

Trigonometric Functions and the Unit Circle: math practice, Grade 12 – download the PDF

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

1 Degrees to radians

★ ★ ★

Convert each angle to radians, in terms of π : a) 45° b) 120° c) 270° d) 15° .

2 Radians to degrees

★ ★ ★

Convert to degrees: a) $\frac{5\pi}{6}$ b) $\frac{7\pi}{4}$ c) $\frac{\pi}{10}$ d) $\frac{3\pi}{5}$.

3 Length of an arc

★ ★ ★

A circular garden path is an arc of a circle of radius **8 m** with central angle $\frac{\pi}{4}$. Find the exact length of the path and a decimal approximation to the nearest hundredth.

4 Reading the unit circle

★ ★ ★

Give the exact value: a) $\sin \frac{\pi}{6}$ b) $\cos \frac{\pi}{3}$ c) $\tan \frac{\pi}{4}$ d) $\cos \frac{\pi}{2}$ e) $\sin \pi$.

5 Quadrants and signs



For each angle, name the quadrant and give the signs of **sin** and **cos**: a) $\frac{5\pi}{6}$ b) $\frac{4\pi}{3}$ c) $\frac{11\pi}{6}$
d) $\frac{7\pi}{12}$.

6 Right triangle ratios



A right triangle has legs **5 in** and **12 in**. Let θ be the acute angle opposite the 5-inch leg. Find the hypotenuse, then **sin** θ , **cos** θ and **tan** θ .

7 Coterminal angles



Find the angle between **0** and **2π** that is coterminal with: a) $\frac{13\pi}{6}$ b) $-\frac{\pi}{3}$ c) $\frac{9\pi}{4}$ d) $-\frac{7\pi}{4}$.

8 Reference angles and values



Give the reference angle, then the exact value: a) **sin** $\frac{5\pi}{6}$ b) **cos** $\frac{4\pi}{3}$ c) **tan** $\frac{7\pi}{4}$ d) **cos** $\frac{11\pi}{6}$.

9 Reciprocal functions



Find the exact value: a) **sec** $\frac{\pi}{3}$ b) **csc** $\frac{5\pi}{6}$ c) **cot** $\frac{3\pi}{4}$ d) **sec** $\frac{7\pi}{6}$ (rationalize the denominator).

10 All six from one value



Suppose **sin** $\theta = \frac{3}{5}$ and θ is in quadrant II. Find **cos** θ , **tan** θ , **csc** θ , **sec** θ and **cot** θ .

11 A leaning ladder

A **20-foot** ladder leans against a wall and makes a **70°** angle with level ground. How high up the wall does it reach, and how far is its foot from the wall? Round to the nearest hundredth of a foot.

12 Sector of a pizza

A slice of a large pizza is a sector with radius **15 in** and central angle **100°** . Find the exact arc length of the crust and the exact area of the slice, then approximate both to the nearest hundredth.

13 True or false?

Decide whether each statement is true for every x . If false, give a counterexample. a) $\sin(-x) = -\sin x$ b) $\cos(-x) = \cos x$ c) $\tan(x + \pi) = \tan x$ d) $\sin(x + \pi) = \sin x$.

14 A bicycle wheel

A bicycle wheel of radius **13 in** turns at **45 rpm**. Find its angular velocity in radians per second and the linear velocity of a point on the tire, in inches per second and in miles per hour (**1 mi = 63,360 in**).

15 Solving sin equals a value

Solve $\sin \theta = -\frac{\sqrt{3}}{2}$ for $0 \leq \theta < 2\pi$.

16 Solving a tangent equation

Solve $\tan \theta = -\sqrt{3}$ for $0 \leq \theta < 2\pi$.

17 Large and negative angles

★★★

Find the exact value: a) $\sin\left(-\frac{11\pi}{6}\right)$ b) $\cos\frac{25\pi}{4}$ c) $\tan\frac{17\pi}{3}$ d) $\sec\left(-\frac{13\pi}{3}\right)$.

18 Finding sine and tangent from cosine

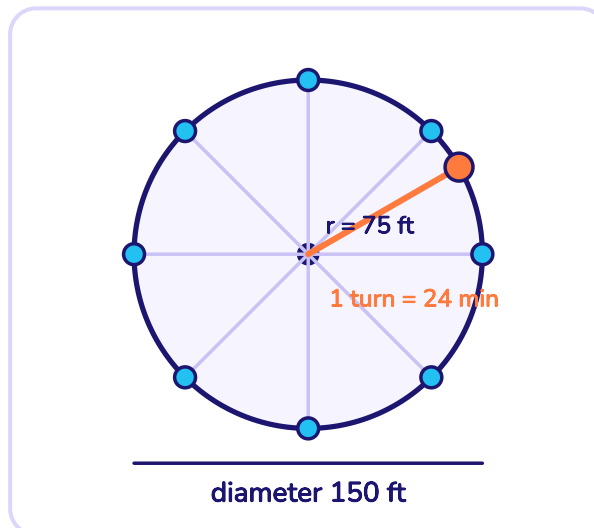
★★★

Given $\cos\theta = -\frac{5}{13}$ and $\tan\theta > 0$, find $\sin\theta$, $\tan\theta$ and $\csc\theta$.

19 The Ferris wheel

★★★

A Ferris wheel has diameter **150 ft** and makes one full turn every **24** minutes.



Find the angular velocity in radians per minute, the speed of a rider in feet per minute, and that speed in miles per hour (**1 mi = 5280 ft**).

20 Height of a tree

★★★

A surveyor stands **50 ft** from the base of a tree. Her eye is **5.5 ft** above the ground and the angle of elevation to the treetop is **36°** . How tall is the tree to the nearest tenth of a foot?

21 Using an identity



Given $\tan \theta = 2$ and θ in quadrant III, find $\sec \theta$, $\cos \theta$ and $\sin \theta$ exactly, then check that $\sin^2 \theta + \cos^2 \theta = 1$.

22 A car tire



A car tire has a diameter of **28 in**. The car travels at **60 mph** ($1 \text{ mi} = 63,360 \text{ in}$). Find the tire's angular velocity in radians per second, then in revolutions per minute (nearest whole number).



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