BLOOD SPATTER

Bloodstain Analysis Experiments

Teacher: Activity / Experiment Information

The activities in this program consider bloodstains on a single target surface such as a floor. If multiple surfaces are introduced, complexity significantly increases.

The scenario involves a wall as the target plane.

By conducting the activities listed below students will be able to progressively develop the skills required to determine the 'Area of Origin' of the blood droplets.

- What effect does release height have on the diameter and shape of bloodstains?
- What effect does the surface have on the diameter and shape of bloodstains?
- How can you determine the direction of travel of blood droplets?
- How does the angle of impact affect the appearance of bloodstains?
- How can you work out the angle of impact of a blood droplet?
- What effect does changing the amount of force (i.e. velocity) have on bloodstains?
- How can you determine the origin of a blood droplet?

The Student Handouts that relate to these activities are found in FSB08.

The student handout also has some basic information about hypotheses and variables. Although the methods and apparatus are listed for them they are asked to write a hypothesis and to select the independent and dependent variables.

Activity 1:

What effect does release height have on the diameter and shape of bloodstains

In this activity students will explore the relationship between release height and droplet size. Suggested groups of 2-3 students.

Equipment

- Pipette or bottle with eye-dropper – something that will accurately deliver one drop of fluid with a consistent volume.
- Stand and clamp – something to attach the pipette or bottle holding the synthetic blood.
- Measures: 30cm and 100cm rule.
- Synthetic blood (FSB06 for recipes).
- Graph paper
- Paper – several sheets on a base of newspaper – label sheets as below:

10cm		
Trial 1	Trial 2	Trial 3

Method

- Attach the dropper on the stand so it is X cm, e.g.10cm above the sheet of paper (on a pile of newspaper) labelled 10cm.
- Arrange the paper under the dropper so the first trial droplet lands under the label Trial 1.
- Drop one droplet onto the paper.
- Shift the paper so the paper is positioned for the second droplet to land on the paper under the Trial 2 label etc.
- Repeat for trial 3.
- Remove the paper and allow it to dry.
- Move the dropper on the stand so it is 20cm above a second sheet of paper labelled 20cm.
- Complete 3 trials at 20cm.
- Do 3 trials at each height suggested on Table 1. The “height column” on the student’s worksheet has been left blank.
- When the sheets with the 3 trials at each height are dry, measure the diameter of each droplet in mm and complete Table 1.
- Graph the average diameter of droplets from each height.

Suggested Questions

- From the graph is there a relationship between height and the diameter of the droplet?
- What is the effect of the different heights on the diameter of the droplet?
- Are there any sources of error? What are they? How could these errors affect your results?
- Did you note anything else of interest about the patterns?
    - As the height increased did the droplet pattern change consistently?
    - Was there a height that resulted in no further change?

BLOOD SPATTER
Bloodstain Analysis Experiments

Table 1: Influence of height on the diameter and shape of bloodstains.

Height (cm)	Diameter drop 1 (mm)	Diameter drop 2 (mm)	Diameter drop 3 (mm)	Average diameter of drops	Shape and observations of bloodstains
10					
20					
30					
40					
50					
60					
70					
80					
90					
100					
150					

Activity 2

What effect does the impact surface have on the diameter and shape of bloodstains?

In this activity students will explore the relationship between different surfaces and droplet shape and diameter. Suggested groups of 2-3 students.

Equipment

- Stand and clamp
- Pipette or bottle with eye dropper
- Measures: 30cm and 100cm
- Synthetic blood (FSB06)
- Materials with different surfaces, for example:
    - Cardboard
    - Plastic bag
    - Ceramic tile
    - Carpet square
    - Paper towel
    - Wood
    - Newspaper
    - Metal
    - Clothing – socks, jeans, T shirt etc
- Graph paper, pencil

Method

- Attach the dropper on the stand so it is a standard height and angle, e.g. 30cm, at 60° above the target surface. Choose the height and angle.
- Arrange the newspaper under the dropper so the droplet lands in the target area. There will be 3 trials for each surface.
- Students should include a standard - what they will compare the different surfaces to.
- Place the first experimental surface to be tested under the dropper. Divide the surface into 3 trial areas.
- Drop one droplet onto the surface for Trial 1.
- Shift the target surface so it is positioned for the second droplet to land in the Trial 2 zone.
- Repeat for Trial 3.
- Remove the surface and allow it to dry.
- Repeat with the different target surfaces. **Keep the height the same.**
- When the bloodstain patters are dry, measure the diameter of each in mm and complete Table 2. On the student worksheet the "surface column" has been left blank.
- Graph the average result from each different surface.

Suggested Questions

How does the surface influence the shape and or size of a droplet?

Is there a correlation between surface and the number of spines and satellite stains?

Do you think that any of the surfaces tested would be unable to be used for blood spatter analysis?

What are the potential sources of error?

Table 2: The effect of different surfaces on the diameter and shape of bloodstains.

Surface (examples)	Trial 1 diameter (mm)	Trial 2 diameter (mm)	Trial 3 diameter (mm)	Average (mm)	Shape and observations of stains.
Cardboard					
Plastic bag					
Ceramic tile					
Carpet					
Paper towel					
Wood					

BLOOD SPATTER

Bloodstain Analysis Experiments

Activity 3

How can you determine the direction of travel from a bloodstain?

You may prefer to do this as a demonstration as it potentially could be very messy! There are 2 versions in the Student Dossier (FSB08): one as a demonstration and one practical version.

Equipment:

- Synthetic blood in a small beaker
- Butchers paper on a stack of newspaper
- Toothbrush
- Eye protection

Method: Sample A

- Dip the toothbrush in the simulated blood and fling droplets off the toothbrush as your arm moves across the paper in a definite direction, e.g. R→ L.
- Label the paper R → L.
- Repeat using different pieces of paper moving in a range of different planes, varying the angle and direction.
- Try and label the paper with a general description of the action. E.g. R→ L direction, with the angle changing from shoulder to paper level.
- Each group of students should receive a piece of paper to analyse.
- The paper samples can also be used for Activity 5.

The picture below shows a general set-up although the teacher is not using a toothbrush but fingers. It would probably also be wise to wear an apron and have some sort of protective surrounds.

Method: Sheet B

- Dip the toothbrush in the simulated blood.
- Place your elbow on the table, and, using a protractor position your arm at a pre-determined angle, eg 45°.
- Keeping the arm at the measured angle, fling droplets off the toothbrush as your arm moves across the paper, e.g. R→ L.
- Keep a key of the angle that was used for each prepared sheet of paper. But do not provide a description.

Sheet A:

- With sample A they get information about how the stains were created. Students will analyse the spatter by selecting 4 bloodstains.

Table 3: Sheet A – Determining the direction of the blood droplets from known information.

	Sketch the shape	Height and width (mm)	Direction?
Stain 1		W = L =	
Stain 2		W = L =	
Stain 3		W = L =	
Stain 4		W = L =	

Sheet B:

- With this sample they **do not** get information about how the stains were created. Students will analyse the spatter by selecting 4 bloodstains.

Table 4: Sheet B – Determining the direction of blood droplets from unknown information.

	Sketch the shape	Height and width (mm)	Direction?	Verify with teacher
Stain 1		W = L =		
Stain 2		W = L =		
Stain 3		W = L =		
Stain 4		W = L =		

Suggested Questions

What features of the bloodstains are important when working out the direction the blood droplet came from?

FORENSIC investigations

BLOOD SPATTER

Bloodstain Analysis Experiments

Activity 4

How does the angle of impact affect the appearance of bloodstains?

In this activity students will explore the relationship between bloodstain shape and the angle of impact. Groups of 2-3 students.

Equipment

- Stand and clamp.
- Pipette or bottle with eye dropper – something that will accurately deliver one drop of fluid.
- Measures: 30cm and 100cm rule.
- Synthetic blood (recipes: FSB06).
- Paper (A3 size)
- A board that can be adjusted to different angles.
- Protractor.
- Sticky tape.

An example of a set-up is shown below – it does not have to be sophisticated.

Method:

- Attach a bottle with a dropper containing simulated blood at a selected height. This could be determined from Activity 1.
- Place a piece of paper on a flat, hard surface – you may want to tape the paper in place. Label the paper 90°.
- Allow one drop of blood to fall from the agreed height. This will measure impact at an angle of 90°.
- Repeat so there are 3 trials at 90°. Be careful to adjust the paper so the trials are clearly separate.
- Remove the paper to dry taking care that the droplet patterns do not "run".
- **Do NOT** adjust the height of the dropper.
- Place a different piece of paper labelled 70° on the board.
- Using a protractor, adjust the board so it is at an angle of 70° (or whatever angle you select).
- Allow a drop to fall from the same height. Repeat so there are 3 trials at 70°.
- Repeat this process for the selected angles (e.g. 60, 45 and 30, 20°).
- When the sheets with the 3 trials are dry, measure the length and width of each stain in mm and complete the table. The "angle column" of the student worksheet has been left blank.

NB: when measuring the length and width of the bloodstain do not include spines or satellite stains. See FSB05 for more detailed information.

Suggested Questions

- How does the angle of impact of a droplet influence its shape?
- As the angle decreases what happens to the relationship between length and width of the bloodstain?
- Do you think you will be able to determine the angle that the droplet came from based on the bloodstains?
- What are the potential sources of error?
- As the angle of impact changes, are more satellite stains or spines produced? Why?

Table 5: The influence of the angle of impact on the length, width and shape of bloodstains

Angle (º)	Trial 1 (mm)	Trial 2 (mm)	Trial 3 (mm)	Average (mm)	Shape (draw) and observations of bloodstains.
90	W = L =	W = L =	W = L =	W = L =	
70	W = L =	W = L =	W = L =	W = L =	
60	W = L =	W = L =	W = L =	W = L =	
45	W = L =	W = L =	W = L =	W = L =	
30	W = L =	W = L =	W = L =	W = L =	
20	W = L =	W = L =	W = L =	W = L =	

BLOOD SPATTER

Bloodstain Analysis Experiments

Activity 5

How can you work out the angle of impact from a blood stain?

In this activity students will calculate the angle of impact of 4 blood droplets.

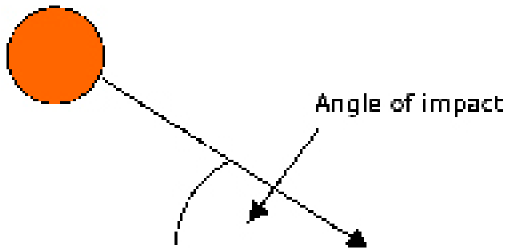
This can be an individual activity. The length and width measurements from **Activity 3, Table 4** (Sheet B, unknown information) will be used.

FSB05 has information about the methods for calculating the angle of impact. The information below is essentially the same as the information in the Student Dossier (FSB08).

Calculating the angle of impact

The angle of impact formula relies on the relationships that exist between the angles of a right triangle and the length of its sides. These are trigonometric functions called sine, cosine and tangent.

Imagine a right triangle formed between the droplet and the target surface as the droplet strikes. A blood droplet in flight is the same shape as a sphere.



A blood droplet striking a surface such as the floor can be thought of as a RIGHT TRIANGLE.

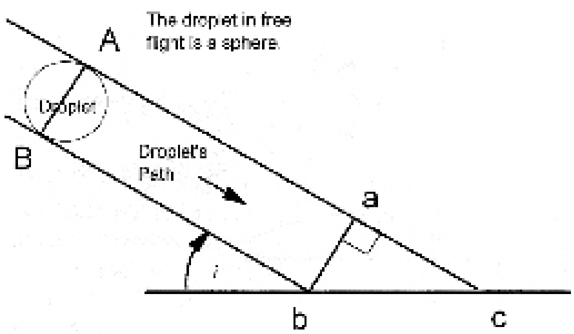


Image used with permission from Tom Bevel & Ross Gardner, June 2006

In the diagram below, line LM of the stain (width of the stain) represents the line ab of the triangle and the line JK (length of the stain) represents line bc of the triangle.

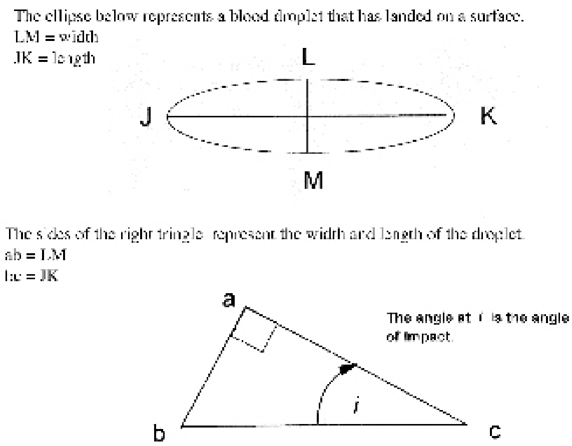


Image used with permission from Tom Bevel & Ross Gardner, June 2006

As a result, the two known measurements from the crime scene, the length and width of the bloodstain, can be used in a mathematical formula:

Sine *i* = Width (ab) / Length (bc)

Inverse Sine (ASIN) i = Angle of Impact

Keep on going!

The steps are:

- Accurately measure the width and length of a given bloodstain. This must be measured to the nearest millimetre.
- Divide the width of the stain by the length of the stain in order to obtain the width to length ratio.
- Calculate the inverse sine of this ratio.
- This value is the angle of impact.

You can use either a calculator with a sine function or sine function table.

An example:

Width of the bloodstain = 3mm

Length of the bloodstain = 5mm

Sine *i* = 3mm / 5mm = 0.6
Inverse Sine *i* (0.6) = 36.8

The angle of impact is between 36-37°

It is important to note that this method gives an estimate of the impact angle rather than a precise result. The accuracy is between 5-7°.

The students will use their results from Activity 4 and Table 5 "from Sheet B: unknown information". The bloodstains for Sheet B were created using particular angle. The students should calculate the angle of impact of each of the 4 stains.

Record their results in Table 6.

After the students have completed the activity they should check with the person/group who created SHEET B.

Table 6: the Angle of Impact of 4 Bloodstains.

Stain Number	Width & length (mm)	Width to length ratio W/L	Inverse sine of the ratio	Angle of impact
1	W = L =			
2	W = L =			
3	W = L =			
4	W = L =			

Activity 6

What effect does velocity have on bloodstains?

In this activity students will assess the effect that changing the velocity of blood droplets has on the resulting bloodstains.

You may prefer to do this as a demonstration as it potentially could be very messy!

Once again there are 2 versions available in the Student Dossier (FSB08)

Different levels of force will be applied to a small mass of synthetic blood, therefore enabling the blood droplets to travel at different velocities, and the resulting bloodstains analysed for size and shape.

What is interesting is how a small amount of "blood" goes a long way. The "area of interest" could be a large cardboard box, one side removed and lined with paper, or a section of the classroom. Be aware that when creating "medium velocity' patterns using an implement on a block of wood or a mousetrap, that the spatter will travel in ***all*** *directions including the ceiling. Using an aerosol spay to create a fine mist is more controllable.*

Equipment

- Synthetic blood (FSB06)
- Butchers paper – several sheets taped to horizontal and vertical surfaces in the area of interest.
- Implement for synthetic blood to drip from – low velocity.
- Block of wood – 10cm x 30cm that can stand upright with a flat top.
- Hammer, bat or another implement to hit the block of wood – medium velocity.
- Aerosol aspirator – high velocity.
- Protective clothing and eyewear.

Another method for creating a medium velocity spatter is via a mousetrap! The following information is from Oller, A.R. 2006 Medium velocity spatter creation by mousetraps in a forensic science laboratory. The American Biology Teacher, 68(3): 159-161.

Equipment

- 1 wooded mouse trap
- 1 large cardboard box (90cm L x 90cm W x 60cm H – approximate)

OR

- 3-4 large pieces of paper (90cm L x 60cm W) and masking tape
- 2mL synthetic blood (FSB06)
- 1m rule
- 1 ball of string and tape
- 1 protractor
- 1 straw or pipette
- 2 sets personal protective equipment (goggles, aprons, gloves)

Methods

Low

- Dip the implement in a small beaker of synthetic blood.
- Hold the implement over the papered area and allow the blood to drip.

Medium A

- Place the block of wood on the ground into the centre of a well-papered area or facing into a prepared cardboard box.
- Place 2mL of synthetic blood on the flat top of the block of wood.
- Use an implement such as a hammer and beat down onto the block of wood.

Medium B

- Orient the mousetrap so the spatter will travel into the box or papered area.
- Using a straw or pipette place approximately 1mL of "blood" on the base area of the trap where the metal will contact the wood.
- Have a partner hold the back edge of the trap to prevent the trap from becoming airborne.
- Be awary of potential injury from using a mousetrap
- Using a pencil, gently trip the trap.

High

- Fill an aerosol sprayer will synthetic blood.
- Spray a fine mist from into the prepared paper area or box.

Complete Table 7.

Extension Activities

The effect of moving – walking, running – on bloodstains. This could be completed with a student performing the action along a paper pathway with some blood dripping. This is an example of low velocity blood spatter.

Table 7: The effect of changing levels of force on bloodstains.

Level of force	Measurement sample 1 (mm)	Measurement sample 2 (mm)	Measurement sample 3 (mm)	General Shape (sketch)
Low	W = L =	W = L =	W = L =	
Medium	W = L =	W = L =	W = L =	
High	W = L =	W = L =	W = L =	

Suggested Questions

Why does the velocity at which the blood droplets are travelling have an effect on the size of the bloodstains?

What sort of objects or activities could create the three different blood spatter patterns?

Low velocity (e.g. cutting a finger while peeling a potato)
Medium velocity (e.g. beating with hand or club, stabbing with a knife)
High velocity (e.g. gunshot wounds, chain saw injury)

Activity 7

How can you determine the origin of a blood droplet?

This activity brings together a number of the skills and procedures previously developed. This could be a culminating activity. Students create bloodstains and then swap with another group: they are working from an unknown but are able to confirm or verify their findings with the class.

Equipment

- Synthetic blood (FSB06).
- Butchers paper – several sheets taped to the floor.
- Aerosol or spray bottle – adjust the nozzle so the "blood" is NOT in a fine mist but in droplets.
- 100cm rule.
- 30cm rule.
- Pencil.
- Protective clothing and eye protection.

Method

- [A large X could be drawn in the middle of the paper taped to the floor. This could be a guide for the students??]
- A student in protective clothing will stand on the paper (on the "X" if drawn) holding the aerosol or spray bottle that contains 2-3ml of synthetic blood in one hand.
- Using the 100cm rule, a predetermined height will be measured (approx waist height) from which the blood will travel from.
- Keeping the bottle at the measured height the student will spray an arc of droplets to their front.
- The student will then step away and the group waits until the spatter pattern is dry.
- Students will write a description of their sample: eg xcm height, sprayed from left to right.
- Each group will swap their sample with another.

The students can then use the spatter pattern to:

- Confirm the directionality of the droplets.
- Select several droplets from different areas of the paper (approx 10 droplets?) and measure the length and width of the droplets.
- Calculate the angle of impact of the selected droplets using the mathematical formula:

  Sine i = Width / Length

  Inverse Sine (ASIN) i = Angle of Impact
- Determine the 2-D 'area of convergence' by drawing lines from the centre of the long axis of individual stains. Where the lines from several stains meet is the area of convergence. (The "X" drawn on the paper could act as a guide).
- Measure the length (cm) from the back of the stain to the area of convergence.
- Enter data and calculations into Table 8
- Using this data, students can calculate the area from which the blood originated. This point will be located above the area of convergence.
- There are 3 separate methods: suggest that students complete all 3 methods and enter results into Table 9.

BLOOD SPATTER

Bloodstain Analysis Experiments

Method 1

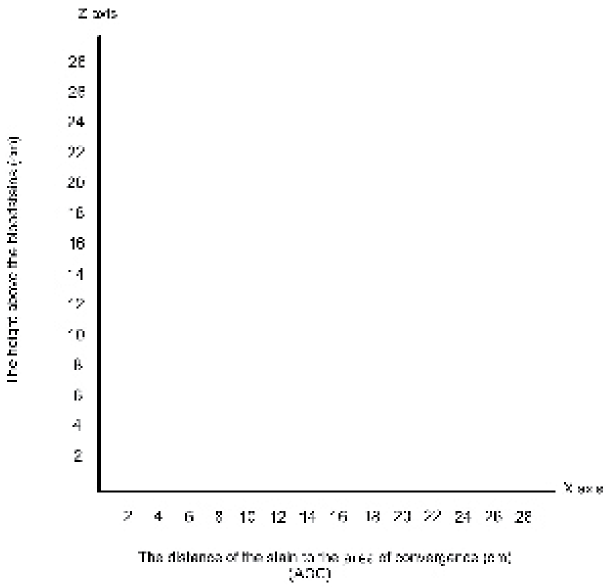
Defining the Area of Origin by the Graphing Method

The scales of both axes used in the graph must be the same.

The **X-axis** represents the target plane and graphs the <u>distance from the back-edge of the stain to the AOC.</u> This is a known value (Table 8). The target plane is the floor.

Make sure the axis of the graph is long enough. In the example below, the biggest distance from a bloodstain to the Area of Convergence is 24cm so the axis is a little bit more.

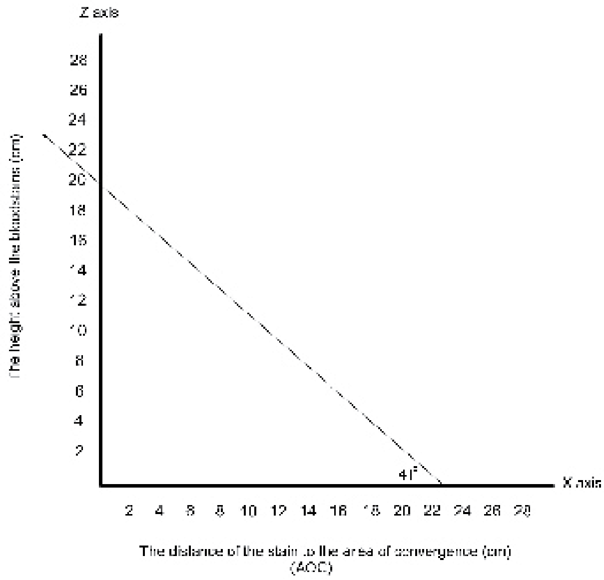
The **Z-axis** represents the height above the target plane – in this example the target plane is the floor. This is an unknown value – it is what you are trying to find out. Make this scale the same as the X axis



Do the following.

1. Mark on the X-axis of the graph the AOC distance (cm) for each different stain. You need to graph a minimum of 3 stains.
2. Using a protractor, draw a line from the mark on the X-axis, at the calculated angle of impact, to the Z-axis. See the example below.

In this example, one line representing one stain has been drawn. The angle of impact of the stain was calculated to be 41° and the distance from the back of the stain to the Area of Convergence was measured to be 23cm.



3. Repeat this procedure for each stain.
4. The point at which the lines from the X-axis converge on the Z-axis establishes the probable height of the Area of Origin.

Enter your results into the column labelled "Estimated Area of Origin Graph Method" in Table 9. Verify your results by calculating the Area of Origin by Method 2.

Method 2
Defining the Area of Origin with the Tangent Function.

Using the same data from Table 8 the following formula is used to calculate the Area of Origin.

You need to use a scientific calculator for this activity.

TAN*i* = H/D

i = angle of impact

D = distance from stain to area of convergence

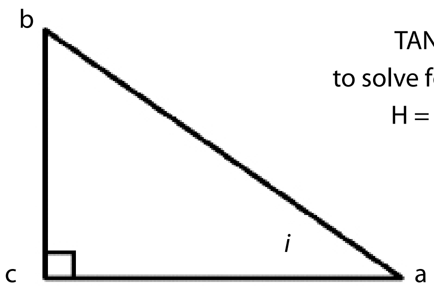
H = unknown distance above target surface

For example:

Line bc = H - height above the target: unknown.

Line ca = D – distance to the area of convergence: known.

i = angle of impact: known.



TAN *i* = H/D
to solve for unknown H
H = TAN *i* * D

Using your data from Table 8, calculate H, the unknown distance above the target surface (floor) for each stain.

Stain Number	*i* Angle of impact	D Distance to the AOC	TAN *i*	H = TAN *i* * D
1				
2				
3				
4				
5				
6				

Enter your results into the column labelled "Estimated Area of Origin Tangent Method" in Table 9. Verify your results by calculating the Area of Origin by Method 3.

Method 3

Defining the Area of Origin by Triangulation.

Using the same data from Table 8 you will use a hands-on method to estimate the Area of Origin.

Apparatus

- Ring stand
- Protractor
- String
- Masking tape
- 100cm rule
- pencil

Method

- Place the ring stand on the Area of Convergence
- Write the calculated Angle of Impact next to each stain.
- Using string, masking tape and a protractor, raise the string to the calculated angle and attach it to the ring stand.
- Do the same for a minimum of 3 stains.
- The place on the ring stand where the string from each stain meets is the Area of Origin.
- Measure the height of the Area of Origin.

Enter your results into the column labelled "Estimated Area of Origin Triangulation Method" in Table 9.

Table 8: The angle of impact and distance to the Area of Convergence of several blood stains.

Stain number	Width / length (mm)	Angle of impact calculation	Length: stain to AOC (cm)
1	W = L =		
2	W = L =		
3	W = L =		
4	W = L =		
5	W = L =		
6	W = L =		

Table 9: Estimation of the Area of Origin by three different methods.

Stain Number	Estimated Area of Origin Graph Method	Estimated Area of Origin Tangent Method	Estimated Area of Origin Triangulation Method
1			
2			
3			
4			
5			
6			

Questions

Which method do you think is the **best** method?

What is your reason for this selecting this method?

Which method do you think is the **worst** method?

Why?

Conclusion

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Bloodstain Analysis Experiments

Activity 8
Online crime scene

Students have access to the following resources:

- Online crime scene that includes some basic information – FSB09.
- Statements from:
    - Suspect
    - Witness
    - Victim

Students should interrogate the online crime scene and determine what evidence they can collect. What is the crime scene telling them?

They may decide they need to conduct some further experiments to assess what type of activity or impact created some of the stains. For example, students may need to assess dripping blood while walking or running.

From the crime scene and the evidence that it holds, students aim to determine the sequence of events and which statement is more likely to be correct.

For your information, the online crime scene was created for a police training exercise. Grateful thanks are extended to Sergeant Mark Reynolds, WAPOL Forensic Crime Scene Unit and PhD student at UWA, for access to the venue and for writing the scenario and statements.

In this scenario, the target plane is a wall.

The 4 images below show the creation of the crime scene.

Bloodstain Pattern Analysis

Crime Scene Scenario

- The **FIRST** component of this bloodshed event was TWO IMPACTS to a source of liquid blood (head) situated in the corner of the kitchen directly opposite the internal door connecting the kitchen and the corridor.
- The blood source was situated 100cm above ground, 40cm out from left wall and 40cm out from far wall (i.e. pushed into corner and hunched/crouched). The blood source was not moved between applications of force and as such it would not be possible in this case to provide a determination of more than two blows (remembering the first blow initiates the blood source – the second or subsequent distribute it).
- The patterns observed on the wall are typical of those encountered from beating events and are classed as impact spatter. Physical, mathematical and computer aided processes could be utilized to determine the blood source location within three dimensions.
- Due to physics (straight line versus parabolic flight paths of blood droplets) the calculated height above floor value will always be greater than the actual and a value of 40-60cm would not be unreasonable.

- The **SECOND** component was a person simulated lying on the ground in front of the stove falling a fall. There has been another IMPACT to the source of liquid blood (head) whilst the blood source was at or near ground level (20cm).
- This pattern was not suitable for physical, mathematical or computer aided processes to determine the blood source location within three dimensions, however there are directionality features within the bloodstains, voided areas cause by surfaces at various orientations and these factors when taken into account with possible versus impossible blood droplet flight paths allow for a determination within three dimensional space of the blood source.
- The two impact locations and this one in particular, provide the information regarding the status (open, closed, partial) for the cupboard doors under the sink.

- The **THIRD** component is the blood pool on the floor near the front of the stove. What this provides is an indication that the blood source was stationary at this location for a period of time (time period cannot be quantified due to many variables) and it is distinct from a blood in blood drip pattern.

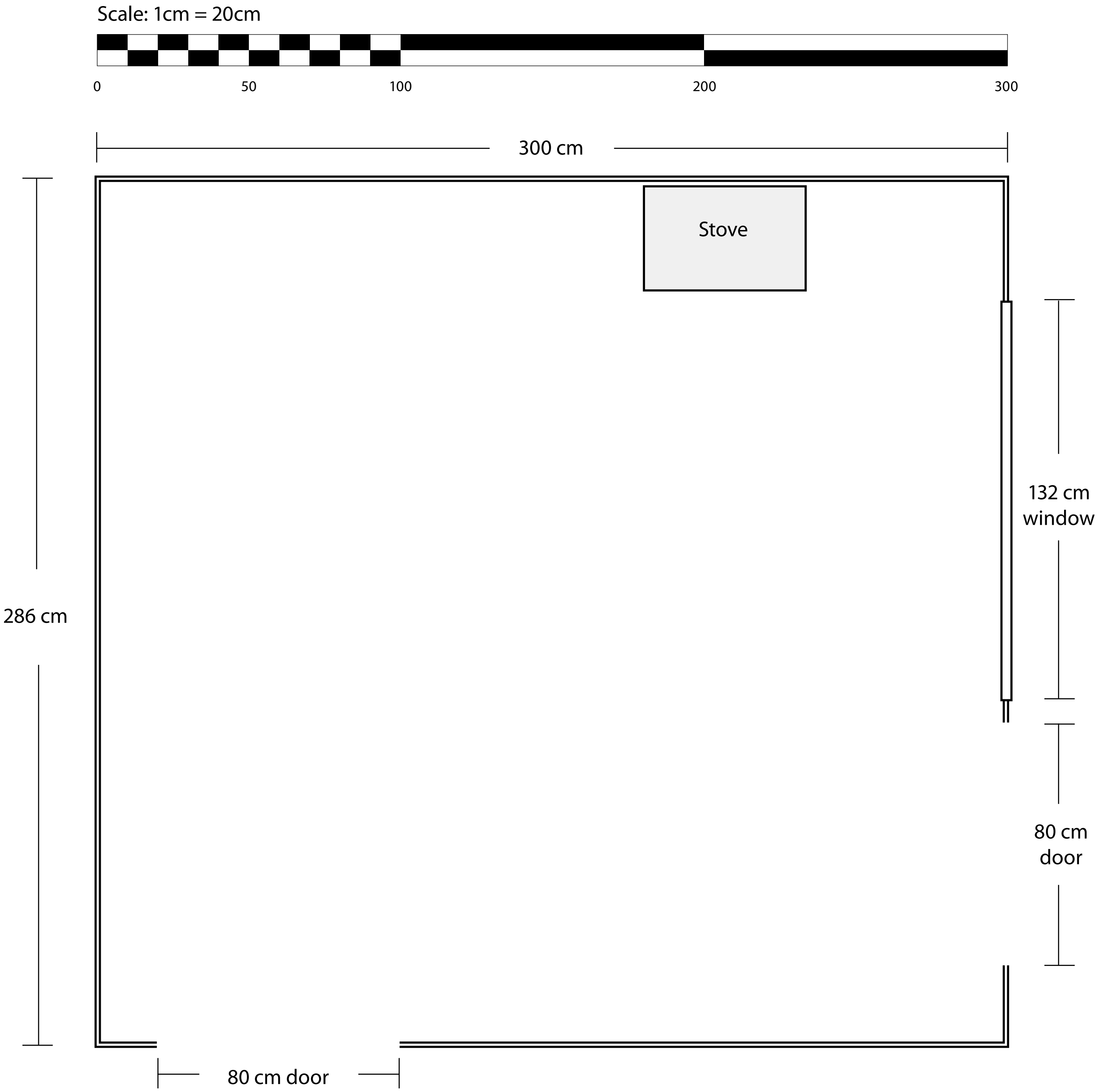
- The **FOURTH** component is the transfer pattern across the floor between the stove and the veranda door. This pattern was designed to simulate lateral movement of a blood source across the floor. Directionality indicators within the pattern demonstrate that the movement is from the stove towards the door. Features within the pattern should also suggest some type of fabric contact.
- A transferred shoe outsole is also present within the pattern and is significant in that it appears to be on top of the pattern and is representative of the offender walking out following the event.
- The trail of shoe impressions begins with one over the transfer (drag) pattern and three others leading towards and out the door to the corridor. One of the three closer to the door has a number of passive blood stains on top of it which signify the victim walking out whilst dripping blood.

- The **FIFTH** component is the blood in blood drip pattern located near the wall opposite the stove. This pattern signifies the victim getting to their feet and remaining in this location for a period of time whilst dripping blood (time period cannot be quantified due to many variables).

- The **SIXTH** component is a trail of passive blood drops from the blood in blood drip pattern towards the door leading out to the verandah. The blood trail then travels towards the door leading out into the corridor. This pattern signifies movement of the victim whilst bleeding.

BLOOD SPATTER

Bloodstain Analysis Experiments



Room plan

You have seen the crime scene online. This is a plan of the room.

The crime scene investigators determined that the bloodstain patterns on the “stove” wall were suitable for analysis. To enable you to analyse these bloodstains a plan of the wall has been included plus close-ups of the actual bloodstains.

Your task is to analyse the bloodstains found on the wall and to try to work out where the victim was located in the room. Where was the victim in relation to the wall?

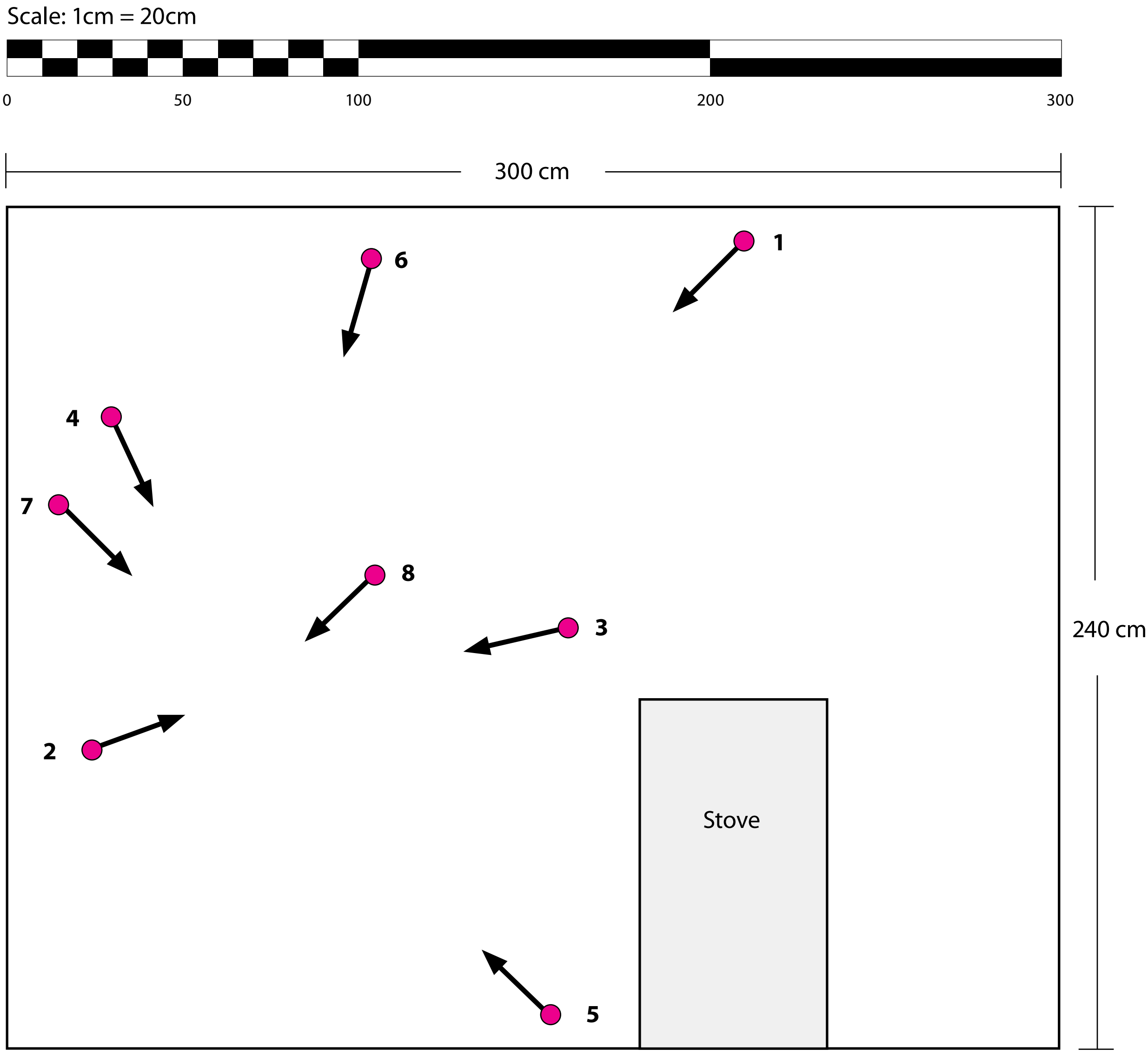
To analyse the bloodstains you need to use the following information:

Wall plan

- Find the area of convergence (AOC).
- Measure the distance from each stain to the AOC.

Bloodstains

- Measure the width and length of each bloodstain.
- Calculate the angle of impact of each stain.



Wall plan

The location of the bloodstains has been marked on the wall plan. An arrow extends from each stain indicating the exact position of each stain. Use the information on the wall plan to determine the AOC and the distance from the stain to the AOC.

Area of convergence (AOC)

- Using a ruler (or compass) and a sharp pencil extend the arrows from each of the bloodstains to find the AOC.

Distance (D)

- Measure the distance (cm) from the **back** of each stain to the AOC. Use the scale to convert to the correct distance.
- Enter D into Table X.

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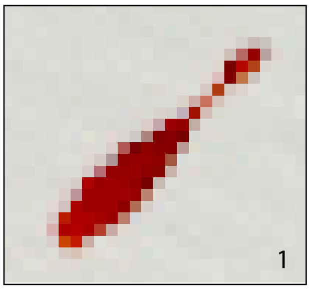
Bloodstains – Angle of impact *i*

Measure the width and length of each bloodstain.
Calculate the angle of impact (*i*) using your Trigonometry Table.
Make sure you do not include any tails or satellite stains in your measurements.



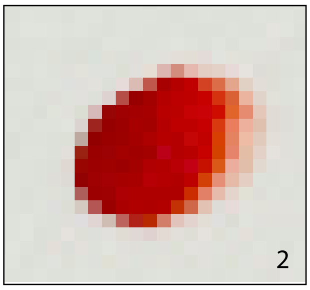
1

W =

L =

W/L =

i = ______________



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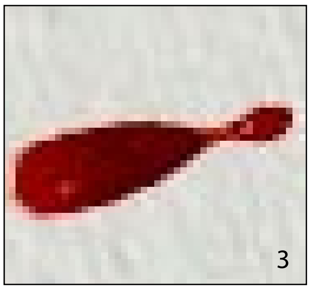
L =

W/L =

i = ______________



3

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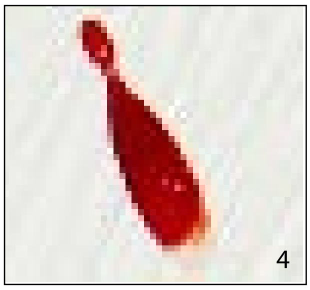
L =

W/L =

i = ______________



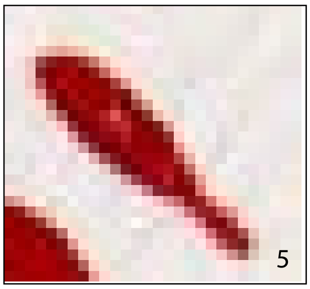
4

W =

L =

W/L =

i = ______________



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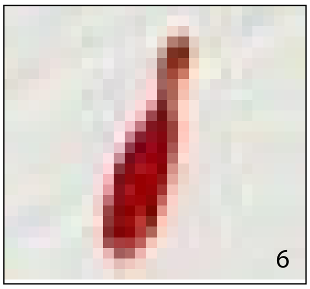
W/L =

i = ______________



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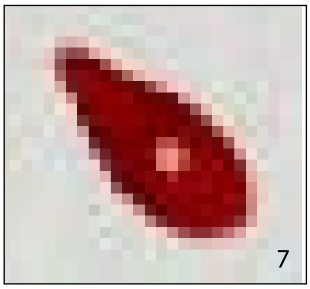
W/L =

i = ______________



7

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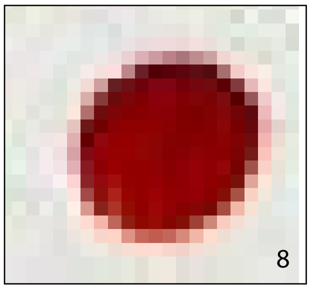
L =

W/L =

i = ______________



8

W =

L =

W/L =

i = ______________

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Bloodstain Analysis Experiments

TABLE X Find H, the area of origin of the blood.

Stain	**D** Distance from stain to AOC (cm)	***i*** Angle of impact	**TAN *i***	**Area of origin** H = TAN*i* x D	**H** Distance from the wall (cm)
1	x 20 =				
2					
3					
4					
5					
6					
7					
8					