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Honors Precalculus
Solving Trigonometric Equations
Review

Level 1

1. **Find the exact value of each expression.**

a. $\sin 315°$

$\sin(270+45) = \sin 270\cos 45 + \cos 270 \sin 45$

$-1 \cdot \frac{\sqrt{2}}{2} + 0 \cdot \frac{\sqrt{2}}{2} = \boxed{\frac{-\sqrt{2}}{2}}$

b. b. $\tan$ ~~25°~~ 15°

~~$\tan(60-45)$~~

$\tan(45-30) = \frac{\tan 45 - \tan 30}{1 + \tan 45 \tan 30} = \frac{1 - \frac{\sqrt{3}}{3}}{1 + 1 \cdot \frac{\sqrt{3}}{3}} = \boxed{\frac{1 - \frac{\sqrt{3}}{3}}{1 + \frac{\sqrt{3}}{3}}}$

$\frac{3\pi}{12} - \frac{4\pi}{12}$

$\frac{3\pi}{4} - \frac{\pi}{3}$

c. $\cos\frac{5\pi}{12}$

$\cos\left(\frac{3\pi}{4} - \frac{\pi}{3}\right) = \cos\frac{3\pi}{4} \cdot \cos\frac{\pi}{3} + \sin\frac{3\pi}{4} \cdot \sin\frac{\pi}{3}$

$-\frac{\sqrt{2}}{2} \cdot \frac{1}{2} + \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} = \frac{-\sqrt{2}}{4} + \frac{\sqrt{6}}{4} = \boxed{\frac{-\sqrt{2}+\sqrt{6}}{4}}$

2. **Write the expression as the tangent of an angle, then find the exact value.**

a. $\frac{\tan 155 + \tan 85}{1 - \tan 155 \tan 85} = \tan(155+85) = \tan 240 = \sqrt{3}$

b. $\sin\frac{15\pi}{36}\cos\frac{\pi}{6} - \cos\frac{15\pi}{36}\sin\frac{\pi}{6} = \sin\left(\frac{15\pi}{36} - \frac{\pi}{6}\right) = \sin\frac{\pi}{4} = \frac{\sqrt{2}}{2}$

$\frac{15\pi}{36} - \frac{6\pi}{36} = \frac{9\pi}{36}$

c. $\cos\frac{2\pi}{3}\cos\frac{\pi}{6} + \sin\frac{2\pi}{3}\sin\frac{\pi}{6} = \cos\left(\frac{2\pi}{3} - \frac{\pi}{6}\right) = \cos\frac{\pi}{2} = 0$

$\frac{4\pi}{6} - \frac{\pi}{6} = \frac{3\pi}{6} = \frac{\pi}{2}$

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Level 2

3. Solve the trigonometric equation for all values of x over *the interval* [0, 2π]

a. $3\tan x + 6 = 0$

$3\tan x = -6$

$\tan x = -2$

No solution

b. $5\cot\theta = \sqrt{3} + 4\cot\theta$

$\cot\theta = \sqrt{3}$

$\cot\theta = \frac{\sqrt{3}}{3}$

$\theta = \frac{\pi}{6}, \frac{7\pi}{6}$

c. $12\sin^2 x - 3 = 6\sin^2 x$

$6\sin^2 x = 3$

$\sqrt{\sin^2 x} = \sqrt{\frac{1}{2}}$

$\sin x = \frac{\pm 1}{\sqrt{2}} = \frac{\pm\sqrt{2}}{2}$

$x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$

d. $4\cos^2 x - 3 = 0$

$4\cos^2 = 3$

$\sqrt{\cos^2 x} = \sqrt{\frac{3}{4}}$

$\cos x = \frac{\pm\sqrt{3}}{2}$

$x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

e. $4\tan^2 x - 1 = \tan^2 x$

$3\tan^2 x = 1$

$\sqrt{\tan^2 x} = \sqrt{\frac{1}{3}}$

$\tan x = \frac{\pm 1}{\sqrt{3}}$

$x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

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Level 3

4. **Solve the trigonometric equation for *all values of x.***

a. $2\tan^2\theta \sin\theta = \frac{2}{\cot^2 x}$

$2\tan^2\theta\sin\theta = 2\tan^2\theta$

$2\tan^2\theta(\sin\theta - 1) = 0$

$2\tan^2\theta = 0 \quad \sin\theta - 1 = 0$

$\tan^2\theta = 0 \quad \sin\theta = 1$

$\tan\theta = 0$

$\theta = 0, \frac{\pi}{2}, \pi\} + 2n\pi$

b. $\sec^2\theta - 1 = 2\tan\theta - 1$

$1 + \tan^2\theta - 1 - 2\tan\theta + 1 = 0$

$\tan^2\theta - 2\tan\theta + 1 = 0$

$(\tan\theta - 1)^2 = 0$

$\tan\theta = 1$

$\theta = \pi/4, \frac{5\pi}{4}\} + 2n\pi$

c. $6\cos 2\theta - 1 = 4\cos 2\theta$

$2\cos 2\theta = 1$

$\cos 2\theta = 1/2$

$2\theta = \frac{\pi}{3}, \frac{5\pi}{3}$

$\theta = \frac{\pi}{6}, \frac{5\pi}{6} + 2n\pi$

d. $\csc^2 x - \cot x \csc^2 x = 0$

$\csc^2 x(1 - \cot x) = 0$

$\csc^2 x = 0 \quad \cot x = 1$

$\csc x = 0 \quad \tan x = 1$

$\sin x = \frac{1}{0}$

und

$x = \frac{\pi}{4}, \frac{5\pi}{4}\} + 2n\pi$

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e. $\cot^2 x - \sec x \cot^2 x = 0$

$\cot^2 x(1-\sec x) = 0$

$\cot^2 x = 0 \quad 1-\sec x = 0$

$\cot x = 0 \quad \sec x = 1$

$\tan x$ und $\cos x = 1$

$x = 0 + 2n\pi$

f. $1 - \cos^2\theta = \sin\theta + 2$

$\sin^2\theta - \sin\theta - 2 = 0$

$(\sin\theta - 2)(\sin\theta + 1)$

$\sin\theta = 2 \quad \sin\theta = -1$

$\sqrt{}$

NO Soln $\quad \theta = \frac{3\pi}{2} + 2n\pi$

g. $2\sin^4 x - 3\sin^2 x = -1$

$(2\sin^2 x - 1)(\sin^2 x - 1)$

$\sin^2 x = \frac{1}{2} \quad \sin^2 x = 1$

$\sin x = \pm\frac{\sqrt{2}}{2}, \pm 1$

$x = \left\{\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}, \cancel{\pi}, \frac{3\pi}{2}\right\} + 2n\pi$