

Trigonometric Identities and Equations: math practice, Grade 12 – download the PDF

22 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Simplify with Pythagorean identities

★★★

Simplify each expression: a. $1 - \cos^2 x$ b. $\sec^2 x - 1$ c. $\csc^2 x - \cot^2 x$.

2 Cosine given, sine and tangent wanted

★★★

Angle θ is in Quadrant IV and $\cos \theta = \frac{5}{13}$. Find $\sin \theta$ and $\tan \theta$.

3 Exact value of sin 15 degrees

★★★

Use $15^\circ = 45^\circ - 30^\circ$ to find the exact value of $\sin 15^\circ$.

4 Cosine of a double angle

★★★

If $\sin \theta = \frac{1}{3}$, find $\cos 2\theta$.

5 True or false: sine of a sum



Is it true that $\sin(A + B) = \sin A + \sin B$ for all angles? Justify with a counterexample.

6 Exact value of $\sin 105^\circ$



Write $105^\circ = 60^\circ + 45^\circ$ and find the exact value of $\sin 105^\circ$.

7 Tangent of a double angle

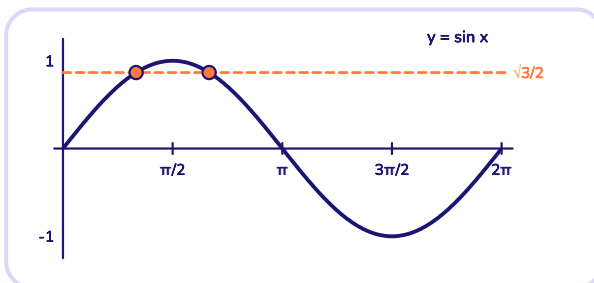


If $\tan \theta = \frac{1}{2}$, find $\tan 2\theta$.

8 A basic equation on one turn



Solve $\sin x = \frac{\sqrt{3}}{2}$ on $[0, 2\pi)$. Use the graph to see why there are two answers.



9 Cosine of 15 degrees from a difference



Use $\frac{\pi}{12} = \frac{\pi}{3} - \frac{\pi}{4}$ to find the exact value of $\cos \frac{\pi}{12}$.

10 Tangent of 15 degrees by half-angle



Use the half-angle formula $\tan \frac{\theta}{2} = \frac{1 - \cos \theta}{\sin \theta}$ with $\theta = 30^\circ$ to find $\tan 15^\circ$.

11 Half-angle with a given cosine

Let $\cos \theta = -\frac{7}{25}$ with $90^\circ < \theta < 180^\circ$. Find $\sin \frac{\theta}{2}$ and $\cos \frac{\theta}{2}$.

12 Product-to-sum practice

a. Write $2 \sin 5x \cos 3x$ as a sum. b. Find the exact value of $\cos 75^\circ \cos 15^\circ$.

13 Sum-to-product practice

a. Write $\sin 7x + \sin 3x$ as a product. b. Find the exact value of $\cos 75^\circ + \cos 15^\circ$.

14 Quadratic in sine

Solve $2 \sin^2 x - \sin x - 1 = 0$ on $[0, 2\pi)$.

15 Verify $\tan + \cot$ 

Verify the identity $\tan x + \cot x = \sec x \csc x$.

16 Verify a half-angle quotient

Verify that $\frac{\sin 2x}{1 + \cos 2x} = \tan x$.

17 Equation with $\cos 2x$ and $\cos x$ 

Solve $\cos 2x = \cos x$ on $[0, 2\pi)$.

18 Do not divide by cosine

★★★

Solve $\sin 2x = \sqrt{3} \cos x$ on $[0, 2\pi)$.

19 Launch angle of a soccer ball

★★★

A ball kicked at $v = 20 \text{ m/s}$ (about 65.6 ft/s) at angle θ travels the horizontal distance

$R = \frac{v^2 \sin 2\theta}{g}$ with $g = 9.8 \text{ m/s}^2$. At what angles between 0° and 90° does the ball land 30 m (about 98 ft) away? Round to the nearest tenth of a degree.

20 Two electrical signals

★★★

Two signals are $\sin\left(x + \frac{\pi}{3}\right)$ and $\sin\left(x - \frac{\pi}{3}\right)$. Prove that their sum is simply $\sin x$.

21 Triple-angle formula

★★★

Prove that $\cos 3x = 4 \cos^3 x - 3 \cos x$. Hint: write $3x = 2x + x$.

22 Extraneous solutions

★★★

Solve $\sin x + \cos x = 1$ on $[0, 2\pi)$ by squaring both sides, then check every candidate.

**Test yourself: quick challenge for Grade 12**[Change level](#)

Level : **Grade 12**

6 random questions, instant feedback.

 **Start the challenge**

 **Speed drill for Grade 12: how many in 60 seconds?**

 **Keep exploring with Zyro**

 **Practice solutions**

Trigonometric Identities and Equations:
practice solutions, Grade 12

 **Math lessons**

Trigonometric Identities and Equations:
math lesson, Grade 12

 Math quizzes

Trigonometric Identities and Equations:
math quiz, Grade 12

 Practice solutions

Law of Sines and Law of Cosines:
practice solutions, Grade 12

 Practice solutions

Vectors, Polar Coordinates, and Complex
Numbers: practice solutions, Grade 12

 Math lessons

Law of Sines and Law of Cosines: math
lesson, Grade 12

Zyro takes you to our partner sites

Blast off to other planets of knowledge and their apps.

Lift off