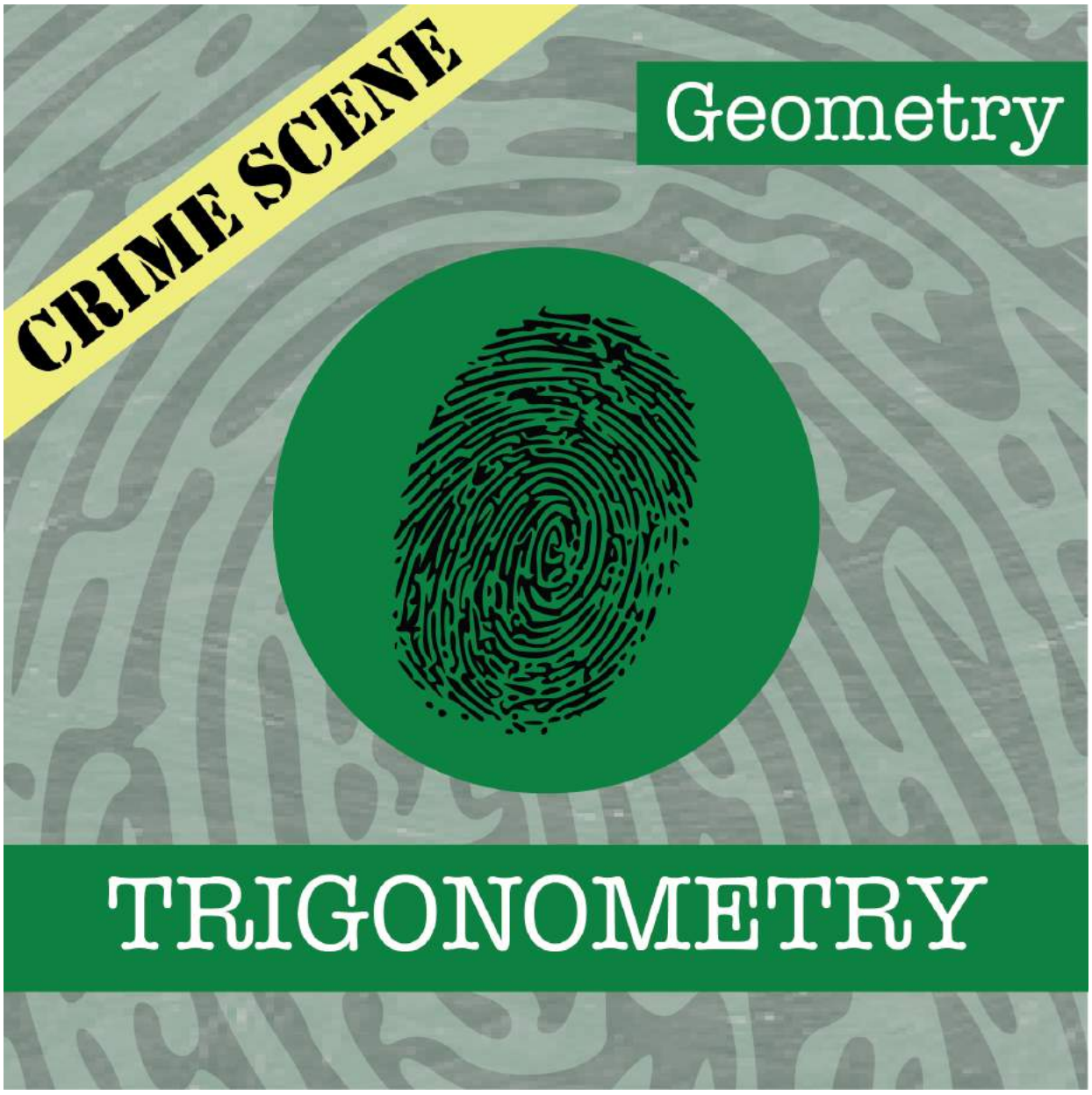

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CSI GEOMETRY

Trigonometry

IDEAL UNIT: Trigonometry	**TIME RANGE:** 45-60 Minutes	**SUPPLIES:** Pencil & Paper

TOPICS OF FOCUS:

- Pythagorean Theorem
- Special Right Triangles
- Sine, Cosine & Tangent
- Law of Sines & Law of Cosines
- Angles of Depression & Elevation

COMMON CORE ALIGNMENT:

This particular unit was mapped to the curriculum of most geometry textbooks. CSI activities are ideal as a small group unit review or an enrichment activity.

G-SRT.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
G-SRT.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
G-SRT.10	Prove the Laws of Sines and Cosines and use them to solve problems.

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CSI

General Procedures

*A.) As an optional hook, you can provide or read students the letter from Chief Harris. These are relatively the same for each CSI activity and introduce the criminal, world region the crimes take place and the math topic.

B.) Provide groups (ideally 2-3), the possible suspects, 6 crime scene puzzles and worksheet. You may choose to laminate the criminals or crime scenes for easier reuse. They also work well printed as a packet.

C.) Students will work to solve the crime. Generally, it takes between 45-60 minutes to complete. You can drop hints or provide assistance to help groups that are behind the pace. There are some problems that push advanced critical thinking in applications and others that focus on repeated skill practice. Previewing which crime scenes might be the most challenging so you can be prepared to help small groups or the whole class is a good idea.

Answers in this document are provided, but not with much detail because there have been instances of students or their parents purchasing the documents when teachers have opted to use it as a summative assessment.

D.) At the end of each scene, students will receive a clue that will substitute into the "Cryptic Text Message". This provides an element of self-checking because if the Cryptic Text does not lead to a criminal, they know they need to recheck their work. In the end, students will determine which suspect should be arrested. *The gender, race and ethnicity of the guilty "suspect" is intentionally varied across the entire CSI series.*

*E.) There is an emphasis on "evidence" since this is an investigation. This means detailed work and the ability to argue their logic. You may like for students to create a portfolio of evidence proving that they have arrested the right person and will demonstrate their understanding of their mathematical content present in the problem.

*F.) Some teachers enjoy having their students present and defend their evidence to the class in a brief oral presentation.

*Optional Extensions

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THE EVIDENCE

INVESTIGATOR:_____

1.

CLUE

2.

CLUE

3.

CLUE

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4.

CLUE

5.

CLUE

6.

CLUE

CRYPTIC TEXT MESSAGE

SUSPECT

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CSI: Trigonometry

Detectives,

As you probably could have guessed, the evil genius terrorist group, the Mathemagicians, are at it again. The latest series of heists have brought a gloom across the entire sub-continent of India. The latest heists are by the hand of anonymous minion, SohCahToa Joe. Investigators fear that the Mathemagicians are putting the finishing touches on their world conquering device -- to conquer the world.

As has become their trademark, the Mathemagicians have scattered six mathematical puzzles and a cryptic text message that must be solved. After solving the puzzles, you can decode the message, which will lead to SohCahToa's favorite number. So far there are six suspects that police have questioned. It is hoped that someone with relatively strong geometry and reasoning skills can crack the codes that have puzzled the detectives on the case so far.

Since you are being brought in as a specialist, you have to have definitive proof in order for any arrest to hold up in court. You need to be prepared to state your case and demonstrate your understanding of the following skills that SohCahToa is known to use in the notes.

- Pythagorean Theorem
- Special Right Triangles
- Sine, Cosine & Tangent
- Law of Sine & Cosine
- Angles of Depression and Elevation

In your investigation, be sure to show all of your work. We need to have clear evidence that supports your calculations and conclusions. This is not a time to be sloppy. The slightest miscalculation or illegible footnote could result in a not guilty verdict.

Oh, did I mention that use of a calculator might prematurely set off his world conquering device? Good luck to you, gumshoe.

Chief Harris

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THE SUSPECTS

Who is SohCahToa Joe?

NAME	Kochi
OCCUPATION	Elementary Teacher
FAVORITE NUMBER	-2009

NAME	Oswald
OCCUPATION	Manager
FAVORITE NUMBER	0

NAME	Tyrone
OCCUPATION	Police Officer
FAVORITE NUMBER	911

NAME	Eden
OCCUPATION	Organic Farmer
FAVORITE NUMBER	-493

NAME	Lin
OCCUPATION	Graduate Student
FAVORITE NUMBER	9

NAME	Carlo
OCCUPATION	Grocer
FAVORITE NUMBER	3,665

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Scene #1 Taj Mahal -- Uttar Pradesh, India

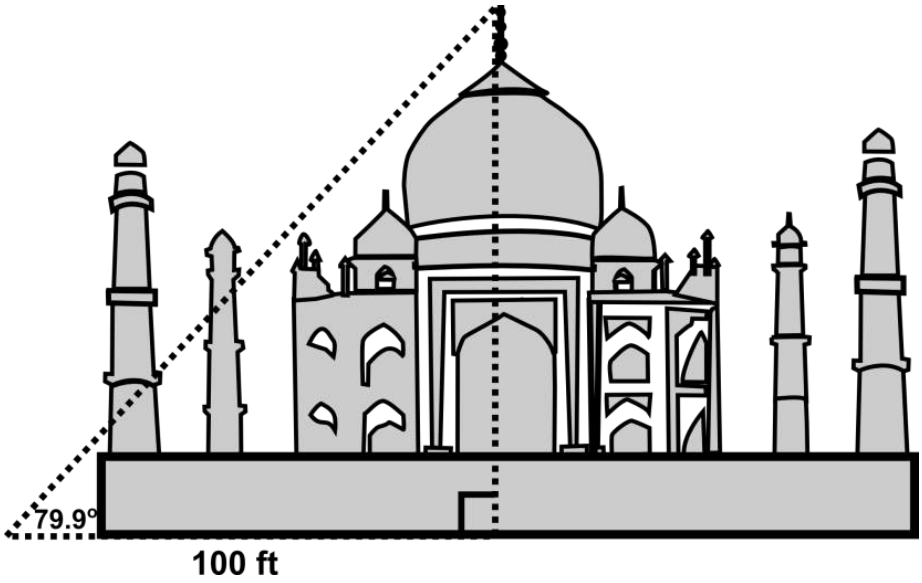
SohCahToa Joe snuck past security at the world famous Taj Mahal mausoleum and stole one of the towering minarets! Carved into one of the pishtaqs investigators found this note.

Greetings! This is your tour guide SohCahToa Joe, and while I introduce a few sites, I'll steal stuff. Sound good?

First on the itinerary is one of the Wonders of the World and according to Wikipedia, a "jewel of Muslim art"... I love me some Wikipedia.

I'm looking up to the top at a 79.9° angle. *Find the height of the Taj Mahal and round to the nearest foot. This will be equal to h and is your first clue.*

h = ____



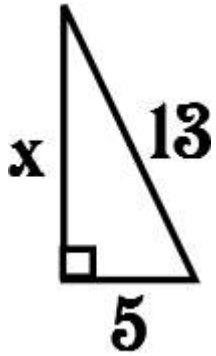
Scene #2 National Centre for Performing Arts -- Mumbai, India

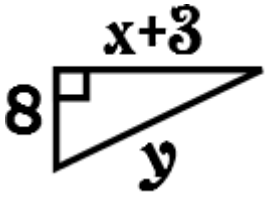
The largest theater in India was stunned to discover their entire prop room was ransacked. Although nearly everything was gone, SohCahToa Joe left behind three wigs.

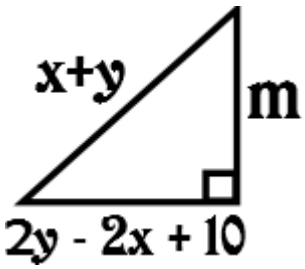
While you can't see me, trust me, I'm dancing. Bollywood Style.

Bollywood Triple Feature!

Solve the three Pythagorean Theorem problems to figure out m.







m = ____

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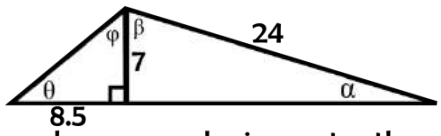
Scene #3 Le Corbusier's Open Hand Sculptures -- Chandigarh, India

In a bizarre turn of events, SohCahToa Joe is suspected to have stolen 10 of India's famous Open Hand Sculptures. How these sculptures play into the World Conquering Device is unclear.

Chandigarh is the richest city in all of India! You can move in just like the *Slumdog Millionaire* if you can answer these three questions. Two right triangles followed by something weird! WHAT A PLAYER! But here's the problem, *it's not your destiny*.



How many of these unknown angles is greater than 50°?

A. Zero **B.** One

C. Two **D.** Three

If $\cos A = \frac{8}{10}$, which of the following is also true?

A. $\tan A = \frac{4}{3}$ **B.** $\sin A = \frac{4}{5}$

C. $\tan A = \frac{3}{4}$ **D.** $\sin A = \frac{5}{3}$

Solve triangle PQR, given m∠Q = 75, q = 40, and p = 25. Round measurements to the nearest tenth.

Which of the following measurements is true?

A. r = 39.1 **B.** r = 37.8

C. P = 37.1° **D.** R = 65.8°

How many of these answers are a? (This number is the clue)

a =____

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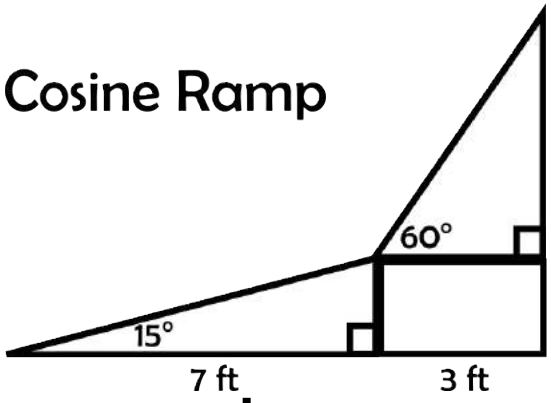
Scene #4 Aryabhata Skate Park -- Dehli, India

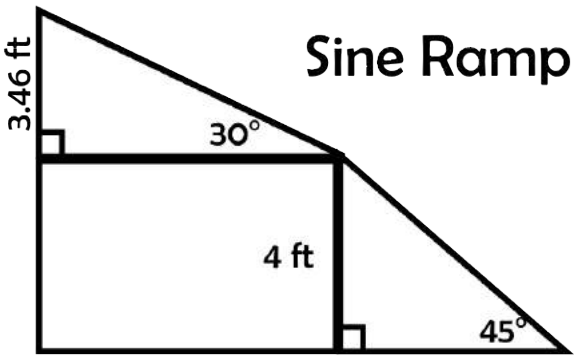
It is believed that SohCahToa stole the three longest skateboard ramps from the park. On the pavement, the following note was graffitied.

According to Wikipedia, this Aryabhata guy lived here a long time ago and thought up all this Sine, Cosine and Tangent stuff. So let's honor him through one of urban India's newest pasttimes. Skateboard Ramps.

Two dudes argue over which ramp is the dopest. *They agree it's whichever is longer. Figure it out!*

ARYABHATA SKATE PARK





j = -5

Which is it?

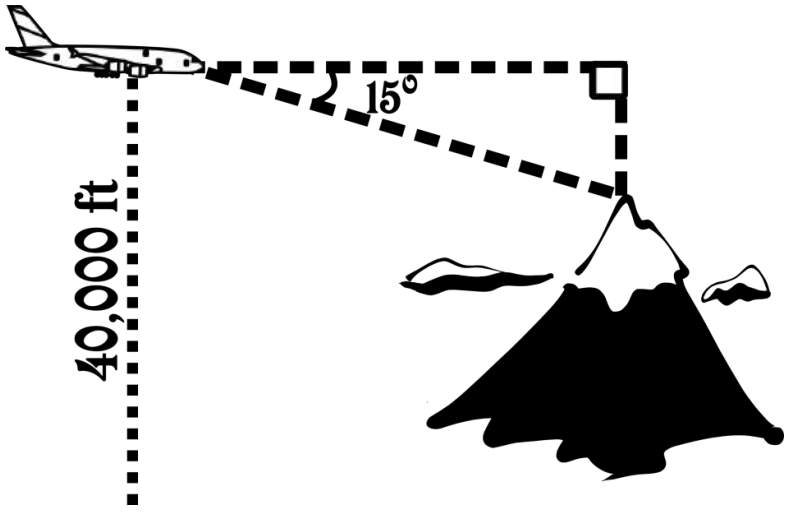
j = 5

Scene #5 Himalayas -- Arunachal Pradesh, India

An avalanche was caused when SohCahToa Joe stole 750 pounds of Himalayan snow and six markhors.

Even though they're still growing (something called Plate Tectonics according to Wiki), I want to know how tall Mt. Everest is.

With an altitude of 40,000 feet, an airplane travels toward Mt. Everest with an angle of depression of 15 degrees. The plane travels at a speed of 853 ft/sec. 48 seconds later the plane is directly above the summit.



How tall is Mt. Everest? Round your answer to the nearest foot. This will be equal to t.

t =____

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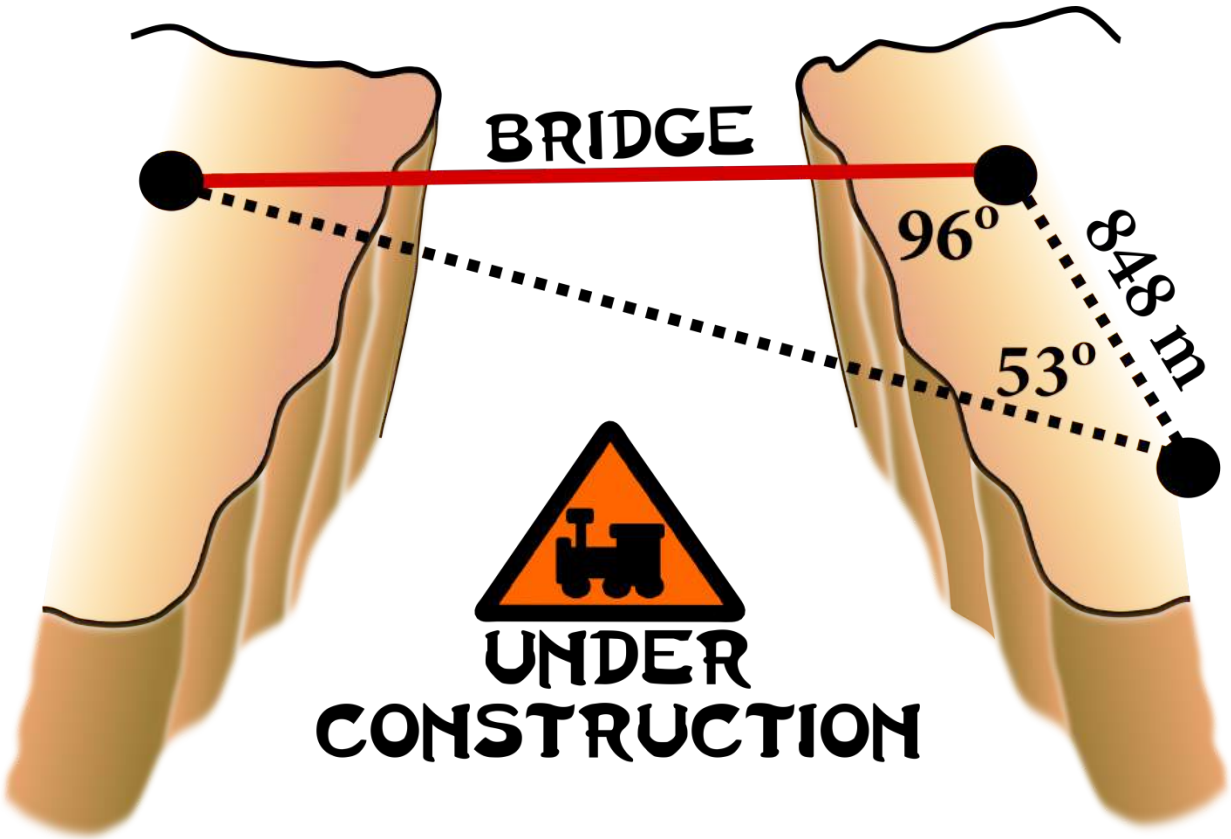
Scene #6 Chenab River - Jammu and Kashmir, India

Engineers were bewildered to find 100 meters of their high-speed rail was taken. Later, investigators were sent a cryptic text message. There is no timetable for when the world conquering device may be deployed.

According to Wikipedia, they are almost done with this bridge. It'll be the highest rail bridge in the world. You better have good karma or there's no way you're going to catch me. Hugs & Kisses, SohCahToa Joe.

Find the length of the bridge. Round to the nearest meter; this will be equal to L.



L =____

CRYPTIC PUZZLE SOLVER TEXT MESSAGE

This answer is not on Wikipedia.

$$(T\ A) + J \bullet [(M - A) + (H + A - L)]$$

SohCahToa Joe

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CSI

Trigonometry

Rubric

Skills & Understandings		Exemplary	Proficient	Developing
I can apply the Pythagorean Theorem to solve for unknown side lengths.				
I can use special right triangles to determine side lengths.				
I can calculate unknown side lengths or angle of right triangles with sine, cosine and tangent.				
I can use the Law of Sines and Law of Cosines to find side lengths in any triangle.				
I can understand and calculate problems that include an angle of depression or elevation.				
Math Processes		**Exemplary**	**Proficient**	**Developing**
Skills & Mechanics	*accurately performs calculations*			
	demonstrates fluency with mathematical skills and processes			
Applications	*accurately interprets word problems and addresses them with appropriate math skills*			
	can articulate the meaning of calculations in the context of the problems.			
Use of Evidence & Analysis	*can determine what evidence is appropriate to answer a question*			
	utilizes mathematical outcomes to support their conclusions			

COMMENTS:

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