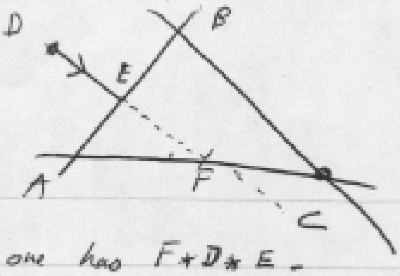
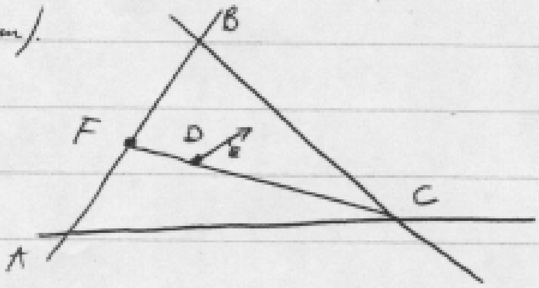
#3 (a) The line $\overleftrightarrow{DE}$ meets AB at E (between A and B), so A and B are on opposite sides of $\overleftrightarrow{DE}$. Thus C must be on an opposite side of one of these 2 pts, say A, so $\overleftrightarrow{DE}$ intersects AC at F. Now F must be on ray $\overrightarrow{DE}$: if not, then one has $F*D*E$.



Since D is outside the triangle it must be on an opposite side of one vertex to ~~an~~ a side. Say D and C are on opposite sides of $\overleftrightarrow{AB}$: then F is on same side as C, thus D and F are opposite (this rules out $F*D*E$). The 2 other cases are similar.

(b) Consider $\overleftrightarrow{CD}$: it cuts AB at F ("crossbar" thm). Now if ray $\overrightarrow{DE}$ doesn't intersect any side, that would mean that all pts A, B, C (and therefore F) are on the same side of $\overleftrightarrow{DE}$ (absurd: one has $F*D*C$).



#4 Take 2 pts on such a line: the ray formed must hit one side (exercise 3b). Thus the line can't be contained in the interior.

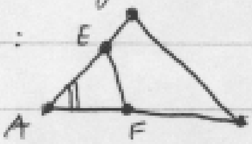
#5 Useful lemma: if S convex, T convex then $S \cap T$ is convex. (easy proof).

Now: convexity of a half-plane: if A, B are on same side of a line ℓ, assume there is a pt E between A and B that is on the other side: then AE must cross the line $\Rightarrow$ A and B are on opposite sides (absurd).

Now the interior of an angle is convex (because it's the intersection of 2 half-planes).

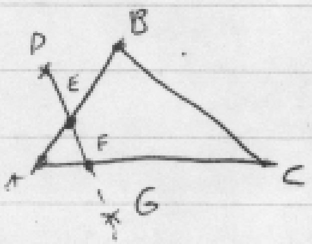
——— a triangle ——— (——— 3 interiors of angles).

. A triangle is not convex:



we proved in class that pts between E and F are in the interior of angle $\hat{A}$ (so they are not on triangle).

. Exterior is not convex:



From D, pick a ray hitting AB, it must exit somewhere (exercise 3) at F, then pick pt G so that ~~DEFG~~ $D*F*G$.