

الف) $\tan\left(2\pi + \frac{3\pi}{4}\right) + \sin\left(3\pi + \frac{3\pi}{4}\right) \cos\left(4\pi + \frac{\pi}{4}\right) \Rightarrow$
 $= \tan \frac{3\pi}{4} + \sin \frac{3\pi}{4} \cos \frac{\pi}{4} = -1 + \left(-\frac{\sqrt{2}}{2}\right)\left(-\frac{\sqrt{2}}{2}\right) = -1 + \frac{1}{2} = -\frac{1}{2}$
 ب) $\tan\left(2\pi + \frac{\pi}{4}\right) \sin\left(3\pi + \frac{3\pi}{4}\right) + \cos\left(3\pi + \frac{\pi}{4}\right) \Rightarrow$
 $= \tan \frac{\pi}{4} \sin \frac{3\pi}{4} + \cos \frac{3\pi}{4} = \frac{1}{1} \times \left(-\frac{\sqrt{2}}{2}\right) + \left(-\frac{1}{2}\right) = -\frac{\sqrt{2}}{2} - \frac{1}{2} = -\frac{\sqrt{2}+1}{2}$

$\cot \alpha = 4 \Rightarrow \tan \alpha = \frac{1}{\cot \alpha} = \frac{1}{4}$ $\tan \alpha + \cot \alpha = \frac{\sin \alpha + \cos \alpha}{\sin \alpha \cos \alpha} = \frac{14}{5} \Rightarrow$
 $\Rightarrow \sin \alpha \cos \alpha = \frac{5}{14}$ $1 + \cot^2 \alpha = \frac{1}{\sin^2 \alpha} \Rightarrow 14 = \frac{1}{\sin^2 \alpha} \Rightarrow \sin^2 \alpha = \frac{1}{14}$
 $\cos^2 \alpha = 1 - \sin^2 \alpha = 1 - \frac{1}{14} = \frac{13}{14}$
 $\Rightarrow \frac{4 \cos^2 \alpha + 5 \sin \alpha \cos \alpha - \sin^2 \alpha}{\sin^2 \alpha + \cos^2 \alpha + 4 \sin \alpha \cos \alpha} = \frac{4\left(\frac{13}{14}\right) + 5\left(\frac{5}{14}\right) - \frac{1}{14}}{1 + 4\left(\frac{5}{14}\right)} = \frac{11}{9} = \frac{11}{9}$

$\sin^2 \alpha + \cos^2 \alpha = 1 \Rightarrow 4 \cos^2 \alpha + \cos^2 \alpha = 1 \Rightarrow \cos^2 \alpha = \frac{1}{5}$ $\cos \alpha = -\frac{\sqrt{5}}{5}$ $\cos < 0$

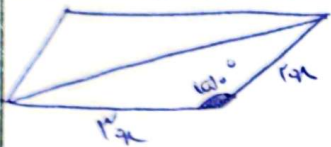
الف) $\cos^2 \alpha = 1 - \sin^2 \alpha = 1 - \frac{4}{5} = \frac{1}{5}$ $\cos \alpha = -\frac{\sqrt{5}}{5}$
 $\frac{11\pi}{6} = 2\pi + \frac{5\pi}{6} \Rightarrow \cos\left(\frac{11\pi}{6} + \alpha\right) = \cos\left(\frac{5\pi}{6} + \alpha\right) = \cos \frac{5\pi}{6} \cos \alpha - \sin \frac{5\pi}{6} \sin \alpha$
 $\Rightarrow = \left(-\frac{\sqrt{3}}{2}\right)\left(-\frac{\sqrt{5}}{5}\right) - \left(\frac{1}{2}\right)\left(\frac{\sqrt{2}}{2}\right) = \frac{\sqrt{15}}{10} - \frac{\sqrt{2}}{4} = \frac{\sqrt{15}-\sqrt{2}}{10}$

ب) $1 + \tan^2 \alpha = \frac{1}{\cos^2 \alpha} = \frac{25}{9} \Rightarrow \cos^2 \alpha = \frac{9}{25}$ $\cos \alpha = \frac{3}{5}$
 $\sin^2 \alpha = 1 - \cos^2 \alpha = 1 - \frac{9}{25} = \frac{16}{25}$ $\sin \alpha = \frac{4}{5}$
 $\frac{13\pi}{6} = 2\pi + \frac{\pi}{6} \Rightarrow \sin\left(\frac{13\pi}{6} + \alpha\right) = \sin\left(\frac{\pi}{6} + \alpha\right) = \sin \frac{\pi}{6} \cos \alpha + \cos \frac{\pi}{6} \sin \alpha$
 $\Rightarrow = \left(\frac{1}{2}\right) \times \frac{3}{5} + \left(\frac{\sqrt{3}}{2}\right) \times \frac{4}{5} = \frac{3}{10} + \frac{4\sqrt{3}}{10} = \frac{3+4\sqrt{3}}{10}$

$\begin{cases} 4 \sin^2 \alpha + \cos^2 \alpha = \frac{5}{9} \\ \sin^2 \alpha + \cos^2 \alpha = 1 \end{cases} \Rightarrow \sin^2 \alpha = \frac{1}{9} \Rightarrow \cos^2 \alpha = 1 - \frac{1}{9} = \frac{8}{9}$
 $1 + \tan^2 \alpha = \frac{1}{\cos^2 \alpha} = \frac{9}{8} \Rightarrow \tan^2 \alpha = \frac{1}{8} \Rightarrow \tan \alpha = \frac{1}{2\sqrt{2}}$

$$S_{\Delta ABC} = \frac{1}{2} ab \sin \alpha = \frac{1}{2} \times 4 \times \sqrt{3} \times \sin \alpha = 4 \Rightarrow \sin \alpha = \frac{4}{4\sqrt{3}} = \frac{\sqrt{3}}{3}$$

$$\Rightarrow \hat{\alpha} = 40^\circ, 140^\circ \Rightarrow \frac{\alpha \text{ بیشترین مقدار}}{\alpha \text{ کمترین مقدار}} = \frac{140}{40} = \boxed{3.5}$$



$$\sin 100^\circ = \sin (180^\circ - 80^\circ) = \sin 80^\circ = \frac{1}{2}$$

$$S_{\square} = 4 \times \frac{1}{2} \times 4 \times \sin 100^\circ = 8 \sin 100^\circ = 4 \Rightarrow \sin 100^\circ = \frac{1}{2}$$

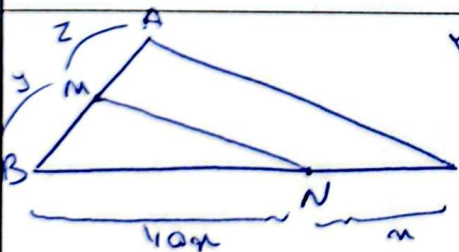
$$\Rightarrow \alpha = 3\sqrt{2}$$

$$P_{\square} = 10\alpha = 10 \times 3\sqrt{2} = 30\sqrt{2}$$

$$S_{\Delta ABC} = \frac{1}{2} \times 4 \times 4 \times \sin \hat{A} = 8 \sin \hat{A} \quad \Rightarrow \quad S_{\Delta ABC} - S_{\Delta ADE} = 4 \sin \hat{A}$$

$$S_{\Delta ADE} = \frac{1}{2} \times 4 \times 4 \times \sin \hat{A} = 8 \sin \hat{A}$$

$$\Rightarrow \sin \hat{A} = \frac{1}{2} \Rightarrow \hat{A} = 30^\circ \Rightarrow \tan \hat{A} = \frac{\sin \hat{A}}{\cos \hat{A}} = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$



$$x \overline{BN} = y \overline{NC} \Rightarrow \overline{BN} = \frac{y}{x} \overline{NC}$$

$$\frac{S_{\Delta ABC}}{S_{\Delta BMN}} = \frac{\frac{1}{2} \times (y+z) \times \sin \hat{B}}{\frac{1}{2} \times y \times \sin \hat{B}} = \frac{y+z}{y} = \frac{4}{3}$$

$$\Rightarrow 4y + 4z = 4y \Rightarrow 4y = 4z \Rightarrow y = z \Rightarrow \frac{BM}{AM} = \frac{y}{z} = 1:1$$

$$\frac{|\sin \alpha|}{\cos \alpha} = -\frac{\sin \alpha}{\cos \alpha} \Rightarrow |\sin \alpha| = -\sin \alpha \Rightarrow \sin \alpha < 0 \Rightarrow \alpha \text{ در ربع سوم یا چهارم قرار دارد}$$

$$\frac{1}{|\cos \alpha|} - \frac{\sin \alpha}{\cos \alpha} = \frac{1 + \sin \alpha}{|\cos \alpha|} \Rightarrow |\cos \alpha| = -\cos \alpha \Rightarrow \cos \alpha < 0 \Rightarrow \alpha \text{ در ربع دوم یا سوم قرار دارد}$$

$$\frac{1}{-\cos \alpha} - \frac{\sin \alpha}{\cos \alpha} = \frac{-1 - \sin \alpha}{\cos \alpha} = \frac{1 + \sin \alpha}{-\cos \alpha} = \frac{1 + \sin \alpha}{|\cos \alpha|}$$

(1) (2)

انتقال کمان α در نیمه شیب است.