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Orthocentre

$AH = 2R\cos A$

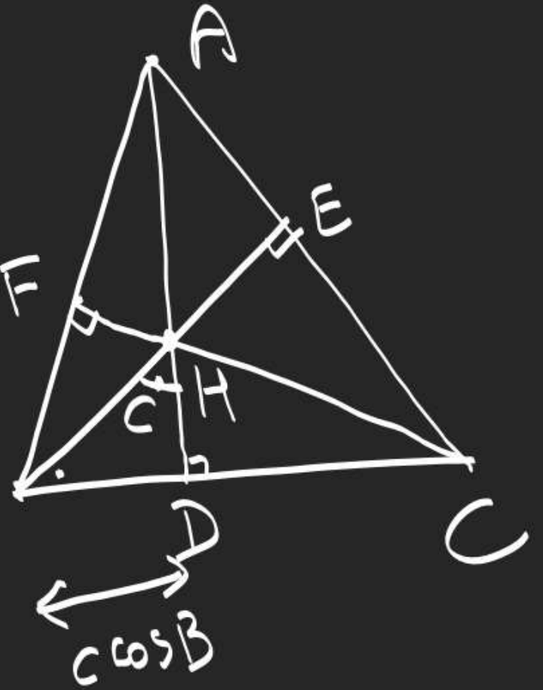
$BH = 2R\cos B$

$CH = 2R\cos C$

$HF = 2R\cos A\cos B$

$HD = 2R\cos B\cos C$

$HE = 2R\cos A\cos C$



HA, HB, HC

HD, HE, HF

ΔBHD

$BH = \frac{BD}{\sin C}$

$= \frac{C\cos B}{\sin C}$

$= 2R\cos B$

$HD = BD\cot C$

$2R\cos B\cos C = \frac{C\cos B\cos C}{\sin C}$

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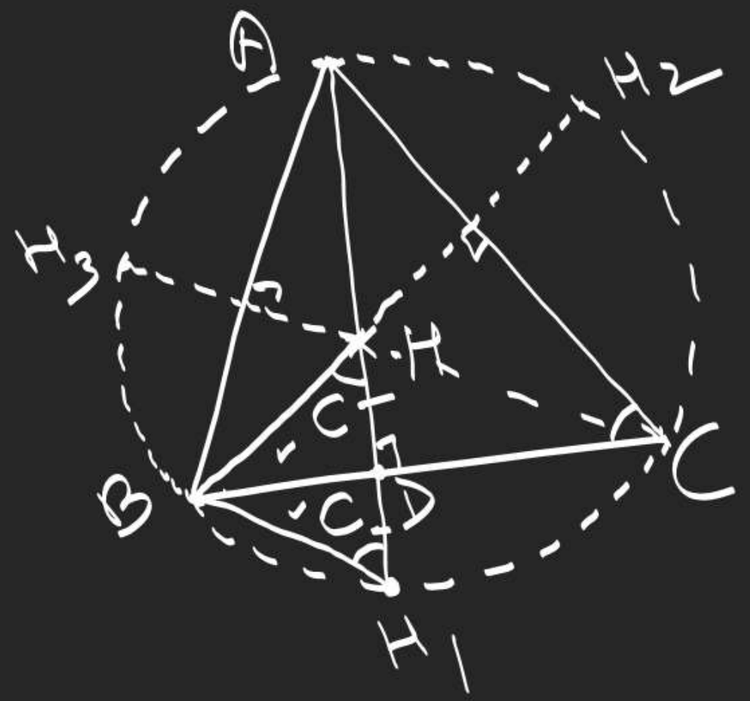
Note →



$HD = DH_1$

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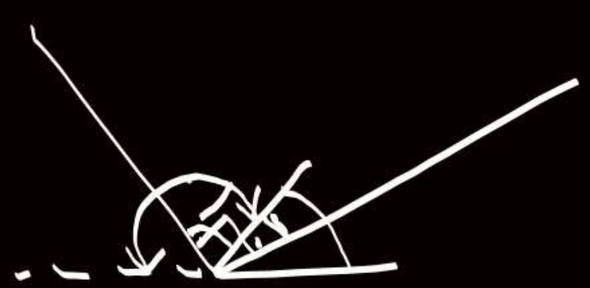

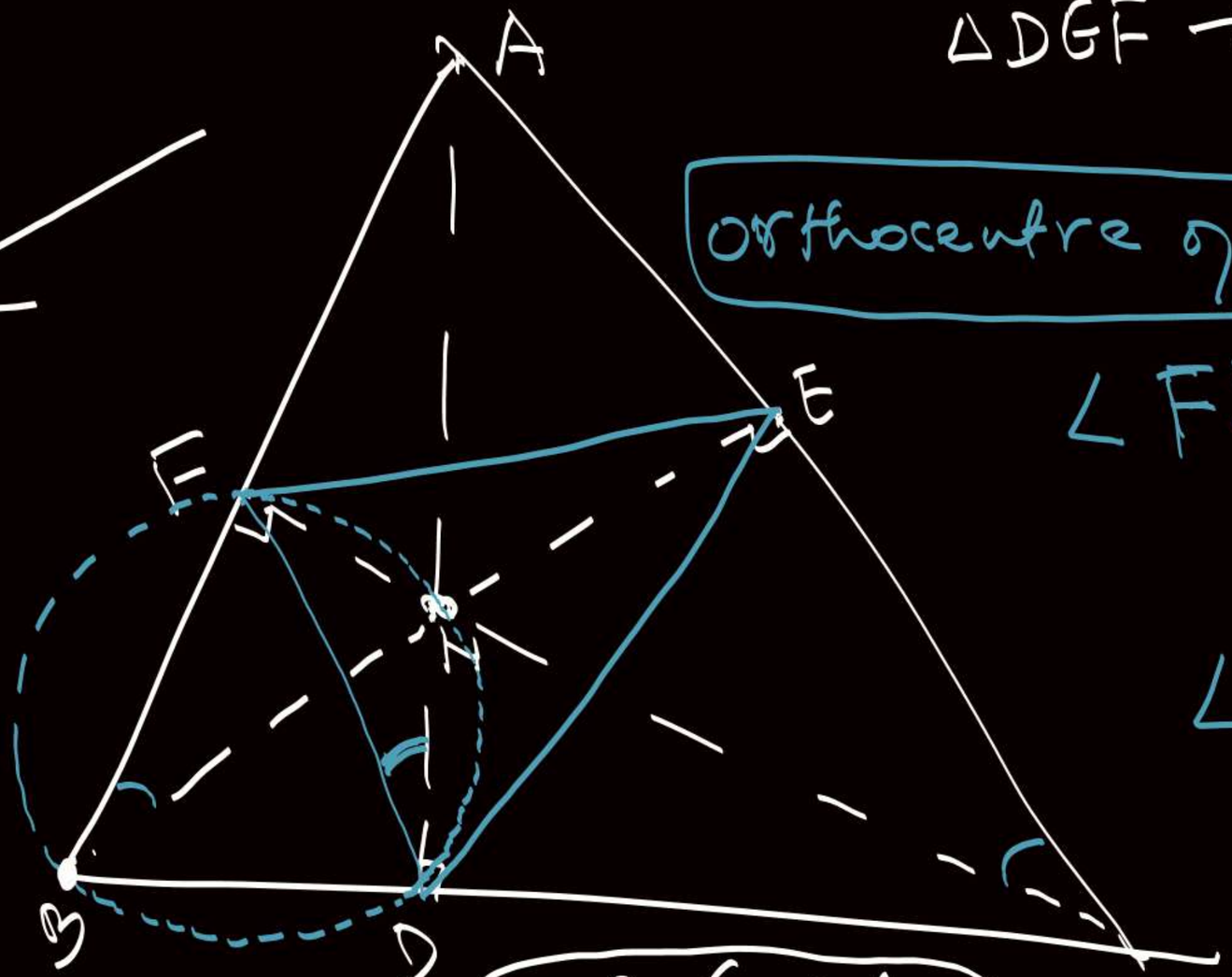

$\triangle DGF \rightarrow$ pedal triangle.

Orthocentre of $\triangle ABC$ = Incentre to $\triangle DEF$

$\angle FDH = \frac{\pi}{2} - A$

$\angle HDE = \frac{\pi}{2} - A$

$\angle D = \pi - 2A$

$\angle E = \pi - 2B$

$\angle F = \pi - 2C$

$ABC \rightarrow$ Excentral triangle for DGF

A, B, C are excentres of $\triangle DEF$

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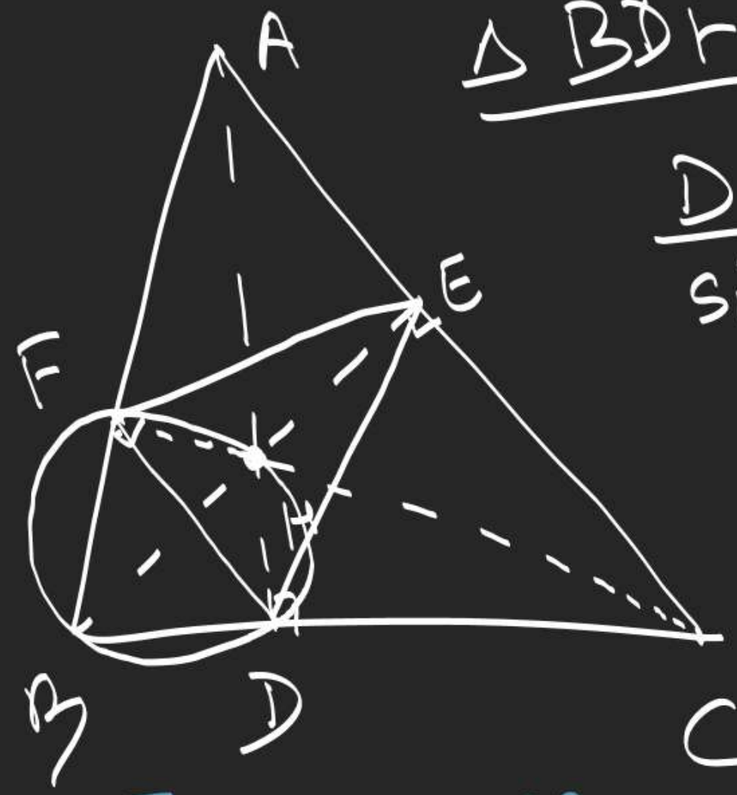

$\triangle BDF$

$$\frac{DF}{\sin B} = 2R_{BDF} = BH$$

$$= 2R\cos B$$

$$DF = R\sin 2B$$

$$DE = R\sin 2C$$

$$EF = R\sin 2A$$

$$2R_{DEF} = \frac{DF}{\sin E} = \frac{R\sin 2B}{\sin(\pi - 2B)} = R$$

$$R_{DEF} = \frac{1}{2}R$$

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Ex → 37

1, 2, 18, 20, 21, 23, 24, 25

S → area of ABC

Ex-36 → 1, 3, 5, 8, 6