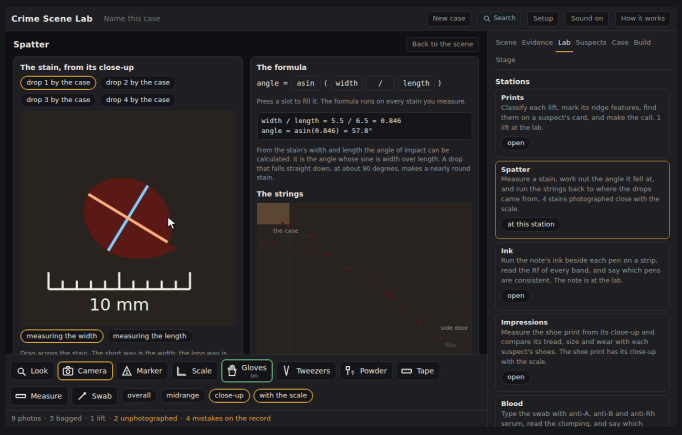
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Crime Scene Lab: Blood Drops and the Angle of Impact

Grades 9-12 · 50 minutes

Forensic science · Math



Slides, rubric and answer key **Print and go** **No student accounts**

Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 50-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a measurement table
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grades 6 to 8 and in a college introductory course
- Standards: Common Core Math

Crime Scene Lab: Blood Drops and the Angle of Impact

Grades 9-12 · 50 minutes · Forensic science, Math

Eight stains on the floor of a virtual crime scene already have their close-up with the scale. Students measure each stain's width and length with a caliper, build the formula for the angle of impact from chips, asin(width / length), and read the working. They drag strings along the drops by the trophy case and watch them cross where the drops came from, then use the angles and the distance to estimate the height of the hand. The round drops fell straight down; the trail to the door came from a hand on the move.

At a glance

ESSENTIAL QUESTION

What can the shape of a drop tell you about where it came from?

OBJECTIVES

Students will be able to:

- measure a stain's width and length and compute the angle of impact as the inverse sine of their ratio
- say what the shape of a stain means: round from straight down, elongated from a low angle, the tail in the direction of travel
- run strings along the long axes of several drops to find where they came from, and estimate the height from the angle and the distance
- say what a drip trail can and cannot tell an investigator

VOCABULARY

Angle of impact, Area of convergence, Area of origin, Tail, Passive stain

STANDARDS

HSG-SRT.C.8

TIME AND MATERIALS

50 minutes, grades 9-12.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- A scientific calculator or the one in the browser, for the inverse sine by hand
- The rubric, one copy per student if you grade the work

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/crimescenelab?lesson=blood-drops-and-the-angle-of-impact&ref=tpt-crimescenelab-3 once on a student computer: it opens with eight stains photographed, and checks that your school's filter allows the app. Measure one stain yourself, about three minutes: a drag across for the width, a

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet's measurement table with the angles figured by hand and checked against the app, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save. The case, the people, the prints and the inks are invented.

drag along for the length, then build the formula once so you know the slots.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the warm-up: project the floor view. Ask which drop fell straight down and what the long one tells them. Write the words they use on the board: fast, sideways, moving.	Answer the warm-up on the worksheet: which drop fell straight down, and one thing the long one tells you.
5 to 13	**Direct instruction (I do)** Model it	Show Width, length, angle. Project the app with the starter open, Lab tab, Spatter station. Drag across the first stain: the width appears. Drag along it: the length. Press each slot of the formula and fill it: asin, width, over, length. Read the working aloud and do the division and the inverse sine by hand on the board. Show Three shapes. **It's working when:** Build the formula wrong once, acos instead of asin, and read the number it gives. The formula runs on every stain, so a wrong formula is wrong everywhere, visibly.	Watch, and fill in the vocabulary on the worksheet.
13 to 23	**Guided practice (We do)** One stain together	Have students open the link or scan the QR code. Together: the Lab tab, the Spatter station, the first stain's width and length, the formula built from chips, the working read. Every student figures the angle by hand on the worksheet before reading the app's. Check that the hand answers are within a couple of degrees of the app before moving on. **Watch for:** Students who measure the length with the tail in, or the width at the tail's end. Either reads the angle too low; the check after hand-in says which reading was off and works the true angle out. Let it.	Measure the first stain, build the formula, write width, length and the angle by hand in the table, then the app's angle beside it.
23 to 42	**Independent practice (You do)** Four stains and the strings	Students measure four more stains on their own, angle by hand first, then drag strings along three of the drops by the case on the floor plan under the formula, read the crossing and the height. Then one drop on the way to the door: its tail. Walk the room with the What to look for questions. **If they ask:** "The drops on the way to the door all have tails pointing the same way. Who do they point at?" The trail	Fill the table for five stains. Draw three strings and write where they cross and the height the app gives. Write what the trail drop's tail says.
42 to 50	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students report the crossing and the height with their reasoning. Answer the trail question together: where, not who. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/crimescenelab?lesson=blood-drops-and-the-angle-of-impact&ref=tpt-crimescenelab-3. A short guide opens over the app. Eight stains on the floor have already been photographed close with the scale: six in a fan by the trophy case, one round drop where the hand was held still, and one on the trail to the door.

1. **Measure.** `Lab` tab, `Spatter` station. Drag across the stain for the width, then along it for the length; the app snaps to the half millimeter and the table fills in. The stain is drawn from its true angle, so a careful drag gives the true number back.
2. **Build the formula.** Press the `function` slot and pick `asin`; then `width`, `/`, `length`. The working shows the division and the inverse sine. A wrong formula runs on every stain, and the check after hand-in says which angles were off.
3. **The strings.** On the floor plan under the formula, drag along a drop's long axis from its tail through its body. The app extends the string. Three strings along the fan's drops cross where the hand was shaken; the height follows from the angles and the distances.
4. **The chart.** `Setup`, middle school: the formula is replaced by a chart of five shapes, 90 to 15 degrees, and the student picks the nearest. The high school check allows five degrees; the middle school check twelve.

> The moment that lands is the trail. Every drop on the way to the door has a tail pointing at the door, and students will say that means the culprit went that way. It does. It does not say who.

Background for the teacher

A drop that strikes a smooth surface at 90 degrees leaves an almost circular stain; as the angle of impact decreases the stain elongates, and its tails or spines extend in the direction of travel. The angle can be calculated from the stain's width and length: the sine of the angle is width over length, so a stain 5 mm wide and 15 mm long came in at about 19 degrees. Lines through the long axes of several stains cross at the area of convergence, where the drops came from on the floor; the area of origin adds the height, from the angles and the distances. These are the principles in the published guides the app's teaching notes cite.

The app's fan of drops came from one point, a hand shaken once by the case, so the strings converge. The trail to the door came from a moving hand, so its drops have tails in the direction of travel but no single origin, and the station says what a trail can say: where someone moved, not who. The still drops by the case fell straight down and are nearly round.

Common mistakes: measuring the length with the tail in, or the width across the tail; building acos or the ratio the wrong way up, which the working shows at once; drawing a string across a drop instead of along it. Measurements are to the half millimeter, so an angle a degree or two from the app's is not wrong, and the check allows five.

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- This stain is 5 by 15. What is the sine, and what is the angle?
- Why is the drop by the case almost round?
- Which way was this drop moving, and how can you tell?
- Where do your three strings cross, and what was there?
- The trail points at the side door. Does it point at a person?

> The last question is the real test: anyone who says the trail says where the hand went and nothing about whose hand it was has understood the limit of the evidence.

Cross-curricular extensions

- Math: for one drop, figure the height from the crossing by hand: distance times the tangent of the angle. Then say why the app calls it an estimate.
- Physics: a drop in the air is a sphere held by surface tension. Explain why the stain's width is the drop's diameter whatever the angle, and why the length grows as the angle falls.
- English: write the fan and the trail as two sentences of a report: what each pattern shows, and what it does not.
- Computer science: copy the stains-as-data table under the strings into a spreadsheet and compute every angle with one formula.

Vocabulary

Angle of impact	The angle at which a drop struck the surface. Its sine is the stain's width over its length.
Area of convergence	Where lines through the long axes of the stains cross: where the drops came from, on the floor.
Area of origin	The convergence with the height added, from the angles and the distances.
Tail	The pointed end of an elongated stain, pointing the way the drop was moving.
Passive stain	A drop that fell under gravity alone, like the round drops by the case.

Differentiation

ENGLISH LEARNERS

- Keep the Three shapes slide up: the three stains and their angles are a picture.
- Pair each learner with a partner for the guided stain; the measuring is dragging and the arithmetic is numbers.
- Accept the worksheet's table as numbers only, and the exit ticket's third question answered with an arrow drawn on a stain.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students for the independent stains, one measuring and one figuring.
- Zoom the browser to 150%: the stain and the caliper lines stay readable.
- Allow three stains instead of five and the strings together as a class, where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter for the exit ticket: 'The angle is small because the stain is ___ than it is ___.'
- A check-in after the guided stain: every student's hand angle matches the app within two degrees before anyone goes on.
- Open Setup and pick middle school: the angle is read off a chart of shapes and the formula is the extension.

STUDENTS READY FOR MORE

- Figure the height by hand for one drop: the distance from the crossing times the tangent of the angle, and compare it with the app's estimate.
- Open the stains-as-data table under the strings, copy it, and compute every angle in a spreadsheet.
- Open the Stage tab, set the pace to ran, apply, and write how the trail's drops changed and why.

Adapting for other grades

Younger students: In grades 6 to 8, open Setup and pick middle school: the angle is picked off a chart of five shapes instead of computed, and the height is not asked. Drop the third rubric row; total 8, and 6 meets the objectives.

Older students: In a college introductory course, require the height for three drops by hand with the tangent, and a paragraph on why the estimate is an estimate: the drop's arc, the measurement's half millimeter, and the tail left in or out.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/crimescenelab?lesson=blood-drops-and-the-angle-of-impact

Essential question: What can the shape of a drop tell you about where it came from?

Warm-up: The drop that fell straight down is the _____ one. The long one tells me _____.

1. **Vocabulary.** Angle of impact, area of convergence, area of origin, tail, passive stain: write each in your own words.

2. **The formula.** angle = _____ (_____ / _____)

3. **The measurement table.** For five stains: which stain _____; width ____ mm; length ____ mm; width over length _____; the angle by hand ____°; the app's angle ____°.

4. **The strings.** Three drops by the case, strings drawn. They cross at about (____ , ____) cm on the plan. The app's height: about ____ cm. What was there: _____.

5. **The trail.** A drop on the way to the door: its tail points toward _____. That tells me where _____ went, and nothing about _____.

1. Two stains have the same width. One is twice as long as the other. Which came in at the lower angle, and about what is its angle if the shorter one is round?

2. The strings cross by the trophy case. What does that tell you happened there, and what does it not tell you?

Exit ticket

Name: _____

1. A stain is 4 mm wide and 8 mm long. Its angle of impact is about: (A) 30 degrees (B) 45 degrees (C) 60 degrees

2. Lines through the long axes of several stains cross at: (A) the area of convergence (B) the tail (C) the area of origin

3. Draw a stain that came in low, mark its tail, and say which way the drop was moving.

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Exit ticket

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3. Draw a stain that came in low, mark its tail, and say which way the drop was moving.

Answer key: exit ticket

QUESTION	ANSWER	WHY
1	A	Width over length is 4 over 8, 0.5. The angle whose sine is 0.5 is 30 degrees.
2	A	The crossing on the floor is the area of convergence; the origin adds the height from the angles.
3	A long narrow stain with a pointed tail; the drop was moving in the direction the tail points	The tail extends in the direction of travel. A long stain drawn with the tail and the direction named is a full answer; a long stain with no tail is half.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
Measuring and the angle	Five stains measured, every angle figured by hand within two degrees of the app, the working shown.	Five stains measured and every angle figured by hand; one or two off by more than two degrees.	Three stains measured; angles copied from the app without the hand working.	Stains not measured, or the formula not built.
The strings	Three strings along the fan's drops, the crossing read, the height written, and the trail drop's tail explained.	Three strings drawn and the crossing read.	One or two strings, or strings along the wrong drops.	No strings drawn.
Explains how it works	Answers the essential question with the shape, the angle and the direction, and says what a trail can and cannot tell you.	Answers the essential question with the shape and the angle.	Says a long stain came in low, with no reason.	Cannot say what the shape means.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The angle of impact is a trigonometric ratio solved in an applied problem, which is the Common Core geometry standard tagged here. No national standard covers forensics; the NGSS practice of using mathematics is named and not tagged until its text is read.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
Common Core Math	**HSG-SRT.C.8**	9-12	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	The stain's width and length are two sides of a right triangle; the student finds the angle as an inverse sine and, for the origin, a height as a tangent, by hand and in the app.

Checked October 2026 against: Common Core State Standards, High School Geometry, Similarity, Right Triangles, and Trigonometry.

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' cases, and see them all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/crime-scene-lab/lessons/blood-drops-and-the-angle-of-impact/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

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