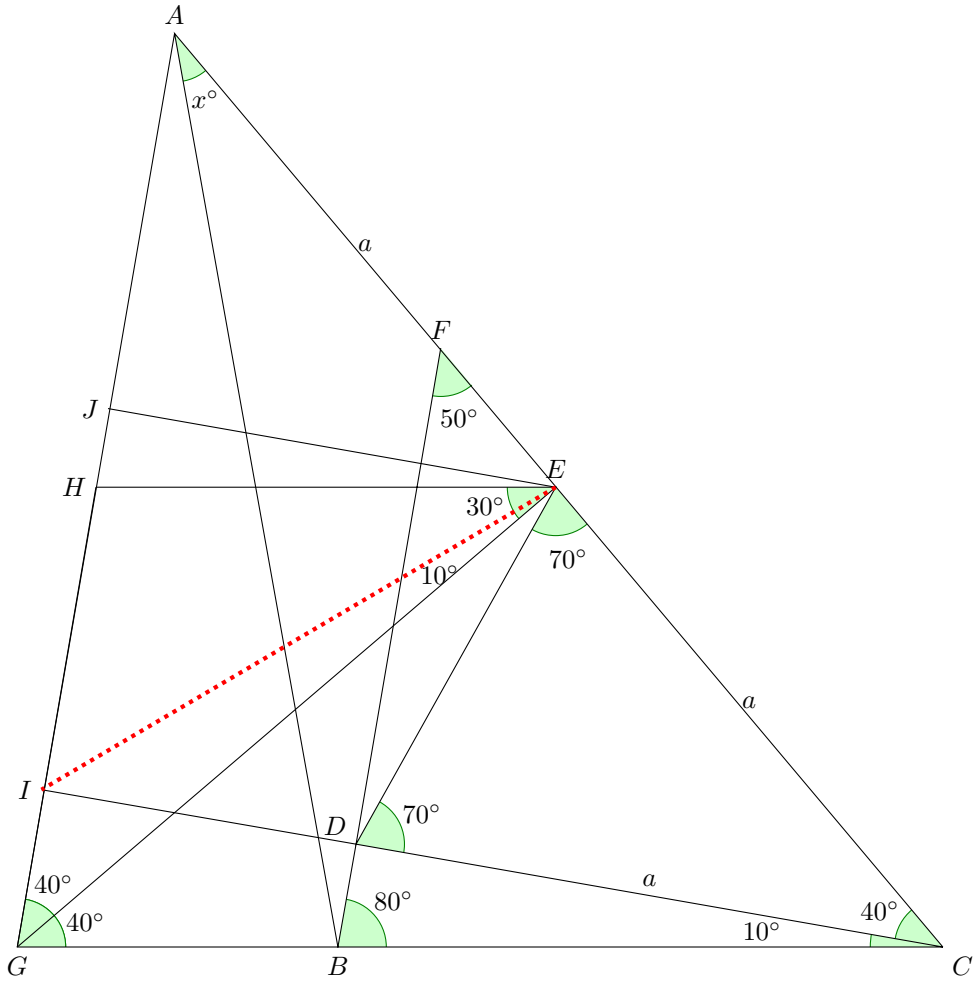

Figure 10: $\overline{AE} = \overline{IE} = \overline{EC}$

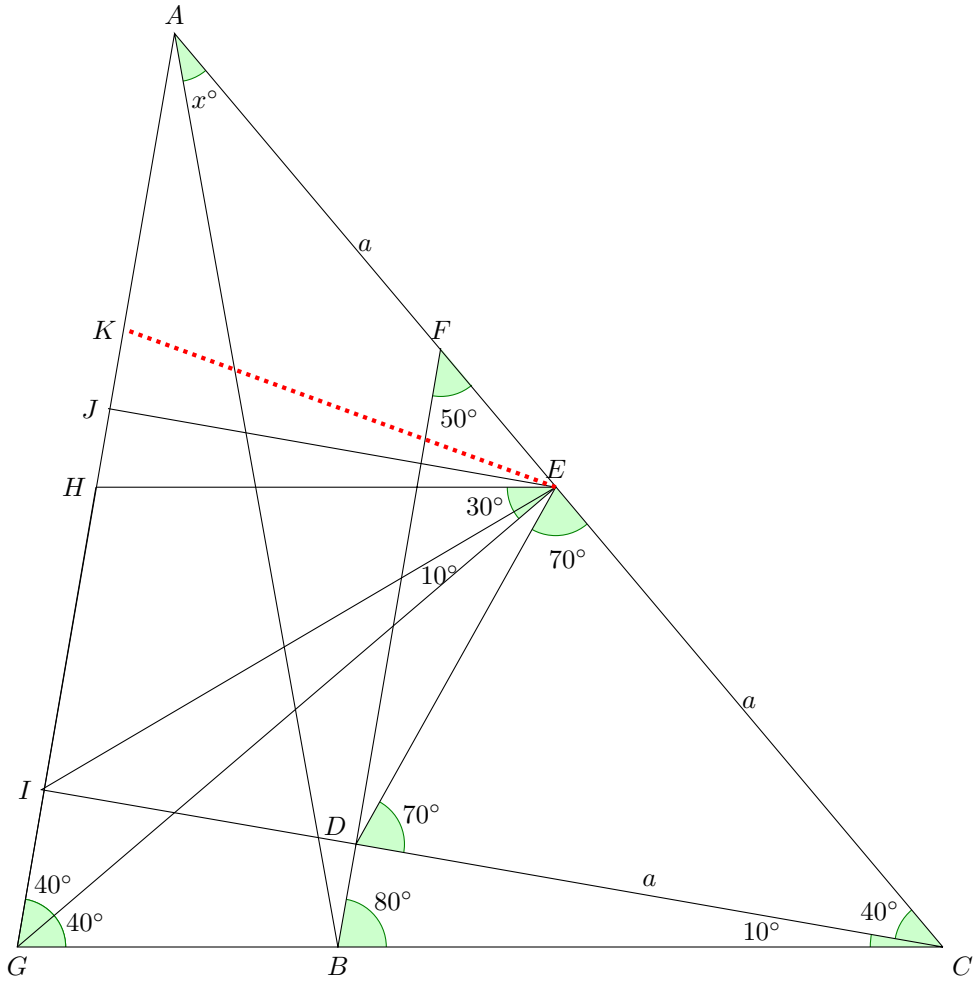

Figure 11: $\triangle HJE \equiv \triangle KJE; \triangle KIE \approx \triangle BCF$

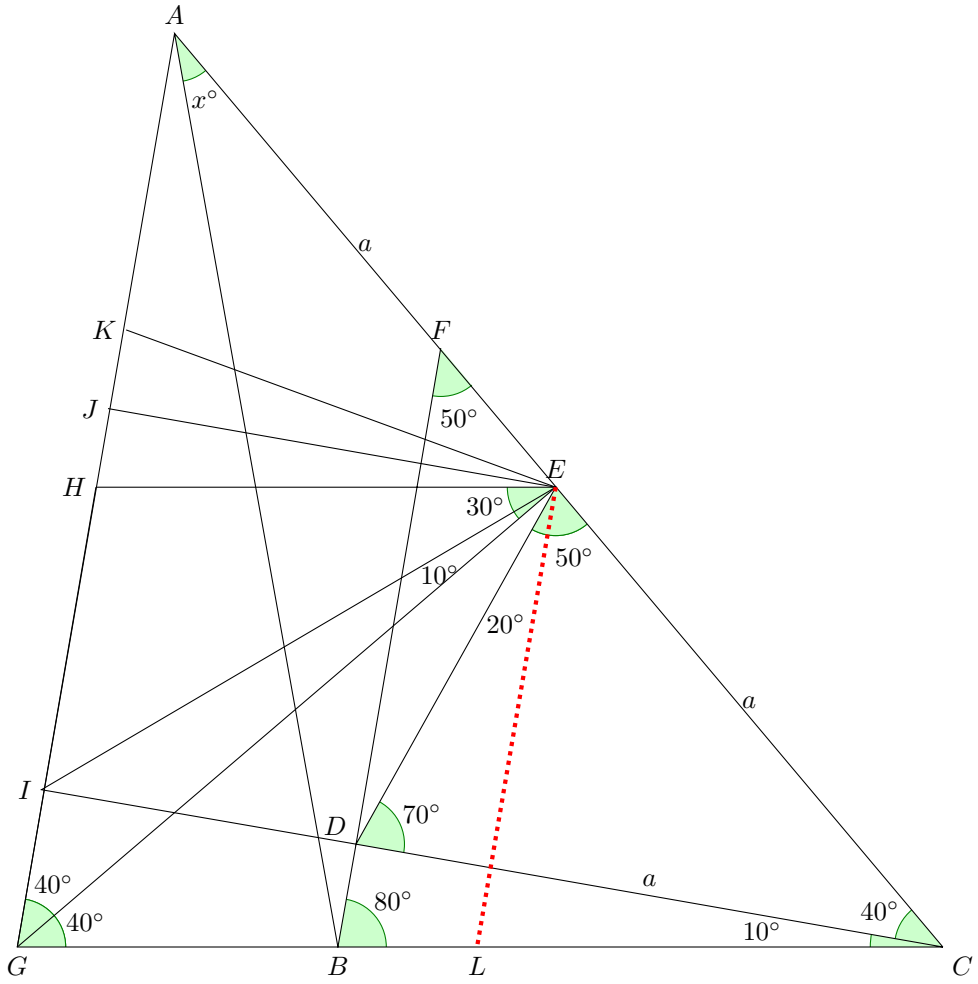

Figure 12: $\triangle HJE \equiv \triangle KJE; \triangle KIE \approx \triangle BCF$

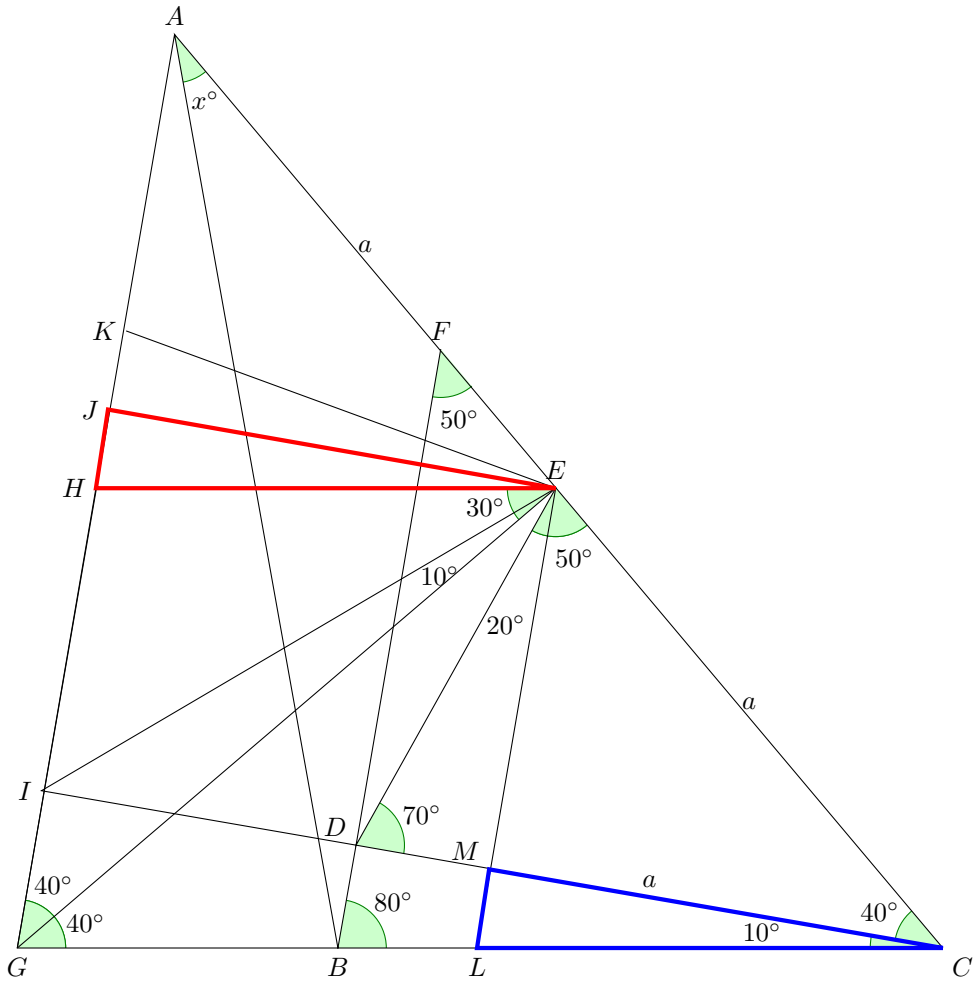

Figure 13: $\overline{JH} = \overline{ML} = \overline{KJ} = \frac{\overline{IG}}{2} \therefore \overline{KH} = \overline{ML}$

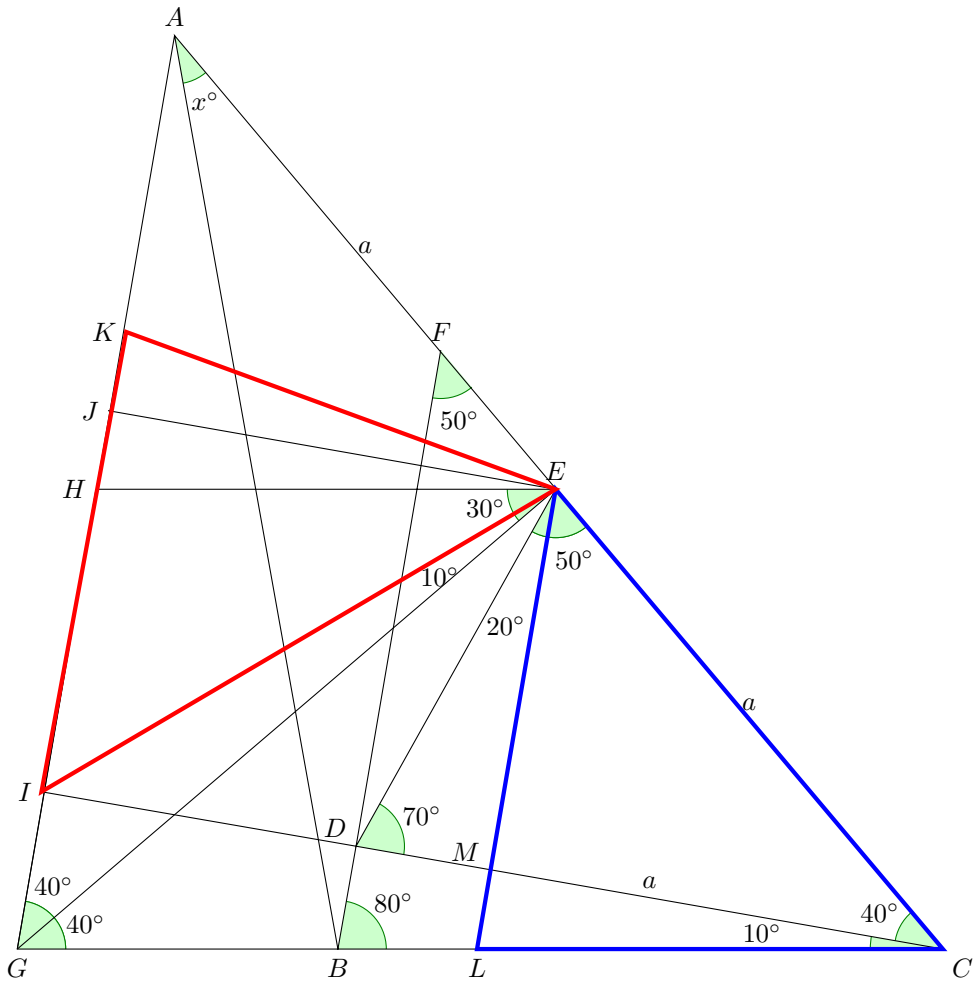

Figure 14: $\overline{AG}//\overline{EL} \therefore \overline{AG} = 2\overline{EL}; \overline{KI} = \overline{LC}, \overline{KE} = \overline{LE}, \angle K\hat{I}E = \angle L\hat{C}E = 50° \therefore \triangle KIE \equiv \triangle LCE$

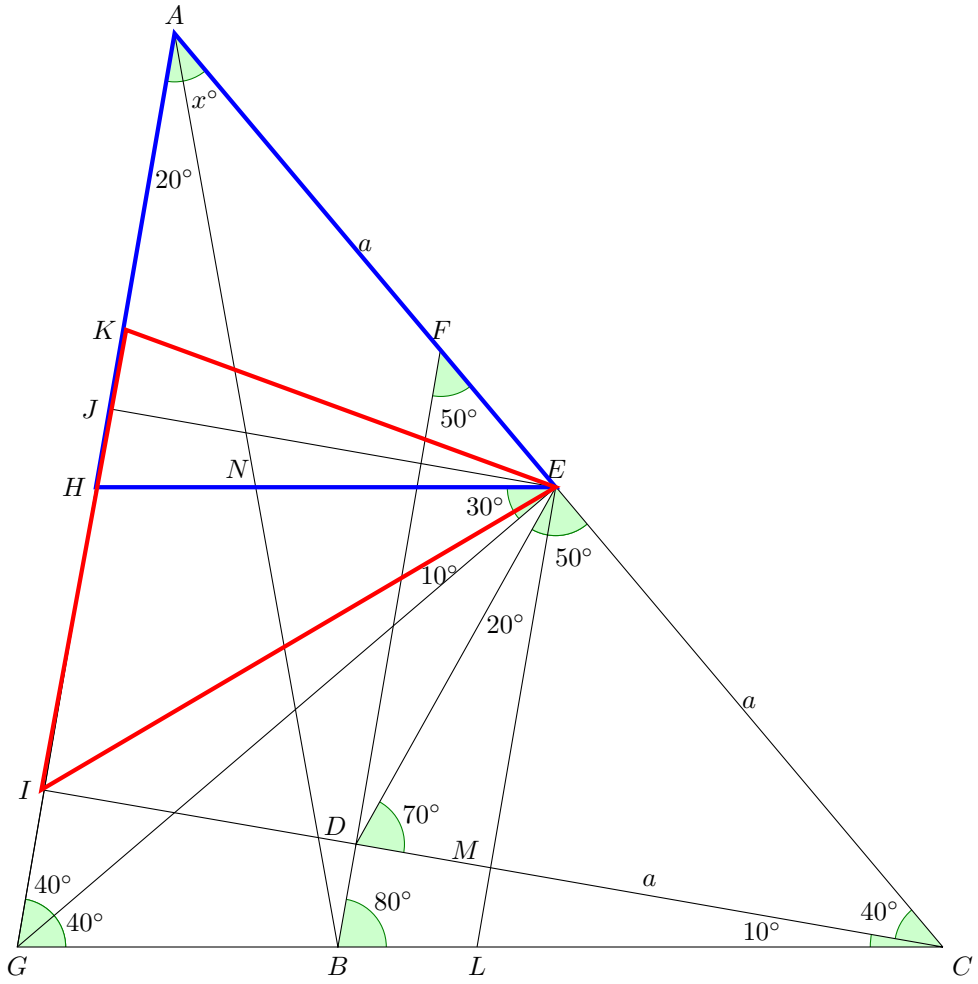

Figure 15: $\triangle KIE \equiv \triangle HEA \therefore \overline{AH} = \overline{AM} \therefore \angle G\hat{A}B = 20° \therefore \angle B\hat{A}C = 30°$