SECONDARY MATH

TRIGONOMETRY

Complete Unit

SOH-CAH-TOA • Unit Circle • Graphing • Law of Sines & Cosines

Visual Guided Notes with Real-World Applications

GRADE LEVEL	VISUAL NOTES	PROGRESSIONS
10 – 11	50+ Pages	5 Units

UNIT PROGRESSIONS

1. Right Triangle Trig (SOH-CAH-TOA)
2. Special Right Triangles
3. The Unit Circle & Radian Measure
4. Graphing Sine & Cosine Functions
5. Law of Sines & Cosines (Ambiguous Case)

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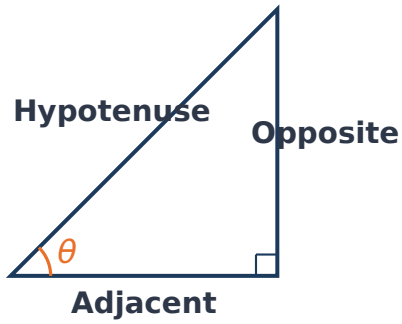
SOH-CAH-TOA Quick Reference Card

Keep this page as a handy reference!



SOH

Sine

$$\sin(\theta) = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

CAH

Cosine

$$\cos(\theta) = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

TOA

Tangent

$$\tan(\theta) = \frac{\text{Opposite}}{\text{Adjacent}}$$

Inverse Trigonometric Functions

Used to find missing ANGLES when you know two sides:

$\theta = \sin^{-1}(\text{Opp/Hyp})$ **$\theta = \cos^{-1}(\text{Adj/Hyp})$** **$\theta = \tan^{-1}(\text{Opp/Adj})$**

Right Triangle Trigonometry

Naming the Sides

Hypotenuse (Hyp):

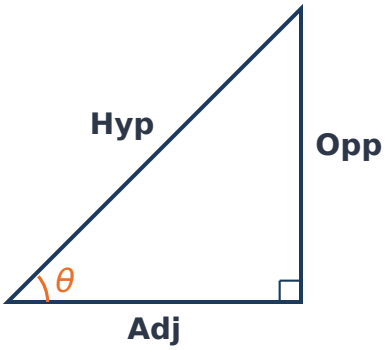
The longest side, always opposite the 90° angle.

Opposite (Opp):

The side directly across from the reference angle θ.

Adjacent (Adj):

The side next to the reference angle θ (that is not the hypotenuse).



The Trigonometric Ratios

Trigonometry relates the angles of a right triangle to the ratios of its sides.

Sine:	**sin(θ) = Opp / Hyp**
Cosine:	**cos(θ) = Adj / Hyp**
Tangent:	**tan(θ) = Opp / Adj**

Mnemonic: *Oscar Had A Heap Of Apples*

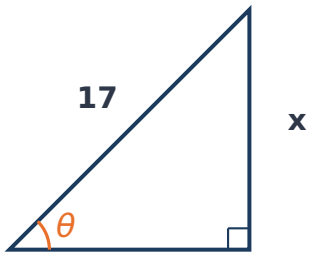
(Opp/Hyp = sin, Adj/Hyp = cos, Opp/Adj = tan)

Finding Missing Sides

Steps for Finding a Missing Side:

1. Label the sides (Opp, Adj, Hyp) relative to the reference angle.
2. Choose the correct trig ratio (SOH, CAH, or TOA).
3. Write the equation, substitute the known values, and solve.

Example 1: Finding a Numerator



Reference angle = 45°

Hyp = 17, Opp = x

Use SOH → sin(45°) = Opp / Hyp

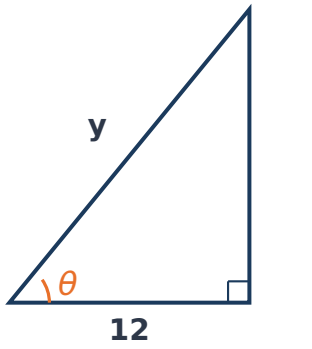
sin(45°) = x / 17

x = 17 × sin(45°)

x = 17 × 0.7071

x ≈ 12.02

Example 2: Finding a Denominator



Reference angle = 35°

Adj = 12, Hyp = y

Use CAH → cos(35°) = Adj / Hyp

cos(35°) = 12 / y

y × cos(35°) = 12

y = 12 / cos(35°)

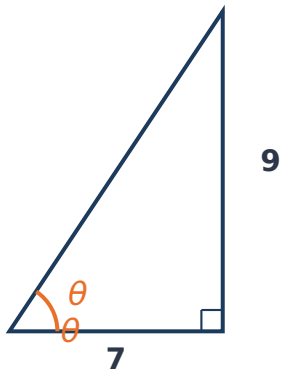
y = 12 / 0.8192

y ≈ 14.65

Finding Missing Angles

Key Concept:
If you know two sides of a right triangle, you can find the missing angle using the INVERSE trig functions ($\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$).

Example: Finding a Missing Angle



Opp = 9, Adj = 7

Use TOA → tan(θ) = Opp / Adj

tan(θ) = 9 / 7

tan(θ) ≈ 1.2857

θ = $\tan^{-1}$(1.2857)

θ ≈ 52.13°

⚠ Common Mistake Warning!

Make sure your calculator is in DEGREE mode! Look for a small 'D' at the top of the screen. If it says 'R', you are in Radian mode and your answer will be wrong.

Quick Check

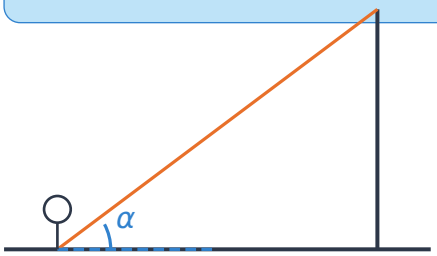
Find the measure of angle θ for the following:

1. sin(θ) = 0.5 → θ = $\sin^{-1}$(0.5) = _____
2. cos(θ) = 0.866 → θ = $\cos^{-1}$(0.866) = _____
3. tan(θ) = 1.732 → θ = $\tan^{-1}$(1.732) = _____

Angles of Elevation & Depression

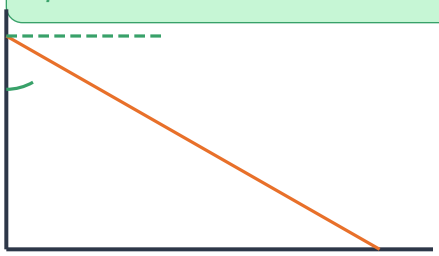
Angle of Elevation

The angle formed by looking UPWARD from the horizontal line of sight.



Angle of Depression

The angle formed by looking DOWNWARD from the horizontal line of sight.



Real-World Application

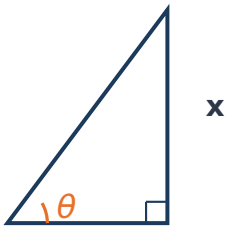
A surveyor is standing 50 meters from the base of a building. She measures the angle of elevation to the top of the building to be 62°. How tall is the building?

Solution:

1. Identify sides: Adj = 50m, Opp = height (h)
2. Choose ratio: TOA (Opp and Adj)
3. Set up equation: tan(62°) = h / 50
4. **Solve: h = 50 × tan(62°) ≈ 50 × 1.8807 ≈ 94.04 meters**

Progression 1 Practice

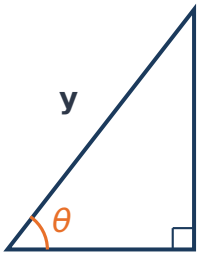
1



Find the value of x.

Answer: _____

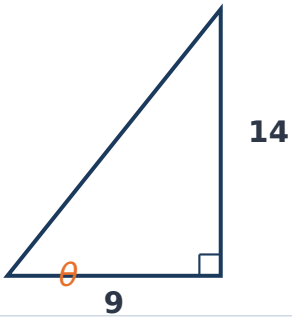
2



Find the value of y.

Answer: _____

3



Find the measure of angle θ.

Answer: _____

4

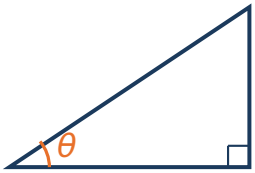
A ladder leans against a wall making a 65° angle with the ground. If the base of the ladder is 4 feet from the wall, how long is the ladder?

Diagram & Answer:

Progression 1 Practice (Continued)

5

Find the value of z.



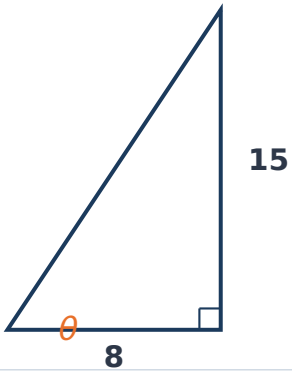
Answer: _____

6

From the top of a 45-meter cliff, a hiker sees a boat at an angle of depression of 22°. How far is the boat from the base of the cliff?

Diagram & Answer:

7



Find angle α.

Answer: _____

8

A ramp is built to reach a doorway 3 feet above the ground. If the ramp is 20 feet long, what angle does the ramp make with the ground?

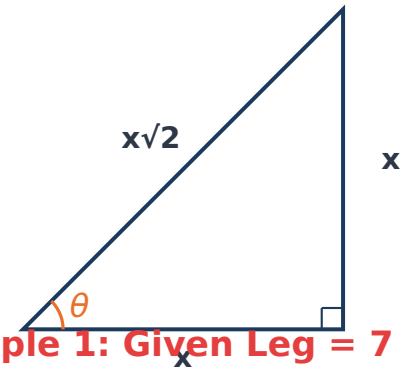
Diagram & Answer:

45-45-90 Triangles

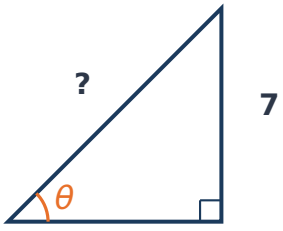
Key Concept:
A 45-45-90 triangle is an isosceles right triangle. The two legs are congruent, and the hypotenuse is exactly √2 times the length of a leg.

The Rules

- Angles: 45° – 45° – 90°
- Legs are equal: a = b = x
- **Hypotenuse: c = x√2**



Example 1: Given Leg = 7



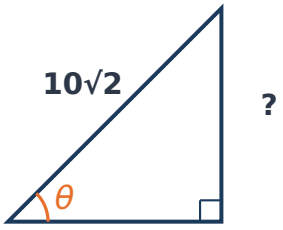
Since the leg (x) = 7:

Hypotenuse = x√2

Hypotenuse = 7√2

Hyp ≈ 9.90

Example 2: Given Hypotenuse = 10√2



Since hyp (x√2) = 10√2:

x = (10√2) / √2

x = 10

Unit Test Answer Key

Parts 1-3

Part 1: Multiple Choice

1. A tan = Opp/Adj = (3/5)/(4/5) = 3/4

2. C Period = 2π/b = 2π/3

3. A 300 × (π/180) = 5π/3

4. B QIII, y is negative, ref angle π/6 → -1/2

5. C Long leg = short × √3 = 6√3

6. C SAS requires Law of Cosines

7. B Amplitude is absolute value of 'a' = | -4 | = 4

8. C $5^2 + 7^2 = 74 < 9^2=81$ → Obtuse

Part 2: Short Answer

9. x ≈ 11.49 x = 15 × cos(40°)

10. √2/2 + √3/2 cos(45°)=√2/2, sin(60°)=√3/2

11. 53.13° $\tan^{-1}(8/6) \approx 53.13°$

12. A=3, P=π, Mid y=-1 Period = 2π/2 = π, d=-1

13. b ≈ 11.31 b = 10 × sin(60°)/sin(50°)

Part 3: Applications

14. 83.91 ft h = 100 × tan(40°) ≈ 83.91 ft

15. 82.71 miles Angle=110°. $d^2 = 40^2 + 60^2 - 2(40)(60)\cos(110°)$

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