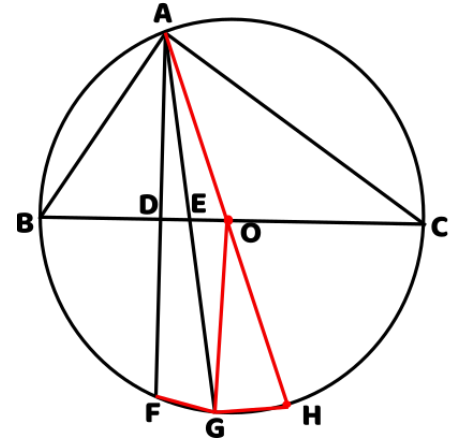


Author's Solution for Cash Award Question of Jan-2025

Construction:

Mark O the circumcentre on BC (midpoint of BC).
Draw diameter AH through O. Join GF & GH.



Proof:

$$\angle OAG = \angle OGA \quad (\because OA = OG) \quad \text{-----(1)}$$

G is the midpoint of arc BC.

$$\Rightarrow OG \perp BC$$

$$\Rightarrow \angle FAG = \angle OGA \quad (AF \parallel OG) \quad \text{-----(2)}$$

(1) & (2) \rightarrow AG is the angle bisector of $\angle FAH$

\therefore As per extended angle bisector theorem,

(Please see page No: 66 of the book Advanced Theorems on Geometry available in this site)

Considering $\triangle AFH$,

$$AG^2 = (AF \times AH) + FG^2 \quad \text{-----(3)}$$

$$(AF \times AH) = (AF \times BC) \quad (BC = AH) \quad \text{----(4)}$$

$$(3) \text{ \& } (4) \rightarrow AG^2 = (AF \times BC) + FG^2 \quad \text{----- Proved}$$

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