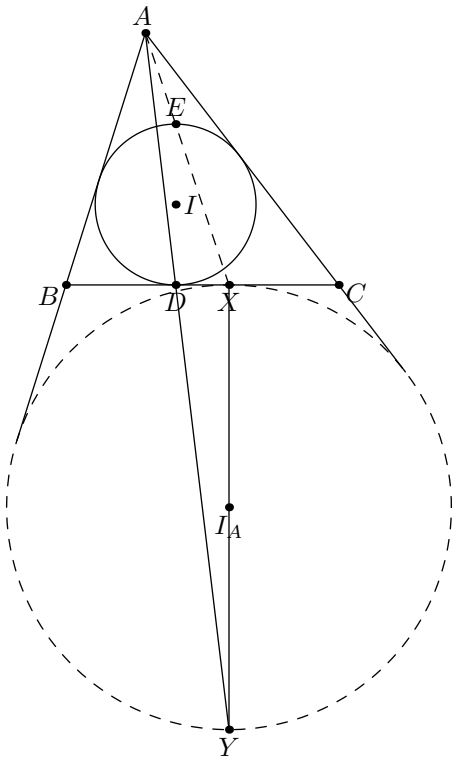
Lemma 4.10 (Diameter of the Excircle). *In the notation of Lemma 4.9, suppose $\overline{XY}$ is a diameter of the A-excircle. Show that D lies on $\overline{AY}$.*

Solution Our solution is based off the following lemma.

Lemma. Let (ABC) be a triangle whose incircle is tangent to $\overline{BC}$ at D. If $\overline{DE}$ is a diameter of incircle and ray AE meets $\overline{BC}$ at X, then X is the tangency point of the A-excircle to $\overline{BC}$.



Proof. According to the lemma, the homothety centered at A, sends E to X. So it also sends diameter ED to diameter XY. This tells us D lies on $\overline{AY}$. □