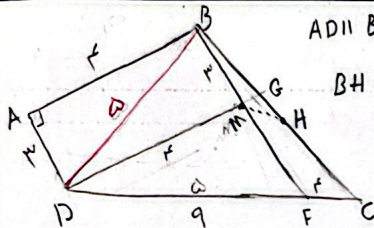


$$DE \parallel BC \rightarrow \frac{DE}{BC} = \frac{AD}{AB} = \frac{4}{12}$$

BD ← ارتفاع مثلث BDE و AB ارتفاع مثلث BCE

$$\Rightarrow \frac{S_{BCE}}{S_{BDE}} = \frac{AB}{AD} = \frac{12}{4} = 3$$

۱



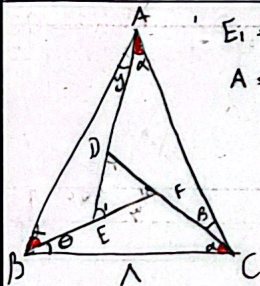
$$AD \parallel BF, AB \parallel DG$$

$$BH \perp HC$$

$$\frac{BH}{BC} = \frac{BM}{BF} = \frac{1}{3} \text{ و زاویه مشترک } B \Rightarrow \triangle BFC \sim \triangle BMH$$

$$\frac{MH}{FC} = \frac{BM}{BC} = \frac{1}{3} \Rightarrow MH = \frac{1}{3} FC$$

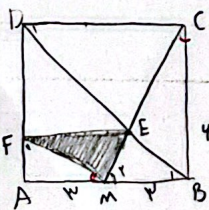
۲



$$\left. \begin{array}{l} \angle E = \gamma + \alpha / \angle D = \alpha + \beta / \angle F = \alpha + \theta \\ \angle A = \gamma + \alpha / \angle C = \alpha + \beta / \angle B = \alpha + \theta \end{array} \right\} \Rightarrow \triangle ABC \sim \triangle DFE$$

$$\frac{DF}{BC} = \frac{EF}{AB} = \frac{DE}{AC} \Rightarrow \frac{3}{AB} = \frac{4}{12} \Rightarrow AB = 9$$

۳



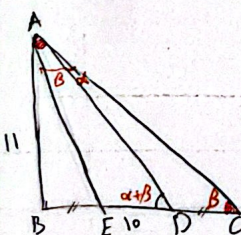
$$\left. \begin{array}{l} \angle C = \angle A \\ \angle B = \angle D \end{array} \right\} \Rightarrow \triangle MBC \sim \triangle AMF \Rightarrow MF \perp AF$$

$$\frac{AF}{AB} = \frac{AM}{CB} \Rightarrow AF = \frac{9}{4} \Rightarrow MF^2 = AF^2 + AM^2 \Rightarrow \frac{9}{4} + 9 = MF^2 \Rightarrow MF = \frac{3\sqrt{5}}{2}$$

$$MC^2 = BC^2 + MB^2 = 9 + 36 \Rightarrow MC = 3\sqrt{5}$$

$$S_{\triangle MFC} = \frac{MF \times MC}{2} = \frac{\frac{3\sqrt{5}}{2} \times 3\sqrt{5}}{2} = \frac{45}{4}$$

۴



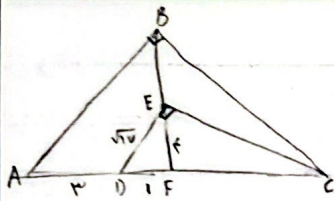
$$\left. \begin{array}{l} \angle C = \angle A \\ \angle E = \angle E \end{array} \right\} \Rightarrow \triangle AED \sim \triangle AEC$$

$$\frac{ED}{AE} = \frac{AD}{AC} = \frac{AE}{EC} \Rightarrow AE^2 = 10(10 + DC)$$

$$AE^2 = AB^2 + BE^2 \Rightarrow AE^2 = 100 + BE^2 \Rightarrow 10(10 + DC) = 100 + BE^2 \Rightarrow 10DC = BE^2$$

$$DC^2 - 10DC + 150 = 0 \Rightarrow (DC - 3)(DC - 17) = 0 \Rightarrow DC = 3 \text{ یا } 17$$

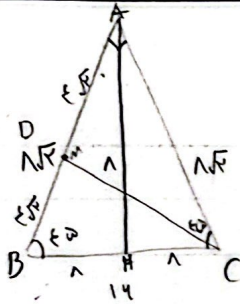
۵



$$ED^2 = DF \times DC \rightarrow (\sqrt{5})^2 = 1 \times DC \Rightarrow DC = 17, FC = 14$$

$$BC^2 = FC \times AC \rightarrow BC^2 = 14 \times 20 = 280 \Rightarrow BC = \sqrt{280} = 14\sqrt{2}$$

6



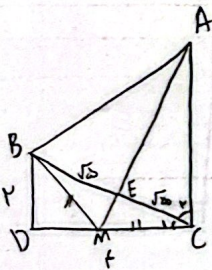
$$AB^2 = BH^2 + AH^2 = 4^2 + 4^2 \Rightarrow AB = 4\sqrt{2} \Rightarrow AC = 8\sqrt{2}$$

میان وارد بر قاعده در مثل متساوی الساقین ارتفاع مثلث هم هست. در نتیجه ضلع BC را نصف می کند و دو مثلث قائم الزامی هم تشکیل می دهد.

$$A = 90^\circ \Rightarrow AC^2 + AD^2 = DC^2 \rightarrow (8\sqrt{2})^2 + (4\sqrt{2})^2 = 140$$

$$\Rightarrow DC = \sqrt{140} = 2\sqrt{35}$$

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$$BC^2 = CD^2 + BD^2 = 14^2 + 4^2 = 200 \Rightarrow BC = 20\sqrt{2}$$

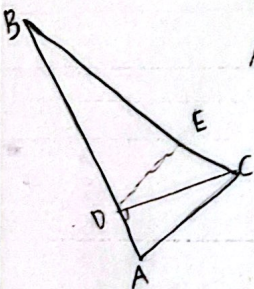
ME ارتفاع مثلث BMC است و چون مثلث متساوی الساقین است میان مثلث هم می باشد و در نتیجه

$$BE = EC = \frac{20\sqrt{2}}{2} = 10\sqrt{2}$$

$$C_1 + C_2 = 90^\circ \quad \cot C_1 = 2 \Rightarrow \tan C_2 = 2$$

$$\tan C_2 = \frac{AE}{EC} = 2 \Rightarrow AE = 2\sqrt{2} \quad , \quad S_{ABE} = AE \times EC = 2\sqrt{2} \times 10\sqrt{2} \times \frac{1}{2} = 200$$

8

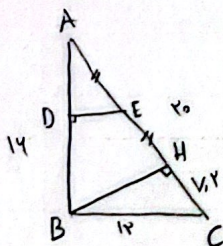


$$AB^2 = AC^2 + BC^2 \rightarrow 9 + 11 = 20 \quad , \quad AB = \sqrt{20} \Rightarrow AB = 2\sqrt{5}$$

$$AC^2 = AD \times AB \Rightarrow 9 = AD \times 2\sqrt{5} \Rightarrow AD = \frac{3\sqrt{5}}{2} \Rightarrow BD = 2\sqrt{5} - \frac{3\sqrt{5}}{2} = \frac{4\sqrt{5}}{2} = 2\sqrt{5}$$

$$BD^2 = BE \times BC \rightarrow \left(\frac{4\sqrt{5}}{2}\right)^2 = BE \times 9 \Rightarrow BE = 11$$

9



$$AB^2 + BC^2 = AC^2 \rightarrow 14^2 + 12^2 = 40 \quad , \quad AC = 20$$

$$BC^2 = CH \times AC \rightarrow 14^2 = CH \times 20 \Rightarrow CH = 9.8 \Rightarrow AH = 10.2$$

$$AE = EH = \frac{AH}{2} = 5.1 \quad , \quad \frac{AE}{AC} = \frac{DE}{BC} \Rightarrow DE = \frac{5.1 \times 12}{20} = 3.06$$

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