



2023-2024

8.5 Multiple Angle Identities

SCORE:

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Name _____ Date _____ Period _____

Use the appropriate sum or difference identity to prove the double-angle identity. Show work!
Remember you cannot use the identity you are proving in the proof of the identity.

1. $\cos 2u = \cos^2 u - \sin^2 u$

2. $\cos 2u = 1 - 2\sin^2 u$

Find the exact value of each expression using double-angle identities. Show work (do not use the unit circle).

3. $\sin(90^\circ)$

4. $\tan(60^\circ)$

5. $\cos\left(\frac{4\pi}{3}\right)$

6. $\sin\left(\frac{2\pi}{3}\right)$

Use the appropriate identities to simplify each expression to a single trigonometric function. If the trigonometric function is on the unit circle, write the ratio of the trigonometric function. Do not use a calculator. You can use the unit circle.

7. $2\sin(13^\circ)\cos(13^\circ)$

8. $2\cos^2(22.5^\circ)-1$

9. $\frac{2\tan(15^\circ)}{1-\tan^2(15^\circ)}$

10. $\cos^2\left(\frac{\pi}{9}\right)-\sin^2\left(\frac{\pi}{9}\right)$

Find the exact value of each expression using half-angle identities. Do not use a calculator. You can use the unit circle.

11. $\sin(15^\circ)$

12. $\tan(15^\circ)$

13. $\cos\left(\frac{\pi}{8}\right)$

14. $\sin(22.5^\circ)$

For each equation determine whether the positive or negative sign makes the equation correct. Do not use a calculator.

$$15. \quad \sin(118.5^\circ) = \pm \sqrt{\frac{1 - \cos(237^\circ)}{2}}$$

$$16. \quad \cos(100^\circ) = \pm \sqrt{\frac{1 + \cos(200^\circ)}{2}}$$

$$17. \quad \cos\left(\frac{9\pi}{7}\right) = \pm \sqrt{\frac{1 + \cos\left(\frac{18\pi}{7}\right)}{2}}$$

$$18. \quad \tan\left(\frac{17\pi}{12}\right) = \pm \sqrt{\frac{1 - \cos\left(\frac{17\pi}{6}\right)}{1 + \cos\left(\frac{17\pi}{6}\right)}}$$

Prove that each equation is an identity.

$$19. \quad \cos^4 x - \sin^4 x = \cos 2x$$

$$20. \quad (\sin x - \cos x)^2 = 1 - \sin 2x$$

Prove that each equation is an identity.

$$21. \quad \frac{\cos 2x}{\sin^2 x} = \csc^2 x - 2$$

$$22. \quad 2 \sin^2 \left(\frac{x}{2} \right) = \frac{\sin^2 x}{1 + \cos x}$$

$$23. \quad \sin 4u = 2 \sin 2u \cos 2u$$

$$24. \quad 2 \csc 2x = \csc^2 x \tan x$$

In each case, find $\sin \alpha$, $\cos \alpha$, $\tan \alpha$, $\csc \alpha$, $\sec \alpha$, *and* $\cot \alpha$.

25. $\cos 2\alpha = \frac{3}{5}$ and $0^\circ < 2\alpha < 90^\circ$

26. $\cos 2\alpha = \frac{5}{13}$ and $0 \leq 2\alpha \leq \frac{\pi}{2}$

Solve each problem.

27. Find the exact value of $\sin(2\alpha)$ given that $\sin(\alpha) = \frac{3}{5}$ and α is in quadrant II.

28. Find the exact value of $\cos(2\alpha)$ given that $\sin(\alpha) = \frac{8}{17}$ and α is in quadrant II.