Geometry 8.4

Use right triangles to find trigonometric ratios

Use trig ratios to find angle measures in right triangles

opposite across (far away)

adjacent next door

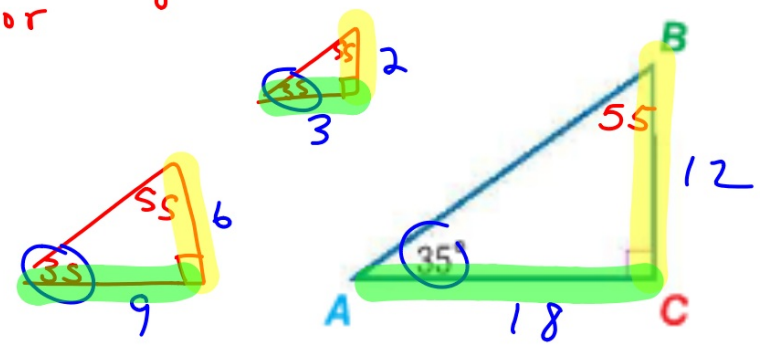
trigonometry

ratio

rt Δ

- trig ratio
- sine
- cosine
- tangent

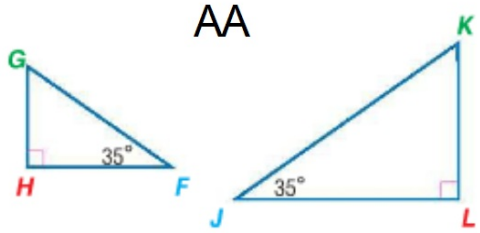
SohCahToa



Every 35-55-90...

By AA Similarity, a right triangle with a given acute angle measure is similar to every other right triangle with the same acute angle measure. So, trigonometric ratios are constant for a given angle measure.

AA

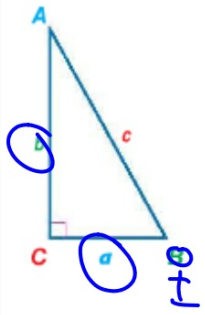


$\triangle ABC \sim \triangle FGH \sim \triangle JKL$, so $\frac{AC}{AB} = \frac{FH}{FG} = \frac{JL}{JK}$

$\sin = \frac{opp}{hyp}$ S h O SOH

KeyConcept Trigonometric Ratios

Words	Symbols
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the **sine** of $\angle A$ (written sin A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the hypotenuse (hyp).	$\sin A = \frac{opp}{hyp}$ or $\frac{a}{c}$ $\sin B = \frac{opp}{hyp}$ or $\frac{b}{c}$
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the **cosine** of $\angle A$ (written cos A) is the ratio of the length of the leg adjacent $\angle A$ (adj) to the length of the hypotenuse (hyp).	$\cos A = \frac{adj}{hyp}$ or $\frac{b}{c}$ $\cos B = \frac{adj}{hyp}$ or $\frac{a}{c}$
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the **tangent** of $\angle A$ (written tan A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the leg adjacent $\angle A$ (adj).	$\tan A = \frac{opp}{adj}$ or $\frac{a}{b}$ $\tan B = \frac{opp}{adj}$ or $\frac{b}{a}$



Douglas Peebles Photography/Alamy

$\cos = \frac{adj}{hyp}$ C $\frac{a}{h}$ CAH

$\tan \frac{opp}{adj}$ T $\frac{O}{A}$ TOA

SohCahToa
No sinning in geometry!

SOHCAHTOA!

(Handel's Hallelujah Chorus)

Soh Cah Toa!
Soh Cah Toa!
Learn it, and use it!
Soh Cah Toa!

Sine is opposite over hypotenuse.
Soh Cah Toa
Soh Cah Toa
Learn it, and use it!

Cosine is adjacent over hypotenuse.
Soh Cah Toa
Soh Cah Toa
Learn it, and use it!

Tangent is opposite over adjacent!
Soh Cah Toa
Soh Cah Toa

SOH CAH TOA!

SohCahToa $\frac{4}{8} = \frac{1}{2}$

Where are you?

Example 1 Find Sine, Cosine, and Tangent Ratios

Express each ratio as a fraction and as a decimal to the nearest hundredth.

a. $\sin P$ $\frac{O}{h} = \frac{15}{17}$

0.88

b. $\cos P$ $\frac{a}{h} = \frac{8}{17}$

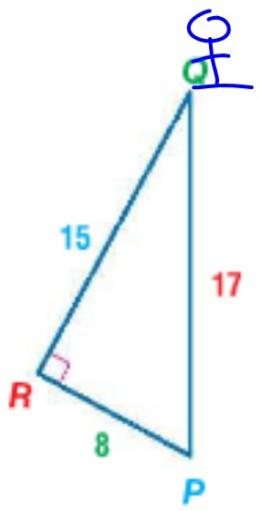
c. $\tan P$ $\frac{O}{a} = \frac{15}{8}$

d. $\sin Q$ $\frac{O}{h} = \frac{8}{17}$

e. $\cos Q$

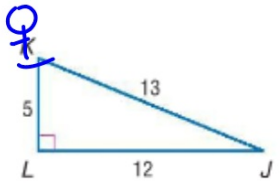
f. $\tan Q$

$\frac{8}{7}$



GuidedPractice

1. Find sin J, cos J, tan J, sin K, cos K, and tan K. Express each ratio as a fraction and as a decimal to the nearest hundredth.



$\sin J \quad \frac{o}{h} = \frac{5}{13}$

$\cos J \quad \frac{a}{h} = \frac{12}{13}$

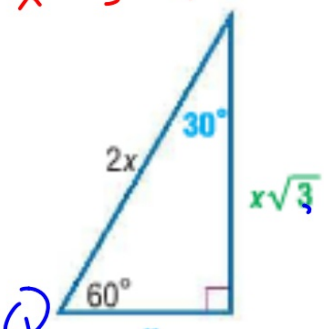
$\tan J \quad \frac{o}{a} = \frac{5}{12}$

$\sin K \quad \frac{o}{h} = \frac{12}{13}$

$\cos K \quad \frac{a}{h} = \frac{5}{13}$

$\tan K \quad \frac{o}{a} = \frac{12}{5}$

$\frac{x}{x}$ $\frac{2}{3}$ $\frac{9}{9}$ $\frac{2}{2}$.



Q I

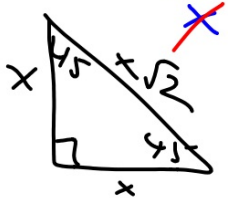
$\sin 60 \quad \frac{o}{h} \quad \frac{x\sqrt{3}}{2x} = \frac{\sqrt{3}}{2}$

$\cos 30 = \frac{x\sqrt{3}}{2x} = \frac{\sqrt{3}}{2}$

$\tan 60 \quad \frac{x\sqrt{3}}{x} \quad \sqrt{3}$

exact

30, 60, 45

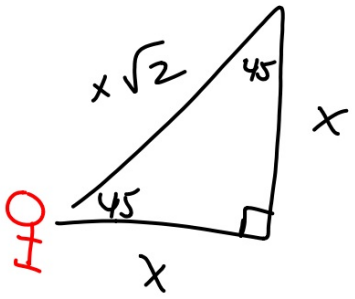


sin 30
cos 30
tan 30
(Where are you?)

exact values vs decimal
(depends on directions)

GuidedPractice

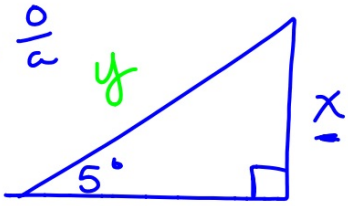
2. Use a special right triangle to express the cosine of 45° as a fraction and as a decimal to the nearest hundredth.



$\cos 45 \quad \frac{a}{h} = \frac{x}{x\sqrt{2}} \quad \frac{1}{\sqrt{2}}$

$\left(\frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}\right)$

tan $\frac{o}{a}$



$\tan 5^\circ = \frac{x}{100}$

$0.0875 = \frac{x}{100}$

$x = 8.75$

$\cos 5 = \frac{100}{y}$ $\quad 0.9962 = \frac{100}{y}$

Where are you?

Identify opposite, adjacent, hypotenuse

Which ratio will help you answer the question?

$100 = 0.9962y$

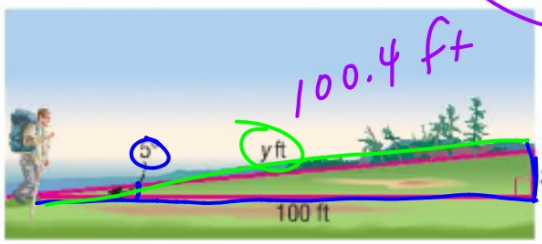
Set calculator to DEGREES!

PT

4 dec. places

Real-World Example 3 Estimate Measures Using Trigonometry

HIKING A certain part of a hiking trail slopes upward at about a 5° angle. After traveling a horizontal distance of 100 feet along this part of the trail, what would be the change in a hiker's vertical position? What distance has the hiker traveled along the path?



8.75 ft

GuidedPractice

Find x to the nearest hundredth.

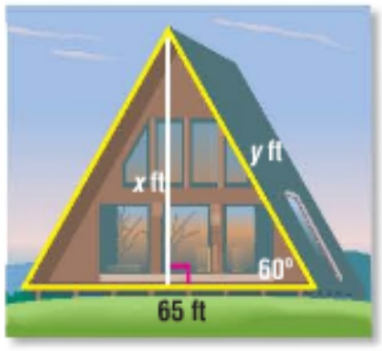
3A.

3B.

Where are you?
Identify o,a,h
Which ratio will help you?

Is it a special triangle?

30. ARCHITECTURE The front of the vacation cottage shown is an isosceles triangle. What is the height x of the cottage above its foundation? What is the length y of the roof? Explain your reasoning.



J. A. Kraulis/Masterf

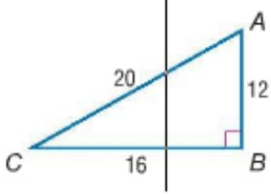
Whiteboards

our Understanding = Step-by-Step Solutions begin on page R14.

Express each ratio as a fraction and as a decimal to the nearest hundredth.

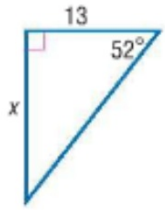
1. sin A **2.** tan C **3.** cos A

4. tan A **5.** cos C **6.** sin C

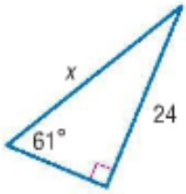


Find x. Round to the nearest hundredth.

8.



9.



10.