

## Half and Double angles

Date \_\_\_\_\_ Period \_\_\_\_\_

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

1)  $\tan \frac{11\pi}{8}$

2)  $\sin \frac{15\pi}{8}$

3)  $\tan 112.5^\circ$

4)  $\sin 157.5^\circ$

**Find the exact value of each.**

5)  $\sin \theta = \frac{4}{5}$  where  $0 \leq \theta < 90$

Find  $\cos 2\theta$ 

6)  $\sin \theta = -\frac{12}{13}$  where  $180 \leq \theta < 270$

Find  $\cos 2\theta$ **Use the half-angle identities to find the exact value of each.**

7)  $\tan 75^\circ$

8)  $\tan 15^\circ$

9)  $\tan 112.5^\circ$

10)  $\cos 157.5^\circ$

**Find the exact value of each.**

11)  $\tan \theta = \frac{4}{3}$  where  $540 \leq \theta < 630$

Find  $\cos 2\theta$

12)  $\cos \theta = \frac{\sqrt{5}}{3}$  where  $270 \leq \theta < 360$

Find  $\sin 2\theta$

**Verify each identity.**

13)  $\frac{2\sin x \cot^2 x}{\cos x} = \frac{\sin 2x}{\sin^2 x}$

14)  $\frac{3\cos^2 x}{\cot^2 x} = 1 - \cos 2x + \sin^2 x$

15)  $\frac{\sin^2 x \csc^2 x}{\tan x} = \frac{2\cos^2 x}{\sin 2x}$

16)  $\cot x \sin 2x = 1 + \cos 2x$

## Half and Double angles

Date \_\_\_\_\_ Period \_\_\_\_\_

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

1)  $\tan \frac{11\pi}{8}$

$1 + \sqrt{2}$

2)  $\sin \frac{15\pi}{8}$

$-\frac{\sqrt{2} - \sqrt{2}}{2}$

3)  $\tan 112.5^\circ$

$-1 - \sqrt{2}$

4)  $\sin 157.5^\circ$

$\frac{\sqrt{2} - \sqrt{2}}{2}$

**Find the exact value of each.**

5)  $\sin \theta = \frac{4}{5}$  where  $0 \leq \theta < 90$

Find  $\cos 2\theta$ 

$-\frac{7}{25}$

6)  $\sin \theta = -\frac{12}{13}$  where  $180 \leq \theta < 270$

Find  $\cos 2\theta$ 

$-\frac{119}{169}$

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

7)  $\tan 75^\circ$

$2 + \sqrt{3}$

8)  $\tan 15^\circ$

$2 - \sqrt{3}$

9)  $\tan 112.5^\circ$

$-1 - \sqrt{2}$

10)  $\cos 157.5^\circ$

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

**Find the exact value of each.**

11)  $\tan \theta = \frac{4}{3}$  where  $540 \leq \theta < 630$

Find  $\cos 2\theta$

$$-\frac{7}{25}$$

12)  $\cos \theta = \frac{\sqrt{5}}{3}$  where  $270 \leq \theta < 360$

Find  $\sin 2\theta$

$$-\frac{4\sqrt{5}}{9}$$

**Verify each identity.**

13)  $\frac{2\sin x \cot^2 x}{\cos x} = \frac{\sin 2x}{\sin^2 x}$

$$\frac{2\sin x \cot^2 x}{\cos x} \quad \text{Use } \cot x = \frac{\cos x}{\sin x}$$

$$\frac{2\sin x \cos^2 x}{\cos x \sin^2 x} \quad \text{Cancel common factors}$$

$$\frac{2\sin x \cos x}{\sin^2 x} \quad \text{Use } \sin 2x = 2\sin x \cos x$$

14)  $\frac{3\cos^2 x}{\cot^2 x} = 1 - \cos 2x + \sin^2 x$

$$\frac{\sin 2x}{\sin^2 x} \cdot \frac{3\cos^2 x}{\cot^2 x} \quad \text{Decompose into sine and cosine}$$

$$\frac{3\cos^2 x}{\left(\frac{\cos x}{\sin x}\right)^2} \quad \text{Simplify}$$

$$3\sin^2 x \quad \text{Use } \cos 2x = 1 - 2\sin^2 x$$

15)  $\frac{\sin^2 x \csc^2 x}{\tan x} = \frac{2\cos^2 x}{\sin 2x}$

$$\frac{\sin^2 x \csc^2 x}{1 - \cos 2x + \sin^2 x} \quad \text{Decompose into sine and cosine}$$

$$\frac{\sin^2 x \cdot \left(\frac{1}{\sin x}\right)^2}{\sin x} \quad \text{Simplify}$$

$$\frac{\sin x}{\cos x}$$

16)  $\cot x \sin 2x = 1 + \cos 2x$

$$\cot x \frac{\sin 2x}{\sin x} \quad \text{Use } \sin 2x = 2\sin x \cos x \text{ Create a common factor}$$

$$\frac{2\cot x \sin x \cos x}{2\cos^2 x} \quad \text{Use } \cot x = \frac{\cos x}{\sin x} \text{ Use } \sin 2x = 2\sin x \cos x$$

$$\frac{2\sin x \cos x}{2\cos^2 x \sin x} \quad \text{Cancel common factors}$$

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

$$\frac{\sin 2x}{2\cos^2 x} \quad \text{Use } \cos 2x = 2\cos^2 x - 1$$