Name_____

Multiple-Angle Identities

Date_____ Period_____

Use the half-angle identities to find the exact value of each.

1) $\sin 292.5°$

2) $\sin 337.5°$

3) $\tan 105°$

4) $\cos 105°$

5) $\cos 157.5°$

6) $\cos 337.5°$

Find the exact value of each.

7) $\tan \theta = \dfrac{15}{8}$ where $180 \le \theta < 270$

Find $\tan 2\theta$

8) $\cos \theta = -\dfrac{2\sqrt{14}}{9}$ where $90 \le \theta < 180$

Find $\sin 2\theta$

9) $\tan \theta = \dfrac{\sqrt{2}}{4}$ where $0 \le \theta < 90$

Find $\cos \dfrac{\theta}{2}$

10) $\tan \theta = \dfrac{\sqrt{3}}{3}$ where $0 \le \theta < 90$

Find $\cos 2\theta$

11) $\cos \theta = \dfrac{3}{5}$ where $270 \le \theta < 360$

Find $\cos 2\theta$

12) $\tan \theta = \dfrac{4}{3}$ where $180 \le \theta < 270$

Find $\tan \dfrac{\theta}{2}$

Verify each identity.

13) $\dfrac{\sin 2x}{\cos x} = 2\sin x$

14) $\dfrac{2\sin x\cos x}{\cos 2x} = \tan 2x$

15) $\dfrac{2\sin x\cos x}{\csc^2 x - 1} = \tan^2 x\sin 2x$

16) $\dfrac{\sin 2x}{\cot^2 x(1 + \cos 2x)} = \tan^3 x$

Multiple-Angle Identities

Use the half-angle identities to find the exact value of each.

1) $\sin 292.5°$

$-\dfrac{\sqrt{2+\sqrt{2}}}{2}$

2) $\sin 337.5°$

$-\dfrac{\sqrt{2-\sqrt{2}}}{2}$

3) $\tan 105°$

$-2-\sqrt{3}$

4) $\cos 105°$

$-\dfrac{\sqrt{2-\sqrt{3}}}{2}$

5) $\cos 157.5°$

$-\dfrac{\sqrt{2+\sqrt{2}}}{2}$

6) $\cos 337.5°$

$\dfrac{\sqrt{2+\sqrt{2}}}{2}$

Find the exact value of each.

7) $\tan \theta = \dfrac{15}{8}$ where $180 \le \theta < 270$

Find $\tan 2\theta$

$-\dfrac{240}{161}$

8) $\cos \theta = -\dfrac{2\sqrt{14}}{9}$ where $90 \le \theta < 180$

Find $\sin 2\theta$

$-\dfrac{20\sqrt{14}}{81}$

9) $\tan \theta = \dfrac{\sqrt{2}}{4}$ where $0 \le \theta < 90$

Find $\cos \dfrac{\theta}{2}$

$\dfrac{\sqrt{18+12\sqrt{2}}}{6}$

10) $\tan \theta = \dfrac{\sqrt{3}}{3}$ where $0 \le \theta < 90$

Find $\cos 2\theta$

$\dfrac{1}{2}$

11) $\cos \theta = \dfrac{3}{5}$ where $270 \le \theta < 360$

Find $\cos 2\theta$

$-\dfrac{7}{25}$

12) $\tan \theta = \dfrac{4}{3}$ where $180 \le \theta < 270$

Find $\tan \dfrac{\theta}{2}$

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Verify each identity.

13) $\dfrac{\sin 2x}{\cos x} = 2\sin x$

$\dfrac{\sin 2x}{\cos x}$ Use $\sin 2x = 2\sin x\cos x$

$\dfrac{2\sin x\cos x}{\cos x}$ Cancel common factors

$2\sin x$ ∎

14) $\dfrac{2\sin x\cos x}{\cos 2x} = \tan 2x$

$\dfrac{2\sin x\cos x}{\cos 2x}$ Use $\sin 2x = 2\sin x\cos x$

$\dfrac{\sin 2x}{\cos 2x}$ Use $\tan 2x = \dfrac{\sin 2x}{\cos 2x}$

$\tan 2x$ ∎

15) $\dfrac{2\sin x\cos x}{\csc^2 x - 1} = \tan^2 x\sin 2x$

$\dfrac{2\sin x\cos x}{\csc^2 x - 1}$ Use $\cot^2 x + 1 = \csc^2 x$

$\dfrac{2\sin x\cos x}{\cot^2 x}$ Use $\sin 2x = 2\sin x\cos x$

$\dfrac{\sin 2x}{\cot^2 x}$ Use $\cot x = \dfrac{1}{\tan x}$

$\tan^2 x\sin 2x$ ∎

16) $\dfrac{\sin 2x}{\cot^2 x\left(1 + \cos 2x\right)} = \tan^3 x$

$\dfrac{\sin 2x}{\cot^2 x\left(1 + \cos 2x\right)}$ Use $\sin 2x = 2\sin x\cos x$

$\dfrac{2\sin x\cos x}{\cot^2 x\left(1 + \cos 2x\right)}$ Use $\cos 2x = 2\cos^2 x - 1$

$\dfrac{2\sin x\cos x}{2\cot^2 x\cos^2 x}$ Cancel common factors

$\dfrac{\sin x}{\cot^2 x\cos x}$ Use $\cot x = \dfrac{1}{\tan x}$

$\dfrac{\tan^2 x\sin x}{\cos x}$ Use $\tan x = \dfrac{\sin x}{\cos x}$

$\tan^3 x$