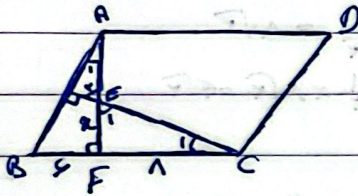


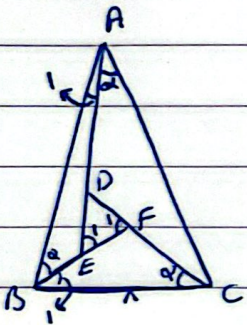
$$\frac{S_{\triangle BCF}}{S_{\triangle BDE}} = \frac{BC}{DE}$$

$$\frac{AD}{AB} = \frac{DE}{BC} \Rightarrow \frac{a}{12} = \frac{DE}{BC} \Rightarrow \frac{BC}{DE} = \frac{12}{a} = \boxed{\frac{2}{1}} \quad (1)$$



$$\left. \begin{array}{l} \hat{E}_1 + \hat{C}_1 = 90^\circ \\ \hat{E}_1 + \hat{A}_1 = 90^\circ \\ \hat{E}_1 = \hat{F}_1 \end{array} \right\} \Rightarrow \hat{A}_1 = \hat{C}_1 \quad \left. \begin{array}{l} \hat{A}_1 = \hat{C}_1 \\ \hat{F}_1 = 90^\circ \end{array} \right\} \Rightarrow \triangle EFC \sim \triangle ABF \quad (2)$$

$$\frac{EF}{BF} = \frac{FC}{AF} \Rightarrow \frac{a}{5} = \frac{12-a}{12+a} \Rightarrow a^2 + 12a - 60 = 0 \Rightarrow (a+12)(a-5) = 0 \Rightarrow \left. \begin{array}{l} a = 5 \text{ (valid)} \\ a = -12 \text{ (invalid)} \end{array} \right\} \Rightarrow AF = 17$$

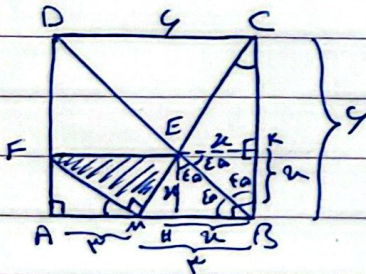


$$\hat{E}_1 = \alpha + \hat{\beta}_1 = \hat{\beta}_1 \quad (1)$$

$$\hat{E}_1 = \hat{A}_1 + \alpha = \hat{A}_1 \quad (2)$$

$$\left. \begin{array}{l} (1) \rightarrow \hat{F}_1 = \hat{\beta}_1 \\ (2) \rightarrow \hat{E}_1 = \hat{A}_1 \end{array} \right\} \Rightarrow \triangle ABC \sim \triangle DEF \Rightarrow \frac{BC}{DF} = \frac{AB}{EF}$$

$$DF = 12, EF = 5 \Rightarrow \frac{12}{12a} = \frac{AB}{5} \Rightarrow AB = \frac{9}{5}$$



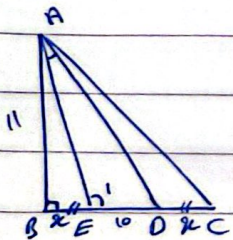
$$\left. \begin{array}{l} \hat{BCM} = \hat{AMF} \\ \hat{A} = \hat{B} = 90^\circ \end{array} \right\} \Rightarrow \triangle BCM \sim \triangle AMF \Rightarrow \frac{BM}{AF} = \frac{BC}{AM} \Rightarrow \frac{5}{AF} = \frac{5}{5} \Rightarrow AF = 5 \quad (3)$$

$$MF^2 = AM^2 + AF^2 \Rightarrow MF^2 = 9 + 9 \Rightarrow MF = 3\sqrt{2}$$

$$EK \parallel MB \Rightarrow \frac{CE}{BC} = \frac{EK}{MB} \Rightarrow \frac{4-u}{5} = \frac{u}{5} \Rightarrow 4-u = u \Rightarrow u = 2 \Rightarrow MH = 3 \times 2 = 6$$

$$ME^2 = EH^2 + MH^2 = 2^2 + 6^2 = 40 \Rightarrow ME = \sqrt{40}$$

$$S_{\triangle EFM} = \frac{1}{2} MF \cdot ME = \frac{1}{2} \times 3\sqrt{2} \times \sqrt{40} = \frac{1}{2} \times 3 \times \sqrt{2} \times 2\sqrt{10} = 3\sqrt{10}$$



$$\left. \begin{array}{l} \hat{DAE} = \hat{ACD} \\ \hat{E}_1 = \hat{A}_1 \end{array} \right\} \Rightarrow \triangle ADE \sim \triangle AEC \Rightarrow \frac{AD}{AC} = \frac{AE}{CE} = \frac{ED}{AE} \quad BE = DE = u \quad (4)$$

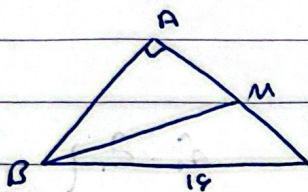
$$\frac{AE}{CE} = \frac{ED}{AE} \Rightarrow AE^2 = ED \times CE = 10(10+u) = 100 + 10u \Rightarrow AE^2 = 100 + 10u \quad (1)$$

$$AE^2 = AB^2 + BE^2 \Rightarrow AE^2 = 12^2 + u^2 \quad (2) \Rightarrow 12^2 + u^2 = 100 + 10u \Rightarrow u^2 - 10u + 44 = 0$$

$$\Rightarrow (u-5)(u-8) = 0 \Rightarrow \left. \begin{array}{l} u=5 \\ u=8 \Rightarrow DC=8 \end{array} \right\}$$

$$EF^2 = DF \times FC \Rightarrow F^2 = 1 \times FC \Rightarrow FC = 19 \quad (5) \quad (9)$$

$$BC^2 = CF \times CA = 19 \times (19 + 1) = 19 \times 20 \Rightarrow BC = \sqrt{380} = 10\sqrt{4} \quad (5)$$



$$AB = AC, AB^2 + AC^2 = BC^2 \Rightarrow 2AC^2 = BC^2 \quad (1)$$

$$\Rightarrow AC\sqrt{2} = BC = 19 \Rightarrow AC = \frac{19}{\sqrt{2}} = 10\sqrt{2}$$

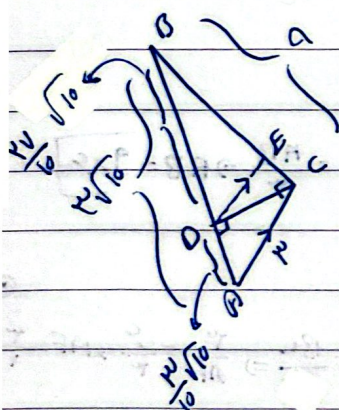
$$\Rightarrow AB = 10\sqrt{2}, AM = \frac{1}{2}AC = \frac{1}{2} \times 10\sqrt{2} = 5\sqrt{2} \quad (5)$$

$$BM^2 = AB^2 + AM^2 \Rightarrow BM^2 = (10\sqrt{2})^2 + (5\sqrt{2})^2 = 200 + 100 = 300 \Rightarrow BM = \sqrt{300} = 10\sqrt{3} \quad (5)$$

$$AE = 2BE \quad DC = 2BD \quad (1)$$

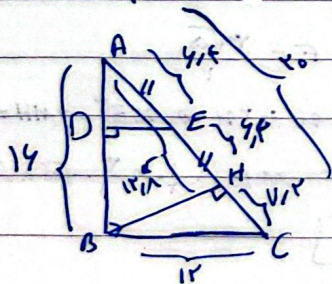
$$BC^2 = BD^2 + CD^2 = 1 + 19 = 20 \Rightarrow BC = 2\sqrt{5} \Rightarrow BE = \frac{BC}{2} = \sqrt{5}, AE = 2\sqrt{5} \quad (5)$$

$$\Rightarrow S_{ABE} = \frac{1}{2}BE \times AE = \frac{1}{2} \times \sqrt{5} \times 2\sqrt{5} = 5 \quad (5)$$



$$BD^2 = AD \times DC \Rightarrow AD = \frac{9}{2} \quad (9)$$

$$\frac{BE}{9} = \frac{2\sqrt{5}}{3\sqrt{5}} \Rightarrow \frac{BE}{9} = \frac{2}{3} \Rightarrow BE = 6 \quad (5)$$



$$(12)^2 = CH \times 20 \Rightarrow CH = 7.2 \quad (10)$$

$$\frac{9.6}{20} = \frac{DE}{12} \Rightarrow DE = 5.76 \quad (5)$$

در مثل BDM، DMH ←  $\hat{D}_1 = \hat{D}_2$  هم‌انشت هستند

در مثل BNC، BNM ←  $\hat{B}_1 = \hat{B}_2$  هم‌انشت هستند پس  $\frac{1}{2}NC = \frac{1}{2}BC$  است

بنابراین فاصله M از وسط قطع BC برابر 2 است

