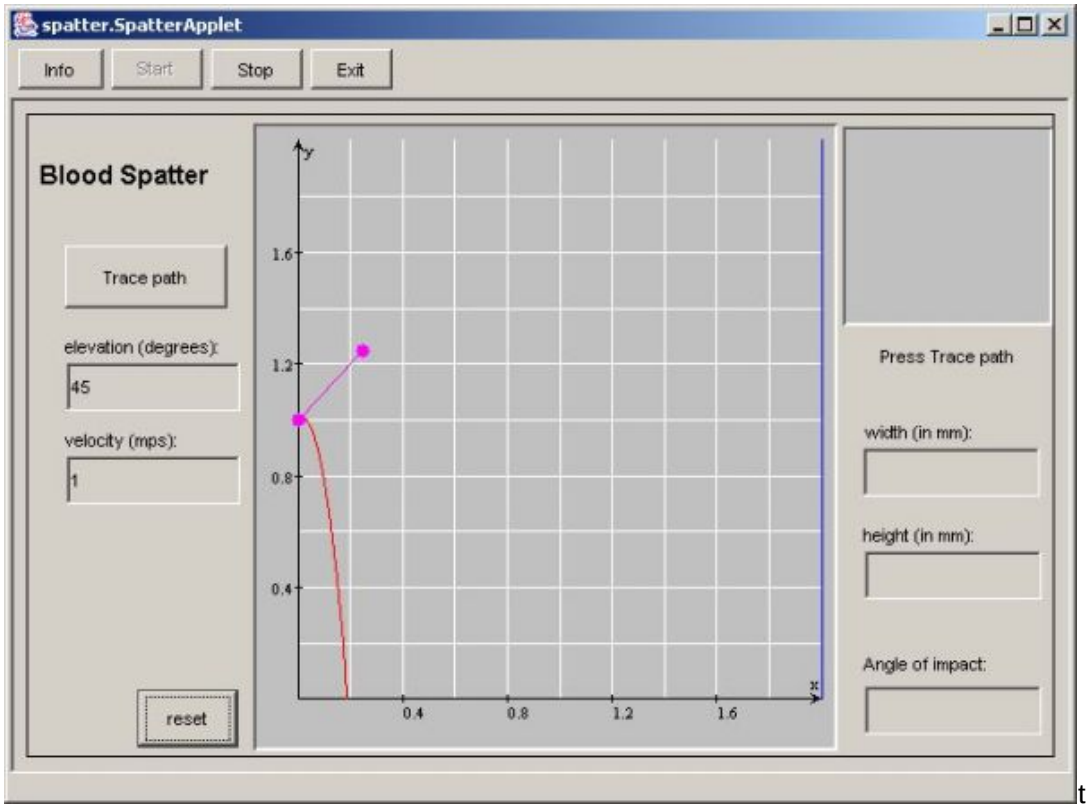
Lab on Forensic Trigonometry

1. Introduction (1 point)

This lab explores a model of blood spatter analysis that needs trigonometry to interpret the results. As you have probably seen from police shows, the pattern of blood droplets left at a crime scene gives clues about the nature of the attack.



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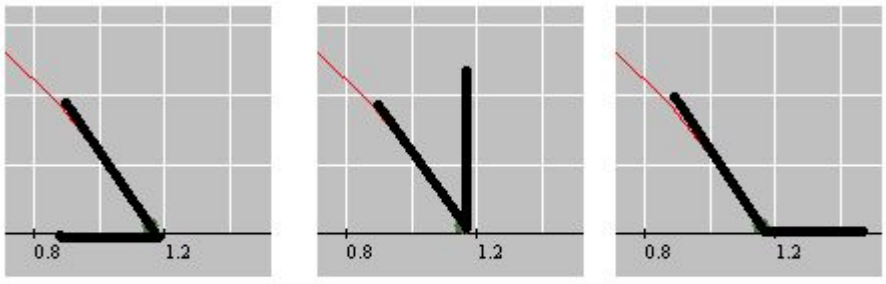
You can move the left hand point up and down on the y axis, to indicate the height of the blood source. The right hand point can be moved to adjust the initial angle of elevation and the velocity. Press the "Trace path" button to see how a droplet of blood would move, and the shape of the droplet where it impacts either the floor or the wall. The height and distance to the wall are in meters, the velocity is meters per second, and the height (or length) and width of the spatters are in millimeters. With the initial settings, what is the angle of impact that is reported?

2. Which angle is angle of impact (1 point)

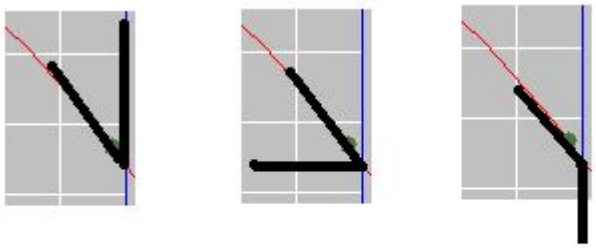
Play with the settings and decide which angle is reported as the angle of impact when the droplet hits the floor



A B C

3. Which angle (1 point)

Play with the settings and decide which angle is reported as the angle of impact when the droplet hits the wall.



A B C

4. Spatter size (1 point)

Notice that the spatter size for a droplet of blood that hits the floor changes when the experiment is repeated, even though the height, the angle of elevation, and the velocity remain the same. But there is an approximate relationship between the width and the length that holds regardless of the droplet size. What is it?

a. The sum of the length and width remains about the same.
b. The difference between the length and width remains about the same.
c. The ratio of the width to the length remains about the same.
d. The product of the width and the length remains about the same.

5. Ratio (1 point)

How does the shape of the spatter relate to the angle of impact when a droplet of blood hits the floor? Do a few experiments and trial calculations to decide.

a. Divide the width by the length. That is about the sin of the angle of impact.
b. Divide the width by the length. That is about the cos of the angle of impact.
c. Divide the width by the length. That is about the tan of the angle of impact.
d. Divide the length by the width. That is about the sin of the angle of impact.
e. Divide the length by the width. That is about the cos of the angle of impact.
f. Divide the length by the width. That is about the tan of the angle of impact.

6. Ratio2 (1 point)

How about the angle of impact reported if the droplet of blood hits the wall? Again, do a few experiments and trial calculations to decide.

a. $\sin^{-1}$(width/height)
b. $\cos^{-1}$(width/height)
c. $\tan^{-1}$(width/height)
d. $\sin^{-1}$(height/width)
e. $\cos^{-1}$(height/width)
f. $\tan^{-1}$(height/width)

7. Velocity (1 point)

At what velocity would a droplet of blood have to be traveling to strike the corner between the floor and the wall, assuming the blood is initially ejected horizontally from a height of 1.6 meters?

8. Unknown height (1 point)

A gunshot wound at height 1.2 meters causes a droplet of blood to fly at an angle of elevation of 25 degrees with a velocity of 4 meters per second. Where would you expect to find the spatter?

a. at a distance of 1.4 meters, on the floor
b. at a distance of 1.6 meters, on the floor
c. at a height of .4 meters, on the wall
d. at a height of .8 meters, on the wall
e. at a height of 1.2 meters, on the wall

9. Higher on wall (1 point)

The height of blood spatter on the wall is always lower than the height of the wound.

True False

10. Angle of impact (1 point)

When blood hits the wall, the angle of impact is always greater than the angle of elevation

True False