

$$AC = \sqrt{(3k)^2 + (3k)^2} = 3k\sqrt{2}$$

$$\rightarrow AF = \frac{AC}{2} = \frac{3k\sqrt{2}}{2}$$

$$BE = \sqrt{(3k)^2 + k^2} = k\sqrt{10}$$

$$\rightarrow EF = x = \frac{BE}{2} = \frac{k\sqrt{10}}{2}$$

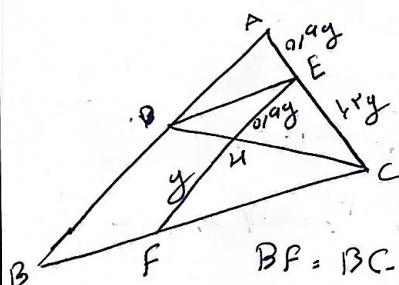
$$\Rightarrow \frac{EF}{AF} = \frac{\frac{k\sqrt{10}}{2}}{\frac{3k\sqrt{2}}{2}} = \frac{\sqrt{10}}{3\sqrt{2}} = \frac{\sqrt{5}}{3}$$

$$\begin{cases} \hat{A} = \hat{A} \\ \hat{C} = \hat{E} \end{cases} \Rightarrow \triangle AED \cong \triangle AEB \Rightarrow \frac{y}{a+1} = \frac{a}{1a} \rightarrow y = a(a+1)$$

$$\rightarrow a^2 + a - y = 0$$

$$(a+5)(a-2) = 0 \Rightarrow a = 2$$

$$y = 2a \rightarrow a = \frac{y}{2} = 0.4y$$

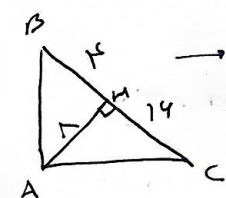


$$\triangle DHE \cong \triangle FHE \Rightarrow \frac{DE}{FC} = \frac{0.4y}{y} \Rightarrow DE = 0.4FC$$

$$DE \parallel BC \rightarrow \frac{AE}{AC} = \frac{DE}{BC} \Rightarrow \frac{0.4y}{1.1y} = \frac{DE}{BC}$$

$$\rightarrow BC = 2.75 DE$$

$$BF = BC - FC = 1.1FC - 1FC = 0.1FC = y \Rightarrow FC = 3.75y \Rightarrow BC = 1.1 \times 3.75y = 4.125y$$



$$AB = 14 \rightarrow AH = 14$$

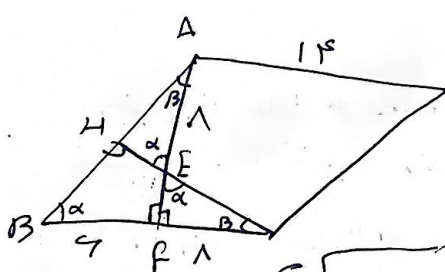
$$BA = \sqrt{14^2 + 4^2} = \sqrt{180}$$

$$AC = \sqrt{14^2 + 20^2} = \sqrt{544}$$

$$\frac{BA}{AC} = \sqrt{\frac{180}{544}} = \sqrt{\frac{1}{3}} = \frac{1}{\sqrt{3}}$$

$$\begin{cases} AM^2 = BM \times MC \\ \rightarrow 14^2 = BM \times MC, BM + MC = 20 \\ \rightarrow 14^2 = (20 - MC)(MC) \Rightarrow MC^2 - 20MC + 196 = 0 \\ MC = \frac{20 \pm \sqrt{400 - 4 \times 196}}{2} = 10 \pm 2\sqrt{31} \approx 1 \end{cases}$$

گزینه صحیح نامزد در این حالت ۱ شد اما قابل قبول نیست

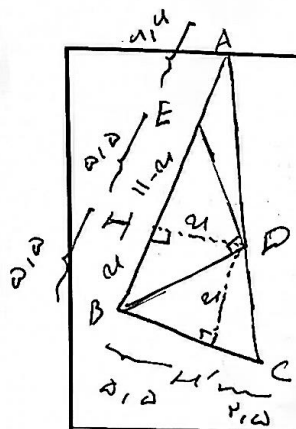


$$\begin{cases} \hat{E} = \hat{B} \\ \hat{A} = \hat{A} \end{cases} \Rightarrow \triangle ADE \sim \triangle ABC$$

$$\frac{EF}{9} = \frac{12}{18} \Rightarrow EF = 6$$

$$AF = 12 + 6 = 18$$

$$(EF - 4)(EF + 12) = 0 \Rightarrow EF = 4$$

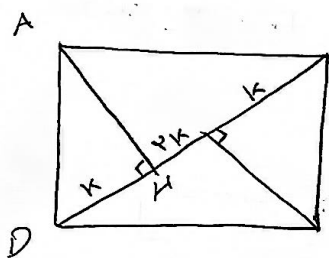


فاصله‌ی هر نقطه روی نیم‌ساز در مرکز اوج برابر است. $\leftarrow$ $\triangle HPH'$ مربع است به ضلع $\frac{a}{2}$

$$\triangle BDE \rightarrow a^2, a(1-a) \rightarrow 2a^2 = 11a \xrightarrow{a > 0} a_1 = 11, a_2 = 1$$

$$LD \parallel BC \rightarrow \frac{HD}{BC} = \frac{AH}{AB} \xrightarrow{\text{تثبیل درستی}} \frac{a, a}{2, a} = \frac{AH}{a, a}$$

$$\rightarrow AH = 11, 1 \rightarrow AE = 11, 1 - 11 = 4, 4 \quad \checkmark$$

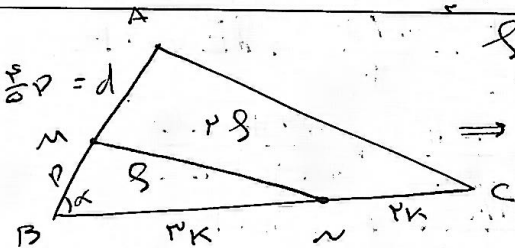


$$AH^2 = DH \times HB \Rightarrow AH = \sqrt{k \times r} = k\sqrt{r}$$

$$S_{ABCD} = 4S_{\triangle ABD} = 4 \times \frac{k\sqrt{r} \times r}{2} = 2k^2\sqrt{r}$$

$$S_{\triangle AHD} = \frac{k\sqrt{r} \times k}{2} = \frac{k^2\sqrt{r}}{2}$$

$$\Rightarrow \frac{2k^2\sqrt{r}}{k^2\sqrt{r}} = 2 \quad \checkmark$$

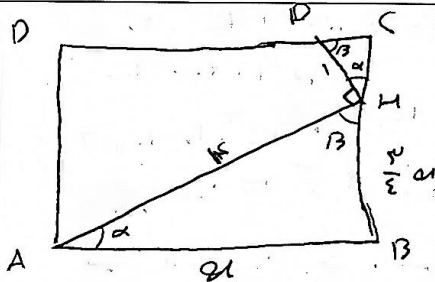


$$S = \frac{1}{2} a \cdot b \cdot \sin \alpha$$

$$\Rightarrow \frac{S_{\triangle BMN}}{S_{\triangle ABC}} = \frac{\frac{1}{2} \times p \times r \times \sin \alpha}{\frac{1}{2} \times (p+q) \times a \times \sin \alpha} = \frac{rp}{ap+aq} = \frac{1}{3}$$

$$\rightarrow 4p, ap+aq \rightarrow rp, aq \Rightarrow q = \frac{2}{3}p$$

$$\Rightarrow \frac{BM}{AM} = \frac{p}{\frac{2}{3}p} = \frac{3}{2} = 1, 2 \quad \checkmark$$

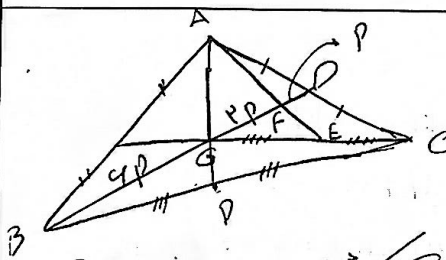


$$\triangle ABH \sim \triangle DCH \Rightarrow \frac{r}{1} = \frac{a}{CH} \Rightarrow CH = \frac{a}{r}$$

$$BH = a - \frac{a}{r} = \frac{r-1}{r}a \rightarrow r^2 = 21 + \frac{9}{14}a^2$$

$$\rightarrow 21 = \sqrt{\frac{14 \times 14}{25}} = \frac{14}{5}$$

$$S = a^2 = \left(\frac{14}{5}\right)^2 = 10, 24 \quad \checkmark$$



می‌دانیم حرکت قتل همان محل برخورد میانه‌ها است، و داریم قتل میانه‌ها به نسبت ۲ به ۱ تقسیم می‌شوند. $\leftarrow$ میانه‌ی سوم (AD) را ببریم

می‌کنیم: چون $GF = EC$ و $AD = DC$ است پس GB میانه‌ی AC است

AE میانه‌ی BC است $\triangle AGC$ $\leftarrow$ $GF = \frac{1}{2}GD, \frac{1}{2}p \leftarrow$ حرکت قتل F میانه GD

$$BD = 9p + 2p + p = 12p \Rightarrow \frac{BD}{p} = \frac{12p}{p} = 12 \quad \checkmark$$