Name: Key Date: ______ Class: ______

5.4 Multiple Angle Identities Practice Worksheet

1. Simplify: $\frac{cos2x}{sinx+cosx}$

$$\frac{\cos^2 x-\sin^2 x}{\sin x+\cos x}$$

$$\frac{(\cos x-\sin x)\cancel{(\cos x+\sin x)}}{\cancel{\sin x+\cos x}}$$

$$= \boxed{\cos x-\sin x}$$

2. $sin2x - cosx = 0$

$2\sin x\cos x-\cos x=0$

$\cos x(2\sin x-1)=0$

$\cos x=0 \quad \sin x=\frac{1}{2}$

$$\boxed{x=\frac{\pi}{2},\ \frac{3\pi}{2},\ \frac{\pi}{6},\ \frac{5\pi}{6}}$$

3. $tan2x + tanx = 0$

$\frac{2\tan x}{1-\tan^2 x}+\tan x=0$

$2\tan x+\tan x-\tan^3 x=0$

$3\tan x-\tan^3 x=0$

$\tan x(3-\tan^2 x)=0$

$\tan x=0 \quad \sqrt{\tan^2 x}=\sqrt{3}$

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

$$\boxed{x=0,\ \pi,\ \frac{\pi}{3},\ \frac{2\pi}{3},\ \frac{4\pi}{3},\ \frac{5\pi}{3}}$$

4. $cos2x = 3sinx + 2$

$1-2\sin^2 x=3\sin x+2$

$2\sin^2 x+3\sin x+1=0$

$2x^2+3x+1=0$

$(2x+1)(x+1)=0$

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

$$\boxed{x=\frac{7\pi}{6},\ \frac{11\pi}{6},\ \frac{3\pi}{2}}$$

5. $sin9x + sin18x = 0$ $\quad \theta=9x$

$\sin\theta+\sin 2\theta=0$

$\sin\theta+2\sin\theta\cos\theta=0$

$\sin\theta(1+2\cos\theta)=0$

$\sin\theta=0 \quad \cos\theta=-\frac{1}{2}$

$\theta=0,\ \pi,\ \frac{2\pi}{3},\ \frac{4\pi}{3}$

$$\boxed{x=0,\ \frac{\pi}{9},\ \frac{2\pi}{27},\ \frac{4\pi}{27}}$$

6. Prove: 2 sin x cos^3 x + 2 sin^3 x cos x = sin 2x

$2\sin x\cos x(\cancel{\cos^2 x+\sin^2 x})$

$2\sin x\cos x = \boxed{\sin 2x}$ ✓

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7. Find the exact value of $sin\frac{5\pi}{8}$ use $\frac{5\pi}{4}$ $\sin\frac{\theta}{2} = \pm\sqrt{\frac{1-\cos\theta}{2}} = \sqrt{\frac{1-\cos\frac{5\pi}{4}}{2}}$ $\sqrt{\frac{1-\left(-\frac{\sqrt{2}}{2}\right)}{2}} = \sqrt{\frac{1+\frac{\sqrt{2}}{2}}{2}} = \sqrt{\frac{\frac{2+\sqrt{2}}{2}}{2}}$ $= \sqrt{\frac{2+\sqrt{2}}{4}} = \boxed{\frac{\sqrt{2+\sqrt{2}}}{2}}$	8. Find the exact value of $cos\frac{\pi}{12}$ use $\frac{\pi}{6}$ $\cos\frac{\theta}{2} = +\sqrt{\frac{1+\cos\theta}{2}} = \sqrt{\frac{1+\cos\frac{\pi}{6}}{2}}$ $= \sqrt{\frac{1+\frac{\sqrt{3}}{2}}{2}} = \sqrt{\frac{\frac{2+\sqrt{3}}{2}}{2}}$ $= \sqrt{\frac{2+\sqrt{3}}{4}} = \boxed{\frac{\sqrt{2+\sqrt{3}}}{2}}$
9. Find the exact value of $tan\frac{11\pi}{12}$ use $\frac{11\pi}{6}$ $\tan\frac{\theta}{2} = \frac{1-\cos\theta}{\sin\theta} = \frac{1-\cos\frac{11\pi}{6}}{\sin\frac{11\pi}{6}}$ $\frac{1-\frac{\sqrt{3}}{2}}{-\frac{1}{2}} = \frac{\frac{2-\sqrt{3}}{2}}{-\frac{1}{2}} =$ $= \boxed{-2+\sqrt{3}}$	10. $\sin^2\left(\frac{x}{2}\right) = 2\cos^2 x - 1$ (Hint: Use half angle identities) $\left(\sqrt{\frac{1-\cos x}{2}}\right)^2 = 2\cos^2 x - 1$ $\frac{1-\cos x}{2} = 2\cos^2 x - 1$ $1-\cos x = 4\cos^2 x - 2$ $4\cos^2 x + \cos x - 3 = 0$ $(4x-3)(x+1)$ $\cancel{\cos x = \frac{3}{4}}$ $\cos x = -1$ $\boxed{x = \pi}$

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