

The Primary Trigonometric Ratios

Learning Goals



- ➔ Explore the connection between the ratios of the sides in the same triangle for similar triangles.
- ➔ Determine the values of the sine, cosine, and tangent ratios for a specific acute angle in a right triangle.

Definition



Trigonometry

- ➔ The branch of mathematics that deals with the relationships between the sides and angles of triangles.
- ➔ In an acute right-angle triangle, choose an angle (not the 90° angle) and write a ratio to compare two out of three sides of the triangle to each other.

Big Ideas

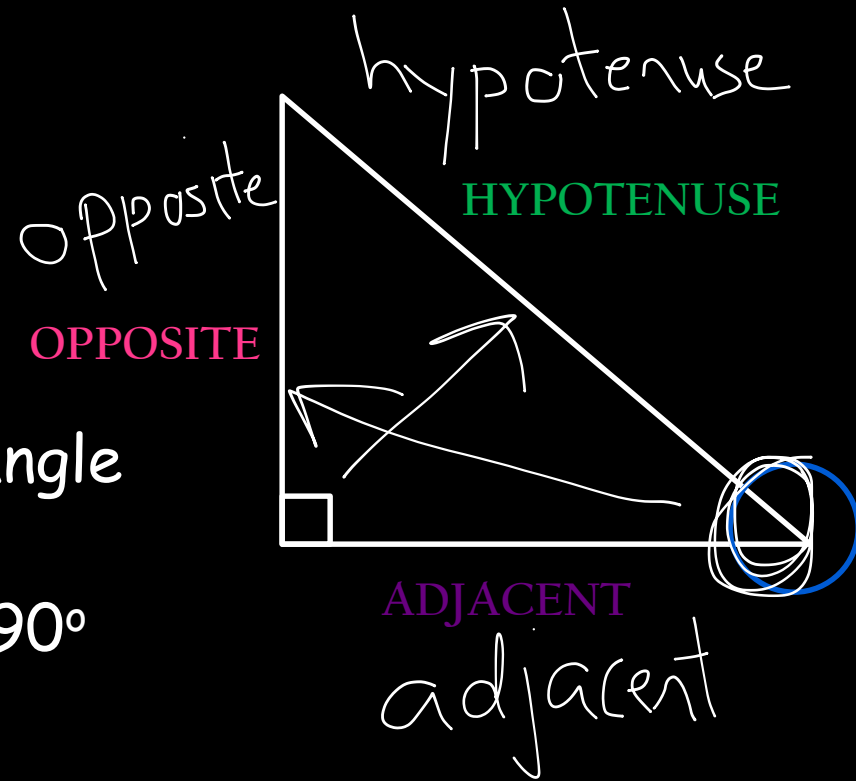
➔ Start with an acute right-angled triangle.

② ➔ Indicate the angle you are interested in by **circling** it.

③ ➔ Label the side opposite this angle the **OPPOSITE** side.

④ ➔ Label the side next to this angle the **ADJACENT** side.

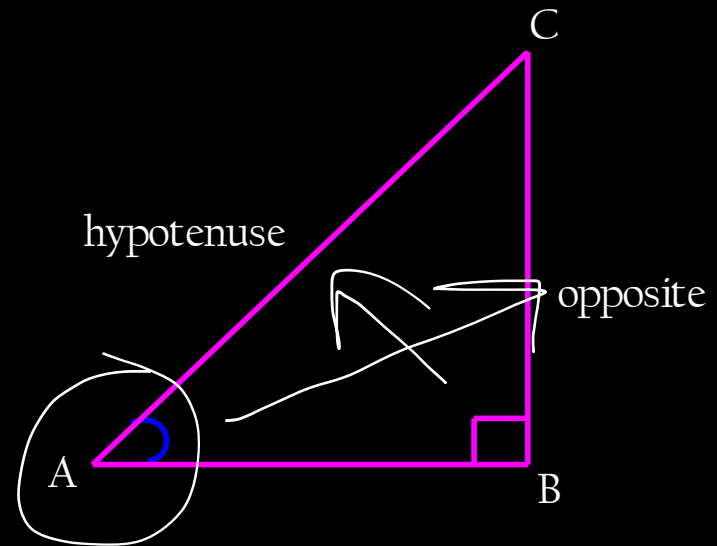
① ➔ Label the side opposite the 90° (the longest side) the **HYPOTENUSE**.



The Trigonometric Ratios

The Sine Ratio

- ➔ If angle A is an acute angle in a right-angled triangle, then the sine of angle A is the **ratio** of the length of the side located **opposite** angle A to the length of the **hypotenuse** of the triangle.
- ➔ It stays the same for any given angle, regardless of the size of the triangle.



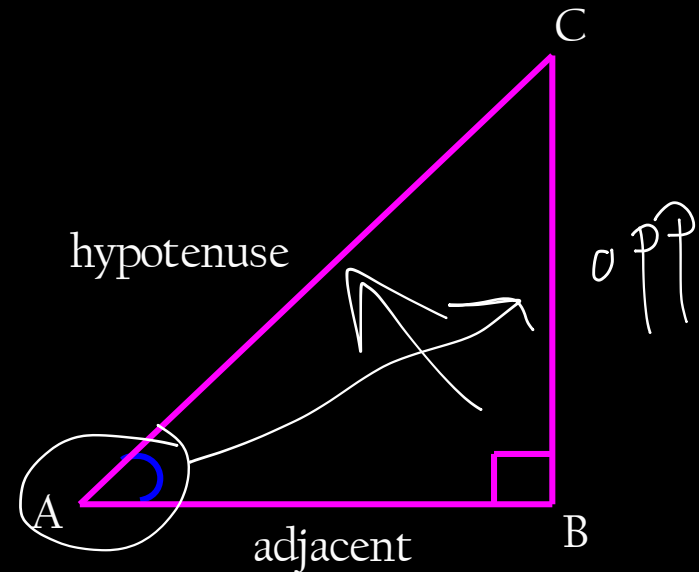
$$\sin A = \frac{\text{opp}}{\text{hyp}}$$

$$\sin A < 1$$

The Trigonometric Ratios

The Cosine Ratio

- ➔ If angle A is an acute angle in a right-angled triangle, then the cosine of angle A is the **ratio** of the length of the side located **adjacent** angle A to the length of the **hypotenuse** of the triangle.
- ➔ It stays the same for any given angle, regardless of the size of the triangle.



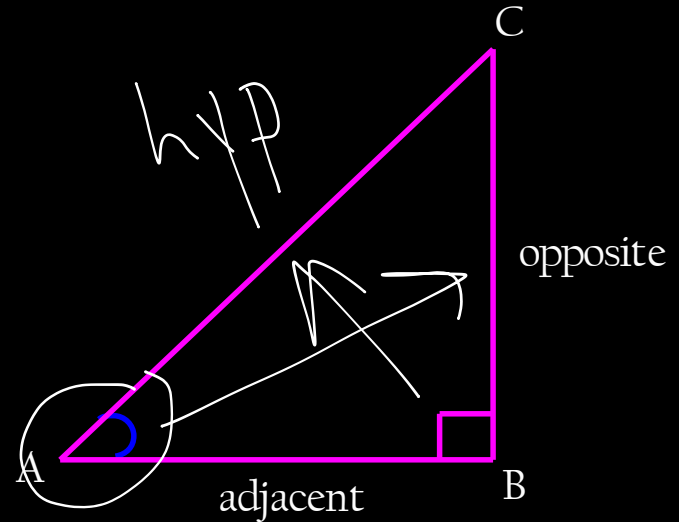
$$\cos A = \frac{\text{adj}}{\text{hyp}}$$

$$\cos A < 1$$

The Trigonometric Ratios

The Tangent Ratio

- ➔ If angle A is an acute angle in a right-angled triangle, then the tangent of angle A is the **ratio** of the length of the side located **opposite** angle A to the length of the side located **adjacent** to angle A .
- ➔ It stays the same for any given angle, regardless of the size of the triangle.



$$\tan A = \frac{\text{opp}}{\text{adj}}$$

$\tan A$ can be $\{, =, \}$

Summary

Step 1) Label the sides of the triangle opposite, adjacent, and hypotenuse in relation to the given the angle.

Step 2) Determine which ratio to use.

S
O
H
C
A
H
T
O
A

$$\sin\theta = \frac{\text{opp}}{\text{hyp}}$$

SOH

$$\sin A = \frac{\text{opp}}{\text{hyp}}$$

$$\cos\theta = \frac{\text{adj}}{\text{hyp}}$$

CAH

$$\cos A = \frac{\text{adj}}{\text{hyp}}$$

$$\tan\theta = \frac{\text{opp}}{\text{adj}}$$

TOA

$$\tan A = \frac{\text{opp}}{\text{adj}}$$

Step 3) Substitute the given information.

Step 4) Solve for the unknown.

Examples

1. Find the following by 4 decimal places:

a) $\sin 37^\circ = \underline{0.6018}$

b) $\sin 55^\circ = \underline{0.8192}$

c) $\cos 66^\circ = \underline{0.4067}$

d) $\cos 28^\circ = \underline{0.8829}$

e) $\tan 30^\circ = \underline{0.5774}$

f) $\tan 67^\circ = \underline{2.356}$

g) $\tan 45^\circ = \underline{1}$

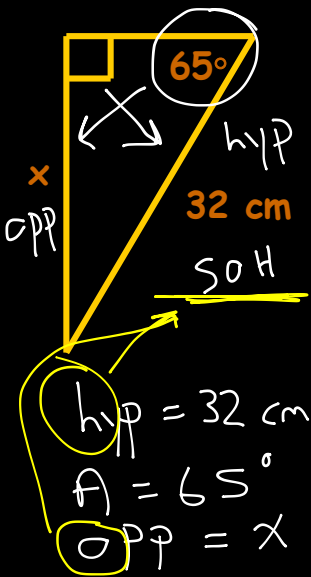


You need your calculator for trig ratios!

- ① Make sure your calculator is always in degree mode.
- ② Practice using your calculator & find a buddy who has the same calculator as you.

Examples

2. Find the missing side length to the nearest tenth.



SOH CAH TOA

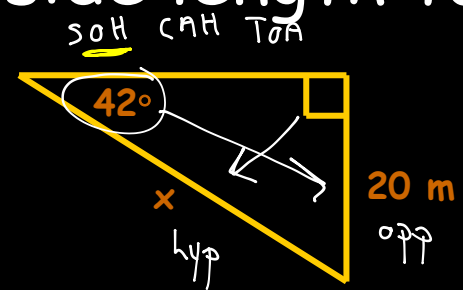
$$\sin 65^\circ = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 65^\circ = \frac{x}{32}$$

$$32 (\sin 65^\circ) = x$$

$$32 (0.9063) = x$$

$$x = 29 \text{ cm}$$



SOH CAH TOA

$\angle A = 42^\circ$
 $\text{hyp} = x$
 $\text{opp} = 20$

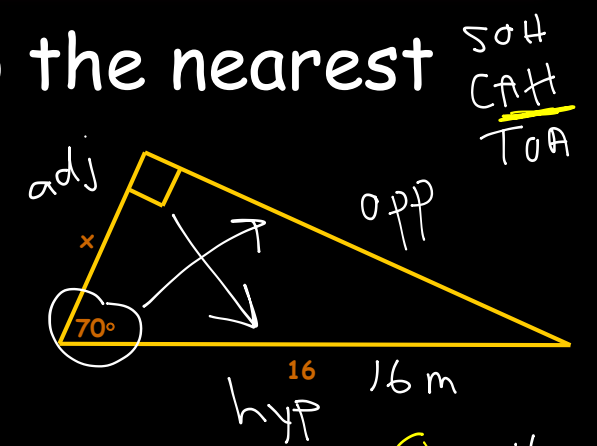
$$\sin A = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 42^\circ = \frac{20}{x}$$

$$x = \frac{20}{\sin 42^\circ}$$

$$x = \frac{20}{0.6691}$$

$$x = 30 \text{ m}$$



SOH CAH TOA

$\text{hyp} = 16 \text{ m}$
 $\text{adj} = x$
 $\angle A = 70^\circ$

$$\cos A = \frac{\text{adj}}{\text{hyp}}$$

$$\cos 70^\circ = \frac{x}{16}$$

$$16 (\cos 70^\circ) = x$$

$$16 (0.3420) = x$$

$$x = 5.5 \text{ m}$$

Examples

3. Draw a sketch of the triangle and find the indicated side to the nearest tenth.

In triangle PQR, angle R = 90° , angle P = 27° , and QR = 5 cm. Find the length of PR.

In triangle ABC, angle B = 90° , angle C = 64° , and BC = 10.3 cm. Find the length of AB.



Reinforcement



- ➔ Pages 398 - 399
 - ➔ #1 - 3, 5, 8, 10