

BLOOD DROP CSI

Using Trigonometry To Determine The Angle Of Impact

Experiments with **blood** have shown that **blood** tends to form into a sphere rather than a teardrop shape when free falling or projected in drop size volumes (*approximately 0.05ml or 20 drops per milliliter; though some are larger and some are smaller*). The formation of the sphere is a result of surface tension. Fresh **blood** is slightly more viscous than water because of its components: corpuscles, leukocytes, platelets, salt, and collagens, and so it tends to hold the sphere shape in flight. The sphere shape of **blood** in flight is critical to the calculation of the angle of impact of **blood** spatter which will be used to determine the point or area from which the **blood** originated or point of origin (*PO*).

Hypotenuse² = Opposite² + Adjacent² ($H^2 = O^2 + A^2$)

Generally, a single spatter of **blood** is not enough to determine the point of origin at a crime scene. The determination of the angle of impact and placement of the PO should be based on the consideration of a number of spatters. The process for determining the angle of impact is not complicated. When a sphere of **blood** strikes a flat surface the diameter of the sphere in flight will equal the width of the stain on the surface (which is equal to the opposite side of a right triangle) as seen in Figure 1. The length of the spatter will be equal to the hypotenuse of an inverted triangle. This is portrayed graphically in Figures 2, 3, and 4.

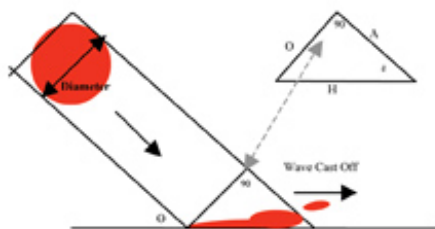


Figure 2: Side view of **blood** drop in air, and then striking a flat surface



Figure 3: Top View of drop in air and the stain left after it has hit a flat surface

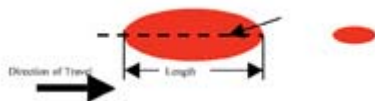


Figure 4: Resulting stain left by drop of **blood** that impacted at about 30 degrees on a flat surface

To find the point of origin (*PO*), one must first determine the two dimensional point of convergence (*POC*). The POC is the intersection where lines drawn through the center of the individual stains meet (*at the X-Y axis intersection*) and is determined by drawing lines or strings through the long axis of individual spatters as seen in Figure 5 below.

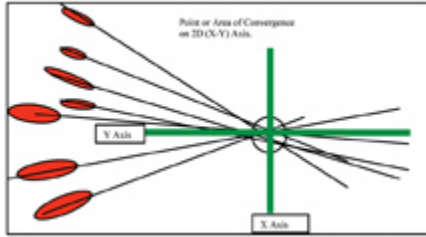


Figure 5: Lines through the central axes of the spatter cross at the point of convergence

The next step in the process is to determine the angle of impact (AOI) for representative **bloodstains**. As stated above opposite and hypotenuse are the same as the length and width. The AOI will necessarily be the same as angle a inside the triangle (as in Fig 2a). The angle of impact is the inverse arc sin of the W/L ratio, so first calculate ratio (W/L) then SIN -1 (2nd function) to get the degrees of a and AOI.

To Determine the Angle Of Impact (AOI).

Where Opposite = Width and Hypotenuse = Length & Angle of Impact = Arc sin of W/L ratio

- a. First calculate ratio (W/L)
- b. Then SIN -1 (2nd key) to get degree of AOI.

