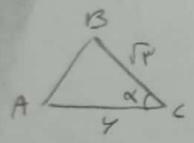
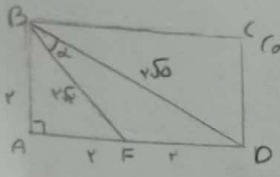


$\frac{1}{2}ab\sin\alpha = S \Rightarrow \frac{15}{4} = \frac{1}{2}\sqrt{3}\times y\times\sin\alpha$

$\frac{\frac{15}{4}}{\frac{7\sqrt{3}}{2}} = \frac{3\times5}{\sqrt{3}} = \frac{3\times\sqrt{3}\times5}{3} = \frac{\sqrt{3}}{2} = \sin\alpha \Rightarrow \alpha = 60^\circ$ یا $\alpha = 120^\circ \Rightarrow \frac{120}{60} = 2$ برابر



$\cot\alpha$?

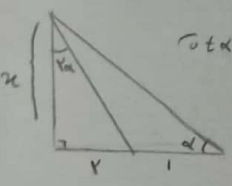
$BD^2 = 2^2 + 4^2 \Rightarrow BD^2 = 20 \Rightarrow BD = \sqrt{20} = 2\sqrt{5}$

$2 = \sqrt{\frac{(2\sqrt{2})^2}{8} + \frac{(2\sqrt{5})^2}{20} - \frac{2(2\sqrt{2})(2\sqrt{5})\cos\alpha}{4\sqrt{10}}} \Rightarrow 2 = \sqrt{28 - 8\sqrt{10}\cos\alpha} \Rightarrow 4 = 28 - 8\sqrt{10}\cos\alpha$

$24 = 8\sqrt{10}\cos\alpha$

$\cos\alpha = \frac{3}{\sqrt{10}}$

$\tan^2\alpha + 1 = \frac{1}{\cos^2\alpha} \Rightarrow \tan^2\alpha = \frac{1}{\frac{9}{10}} - 1 \Rightarrow \tan^2\alpha = \frac{10}{9} - \frac{9}{9} = \frac{1}{9} \Rightarrow \cot\alpha = 3$

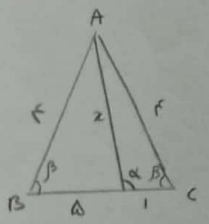


$\cot\alpha = ?$

$x = 2\sqrt{1+2^2} = 2\sqrt{5}$

$4 = \sqrt{1+4-2\times2\sqrt{5}\times2\sqrt{5}\cos\alpha} \Rightarrow 4 = 21 - 10\sqrt{10}\cos\alpha \Rightarrow \cos\alpha = \frac{3}{\sqrt{10}} \Rightarrow$

$\cot\alpha = 3$



$x = \sqrt{4^2+5^2-2(4)(5)\cos\beta} \Rightarrow 41 - 40\cos\beta = 17 - 8\cos\beta$

$x = \sqrt{4^2+1^2-2(4)(1)\cos\beta}$

$24 = 32\cos\beta \Rightarrow \frac{3}{4} = \cos\beta \Rightarrow x = 17 - 8\cos\beta = 11 \Rightarrow x = 11$

$4 = \sqrt{11^2+1^2-2(11)(1)\cos\alpha} \Rightarrow 16 = 122 - 22\cos\alpha \Rightarrow 100 = 22\cos\alpha \Rightarrow \cos\alpha = \frac{2}{\sqrt{11}}$

$\tan^2\alpha + 1 = \frac{1}{\frac{4}{11}} \Rightarrow \frac{11}{4} - 1 = \tan^2\alpha \Rightarrow \tan^2\alpha = \frac{7}{4} \Rightarrow \tan\alpha = -\frac{\sqrt{7}}{2}$

$2\sin^2x + \cos^2x = \frac{4}{3} \Rightarrow \sin^2x + \underbrace{\sin^2x + \cos^2x}_{1} = \frac{4}{3} \Rightarrow \sin^2x = \frac{1}{3} \Rightarrow \frac{7}{15} + \cos^2x = \frac{4}{3} \Rightarrow$

$\cos^2x = \frac{4}{3} - \frac{7}{15} = \frac{13}{15}$

$\tan^2x = \frac{\sin^2x}{\cos^2x} = \frac{\frac{1}{3}}{\frac{13}{15}} = \frac{1}{13}$

$\frac{\sin^4\alpha + 4\cos^2\alpha}{1+\cos^2\alpha} - \frac{\cos^4\alpha + 4\sin^2\alpha}{\sin^2\alpha+1} \Rightarrow \frac{(1-\cos^2\alpha)^2 + 4\cos^2\alpha}{\cos^2\alpha+1} - \frac{(1-\sin^2\alpha)^2 + 4\sin^2\alpha}{\sin^2\alpha+1} = \frac{1-2\sin^2\alpha+\sin^4\alpha+4\sin^2\alpha}{\sin^2\alpha+1} =$

$\frac{1-2\cos^2\alpha+\cos^4\alpha+4\cos^2\alpha}{\cos^2\alpha+1} = \frac{(\cos^2\alpha+1)^2}{\cos^2\alpha+1} = \cos^2\alpha+1$

$\cos^2\alpha + 1 - \sin^2\alpha - 1 = \cos 2\alpha$

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$\sin\left(\frac{9\pi}{2}+\alpha\right)\cos\left(\frac{\pi}{2}-\alpha\right)-\tan\left(\alpha-\frac{3\pi}{2}\right) = (+\cos\alpha)\times(-\sin\alpha) - \cot\alpha \Rightarrow -\cos\alpha\sin^2\alpha - \cos\alpha \Rightarrow -\frac{\cos\alpha(\sin^2\alpha+1)}{\sin\alpha}$ (1)

$-\tan\alpha(\sin^2\alpha+1) =$

$\cot\alpha = \frac{3}{4} \Rightarrow \frac{9}{16}+1 = \frac{1}{\sin^2\alpha} \Rightarrow \sin^2\alpha = \frac{16}{25}$

$-\frac{4}{3}\left(\frac{16}{25}+1\right) = -\frac{4}{3}\times\frac{41}{25} = -\frac{164}{75}$

$2\cos\frac{\pi}{3} + \sqrt{2}\sin\frac{\pi}{12} - \sqrt{2}\cos\frac{\pi}{12} \xrightarrow{\times\sqrt{2}} \frac{2\sqrt{2}}{2} + \sin\frac{\pi}{4} - \cos\frac{\pi}{4} = \frac{2}{2} - 1 = \frac{1}{2}$ (1)

$\tan\frac{\alpha}{2} = \frac{1}{4} \Rightarrow \cos\frac{\alpha}{2} = \frac{4}{\sqrt{17}}$

$\sin\frac{\alpha}{2} = \frac{1}{\sqrt{17}}$

$\Rightarrow \sin\alpha = 2\sin\frac{\alpha}{2}\times\cos\frac{\alpha}{2} = 2\times\frac{4}{\sqrt{17}}\times\frac{1}{\sqrt{17}} = \frac{8}{17}$ (9)

$\sin\alpha = \frac{8}{17}$, $\cos = \frac{15}{17}$

$\frac{\tan\alpha-\sin\alpha}{\sin\alpha-\cos\alpha} = \frac{\frac{8}{15}-\frac{1}{17}}{\frac{8-15}{17}} = -\frac{119}{105}$

$2\sin\alpha < \sin 2\alpha \Rightarrow 2\sin\alpha - 2\sin\alpha\cdot\cos\alpha < 0 \Rightarrow 2\sin\alpha\times(1-\cos\alpha) < 0 \Rightarrow \sin\alpha < 0$ (1)

$2\sin\alpha\cdot\cos\alpha$ (+) (4,3)

$\frac{\cot\alpha}{\sin\alpha} > 0 \Rightarrow \frac{\cos\alpha}{\sin^2\alpha} > 0 \Rightarrow \cos\alpha > 0$ (4,1)

(4,3)

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