

$$ED = 2AE$$

$$\frac{EF}{AF} = ?$$

①

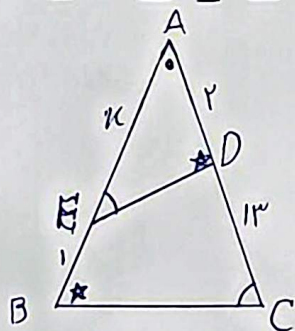
$$\triangle FBC \sim \triangle FAE \Rightarrow \frac{AF}{FC} = \frac{EF}{FB} = k$$

$$\begin{aligned} AC^2 &= AD^2 + CD^2 \sim AC = 3\sqrt{2}k \\ BE^2 &= AB^2 + AE^2 \sim BE = \sqrt{10}k \end{aligned} \Rightarrow \begin{cases} \frac{z}{y} + \frac{nz}{ny} = 3\sqrt{2}k \\ \frac{y}{z} + \frac{ny}{nz} = \sqrt{10}k \end{cases} \Rightarrow \begin{cases} z(1+k) = 3\sqrt{2}k \\ y(1+k) = \sqrt{10}k \end{cases}$$

$$BE^2 = AB^2 + AE^2 \sim BE = \sqrt{10}k$$

$$\frac{y}{z} = \frac{EF}{AF} = \frac{\sqrt{5}}{3}$$

$$\frac{z}{y} = \frac{3\sqrt{2}}{\sqrt{10}}$$



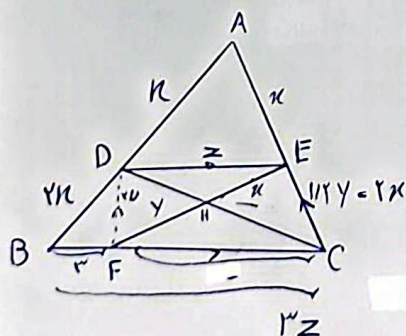
$$k = ? \quad \triangle AED \sim \triangle ACB \Rightarrow \triangle ACB \sim \triangle AED$$

②

$$\frac{AE}{AC} = \frac{AD}{AB} \Rightarrow \frac{y}{2} = \frac{k}{k+1} \rightarrow k^2 + k = 2$$

$$k = 1$$

$$k^2 + k - 2 = 0 \Rightarrow (k+2)(k-1) = 0 \Rightarrow \begin{cases} k = 1 \checkmark \\ k = -2 \text{ (reject)} \end{cases}$$



$$\begin{aligned} DE &\parallel BC \\ 2y &= 3k \\ BF &= 3 \\ BC &= ? \end{aligned}$$

$$DE = BC \quad I$$

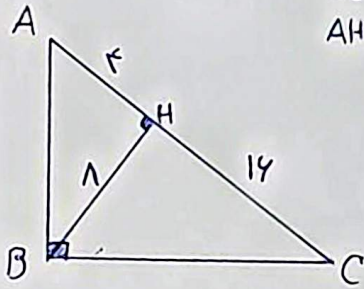
③

$$\triangle DEH \sim \triangle FCH \rightarrow \frac{EH}{FH} = \frac{DE}{FC} = \frac{DE}{3-DE}$$

$$\sim \frac{3}{3} = \frac{DE}{3-DE}$$

$$9DE = 3 - DE$$

$$DE = \frac{3}{10} \xrightarrow{I} \boxed{BC = \frac{3\sqrt{5}}{5}}$$



$$AC = 20 \quad AB = ?$$

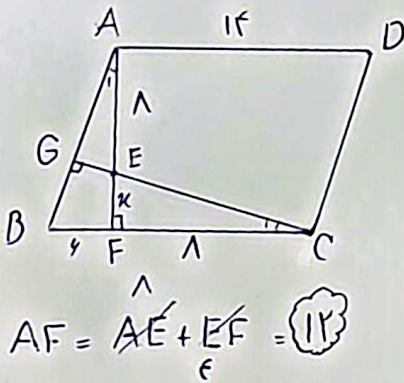
$$AH = 4 \quad BC = p$$

$$\Rightarrow \frac{BC}{AB} = \sqrt{\frac{20^2}{16}} = \sqrt{25} = 5 \quad (4)$$

$$BH^2 = AH \times CH \rightarrow BH = 14$$

$$AB^2 = AH^2 + BH^2 \rightarrow 16 + 196 = AB^2 \rightarrow AB = \sqrt{212}$$

$$BC^2 = BH^2 + CH^2 \rightarrow 196 + 144 = BC^2 \rightarrow BC = \sqrt{340}$$



$$AF = ?$$

$$\triangle AFB \sim \triangle CGE \Rightarrow \hat{A}_1 = \hat{C}_1$$

$$\triangle AFB \sim \triangle CGE \Rightarrow \frac{EF}{BF} = \frac{FC}{AF} \rightarrow \frac{4}{4} = \frac{12}{12+4}$$

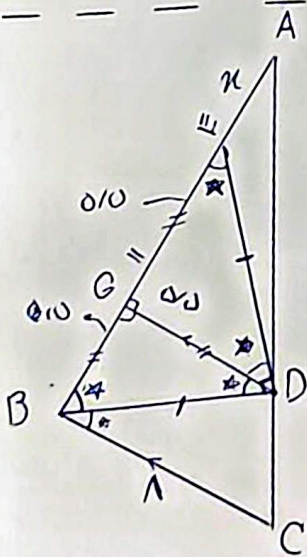
$$12 + 12 - 4 = 0$$

$$(12-4)(12+4) = 0$$

$$12 \rightarrow \frac{12}{12-4} = 1.5$$

$$\downarrow$$

$$4 = 12 + 12$$



$$AE = ?$$

$$\left. \begin{array}{l} \hat{A} + \hat{O} = 90^\circ \\ \hat{A} = 50^\circ \end{array} \right\} \rightarrow \hat{O} = 40^\circ$$

$$\hat{B} = 90^\circ$$

$$\frac{AG}{AB} = \frac{GD}{BC} \Rightarrow \frac{4}{12+4} = \frac{12}{12}$$

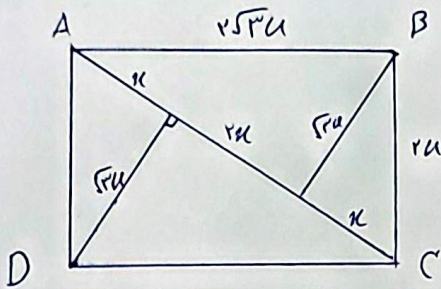
$$12 + 4 = 16, 12 + 12 = 24$$

$$12/16 = 3/4$$

$$12 = 3/4$$

$$\frac{S_{\square}}{S_{\triangle ABC}} \Rightarrow \frac{\sqrt{3} \mu \times \mu}{\sqrt{3} \mu \times \mu} = \textcircled{F}$$

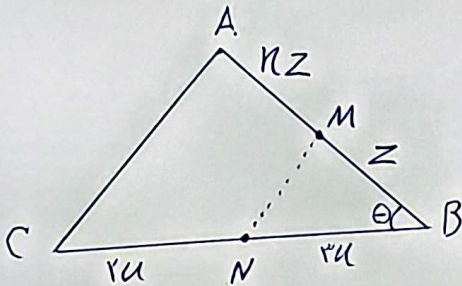
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$$BC = DC = \sqrt{k \times \mu} = \sqrt{3} \mu$$

$$AB^2 = CD^2 = \mu^2 + \mu^2 = \sqrt{3} \mu$$

$$BC^2 = AD^2 = \mu^2 + \mu^2 = \mu$$



$$S_{\triangle ABC} = 3 S_{\triangle MNC}$$

$$\frac{BM}{AM} \cdot \frac{1}{k} = \textcircled{\frac{\Delta}{F}}$$

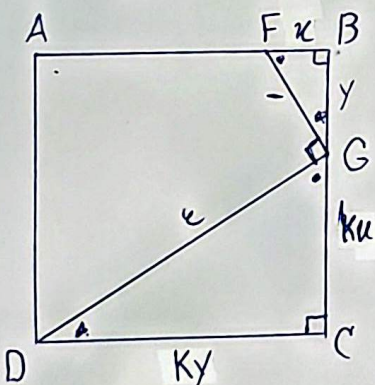
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$$\Downarrow$$

$$\mu = \frac{\frac{1}{2} \sin \theta \times \mu \times \mu \times \mu}{\frac{1}{2} \sin \theta \times \mu \times \mu} = \frac{9}{8} = k+1$$

$$\downarrow$$

$$k = \frac{1}{8}$$



$$ABCD = \text{ج} \Rightarrow S_{\square}$$

$$BFG \sim CGD$$

$$\begin{cases} k^2 + y^2 = 1 \\ k^2(\mu^2 + y^2) = 14 \end{cases} \Rightarrow \boxed{k = \frac{1}{8}}$$

$$ky = k\mu + y$$

$$ky - y = k\mu \Rightarrow 3y = k\mu$$

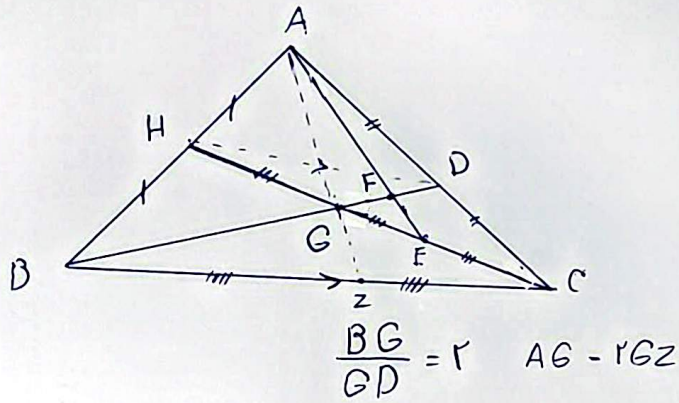
$$y = \frac{k}{3} \mu \Rightarrow k^2 + \frac{14}{9} \mu^2 = 1 \Rightarrow k^2 \left(\frac{14}{9} \right) = 1$$

$$S = \left(\frac{k}{3} \mu + k\mu \right)^2$$

$$\left(\frac{k}{3} + k \right)^2 = \frac{147}{14}$$

$$k \frac{14}{9} = 1$$

$$\boxed{k = \frac{9}{14}}$$



$$CE = EG = GH$$

$$BD = \underset{2FD}{BG} + \underset{2FD}{GD} = \underset{4FD}{9FD}$$

$$\Rightarrow \frac{BD}{FD} = \frac{9FD}{FD} = 9$$

G = مرکز ثقل = محل برخورد میانه‌ها در مثلث
($\triangle ABC$) حاده

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$$\frac{BD}{FD} = ?$$

F = میانه مثلث حاده
($\triangle ABC$)

$$GF = 2FD$$

$$GD = GF + FD$$

$$GD = 3FD$$