Worked Examples - Trigonometric Ratios: sin, cos, and tan (IXL Geometry Q.1)

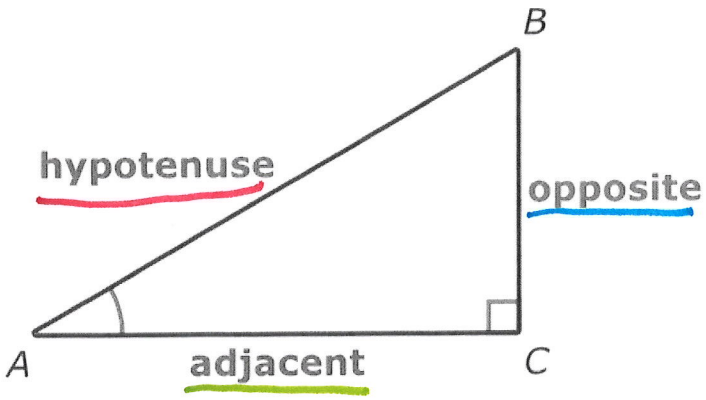
Trigonometric ratios relate the side lengths of a right triangle. The basic trigonometric ratios are sine (sin), cosine (cos), and tangent (tan):

- The **sine** of an acute angle is the ratio of the length of the leg opposite the angle to the length of the hypotenuse.

- The **cosine** of an acute angle is the ratio of the length of the leg adjacent to the angle to the length of the hypotenuse.

- The **tangent** of an acute angle is the ratio of the length of the leg opposite the angle to the length of the leg adjacent to the angle.

The basic trigonometric ratios are defined below with respect to $\angle A$.



$$\sin(A) = \frac{\text{opposite}}{\text{hypotenuse}} \qquad \frac{O}{H}$$

$$\cos(A) = \frac{\text{adjacent}}{\text{hypotenuse}} \qquad \frac{A}{H}$$

$$\tan(A) = \frac{\text{opposite}}{\text{adjacent}} \qquad \frac{O}{A}$$

$S\frac{O}{H}\quad C\frac{A}{H}\quad T\frac{O}{A}$

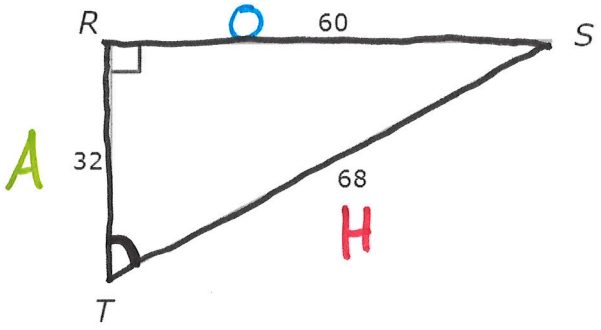
To remember these ratios by using the following device:
Some **O**ld **H**ippy **C**aught **A**nother **H**ippy **T**rippin' **O**n **A**cid

Or

SOH CAH TOA

Now let's try some examples:

1. Find the cosine of ∠T. Simplify your answer and write it as a proper fraction, improper fraction, or whole number.



1. Label

2. Take the trig formula

$\cos(\theta) = \frac{A}{H}$

3. Plug in

$\cos(T) = \frac{32}{68}$

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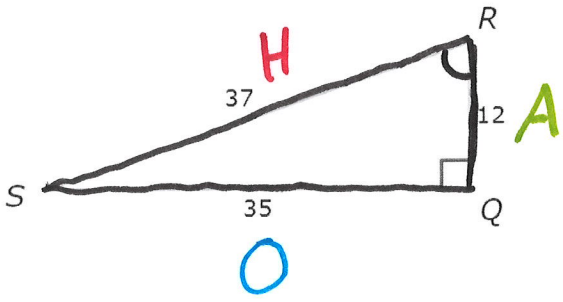
4. Simplify

$\cos(T) = \frac{8}{17}$

2. Find the tangent of ∠R. Simplify your answer and write it as a proper fraction, improper fraction, or whole number.

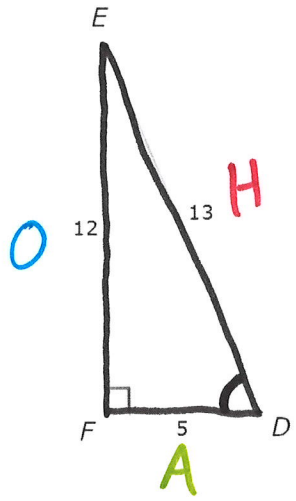


$\tan(\theta) = \frac{O}{A}$

$\tan(R) = \frac{35}{12}$

∠D

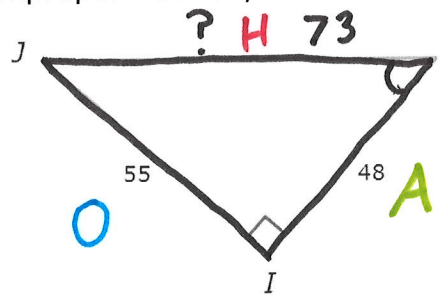
3. Find the sine of ●. Simplify your answer and write it as a proper fraction, improper fraction, or whole number.



$\sin(\theta) = \frac{O}{H}$

$\sin(D) = \frac{12}{13}$

4. Find the sine of ∠K. Simplify your answer and write it as a proper fraction, improper fraction, or whole number.



$\sin(\theta) = \frac{O}{H}$

$\sin(K) = \frac{55}{73}$

$a^2 + b^2 = c^2$

$55^2 + 48^2 = c^2$

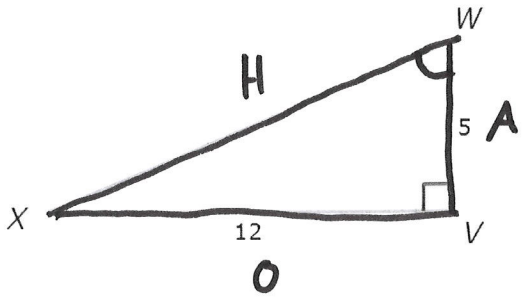
$3025 + 2304 = c^2$

$5329 = c^2$

$\sqrt{5329} = c$

$73 = c$

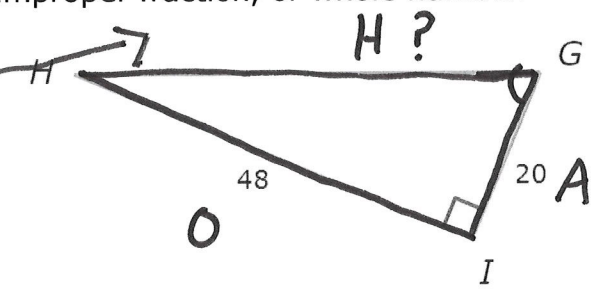
5. Find the tangent of ∠W. Simplify your answer and write it as a proper fraction, improper fraction, or whole number.



$\tan(\theta) = \frac{O}{A}$

$\tan(W) = \frac{12}{5}$

6. Find the cosine of ∠G. Simplify your answer and write it as a proper fraction, improper fraction, or whole number.



$\cos(\theta) = \frac{A}{H}$

$48^2 + 20^2 = GH^2$

$2704 = GH^2$

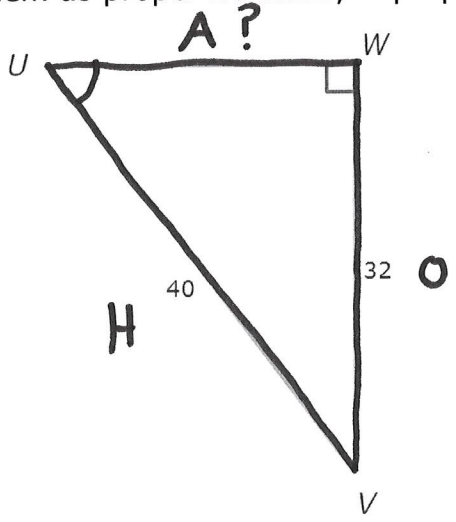
$\sqrt{2704} = GH$

$52 = GH$

$\cos(G) = \frac{20}{52}$ Simplify

$\cos(G) = \frac{5}{13}$

7. Find the sine, cosine, and tangent of ∠U. Simplify your answers and write them as proper fractions, improper fractions, or whole numbers.



$a^2 + b^2 = c^2$

$a^2 + 32^2 = 40^2$

$a^2 + 1024 = 1600$

$-1024 \quad -1024$

$a^2 = 576$

$a = \sqrt{576}$

$a = 24$

↑ Adjacent side

$\sin(\theta) = \frac{O}{H}$

$\sin(U) = \frac{32}{40}$ plug in

$\boxed{\sin(U) = \frac{4}{5}}$ simplify

$\cos(\theta) = \frac{A}{H}$

$\cos(U) = \frac{24}{40}$ plug in

$\boxed{\cos(U) = \frac{3}{5}}$ simplify

$\tan(\theta) = \frac{O}{A}$

$\tan(U) = \frac{32}{24}$ plug in

$\boxed{\tan(U) = \frac{4}{3}}$ simplify