

**Evidence  
&  
Investigation  
Review**

## Evidence and Investigation Study Guide

How do police and investigators solve crimes?

**Observations** are information gathered through our senses (see, smell, touch, taste, hear)

**Inferences** are a conclusion about something based on an observation.

Example: Jim observed that there was a broken window in the classroom. The glass was on the inside of the classroom. Jim inferred that the window was broken from the outside of the classroom.

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**Classify** means to arrange things in groups according to similar qualities. Dichotomous keys are an easy way to help to identify things.

**Evidence** is any bit of information, physical markings or objects that give people a reason to believe something.

### **Common types of evidence are**

- ◆ Fingerprints
- ◆ Materials and fibers
- ◆ Tire tracks
- ◆ Animal tracks
- ◆ Shoeprints or footprints
- ◆ Soil samples
- ◆ Hand writing samples
- ◆ Witness identification

### Fingerprints

**Fingerprints** are a mark left by the tiny ridges of your finger tip. These markings are left by dust or other particles on the oil of your skin.

There are 4 main types of fingerprints



Arch

Whorl

Loop

Composite

**The arch** fingerprint goes from one side of the finger to the other

**The whorl** fingerprint has a central circle area with ridges circling around it.

The whorl ridges do not go from one side to the other.

**The loop** fingerprint begins at one side of the finger, loops around and the ridge ends at the same side of the finger that it began.

**The composite** fingerprint is a combination of the whorl, arch or loop together on the finger.

Within a fingerprint, there are characteristics that help investigators match up fingerprints. These are **ridge characteristics**. These might include:

- ◆ Forks (bifurcation) - here 1 ridge splits to form 2 ridges
- ◆ A island- a short ridge is by itself in not attached to any other ridges
- ◆ A ridge ending- where a ridge just ends

**Fingerprints can be lifted** off of surfaces using powders, brushes and tape.

Smooth surfaces are easier to lift prints off of than rough surfaces. Some surfaces are not good for lifting prints off of.

Good surfaces: glass, mirrors, smooth plastic, smooth metal

Bad surfaces- bricks, materials, wood

**Fingerprints can only be matched** if they have a suspect to compare samples to or if the suspect has fingerprints in a database.

### Shoeprints

Shoeprints can be classified by size, pattern of the print, wear of the pattern.



- ◆ *Lots of tread on shoe*
- ◆ *Different tread on toes than on middle and back*
- ◆ *Heavy tread on outside on heel and toe*
- ◆ *Shaka Logo in middle of shoe*
- ◆ *Right shoe*

When trying to identify specific wear patterns, look for wear on the heel, on the toes, and the wear on the treads

**Looking at the tread** on a shoeprint can give investigators an idea of what type of shoe it is

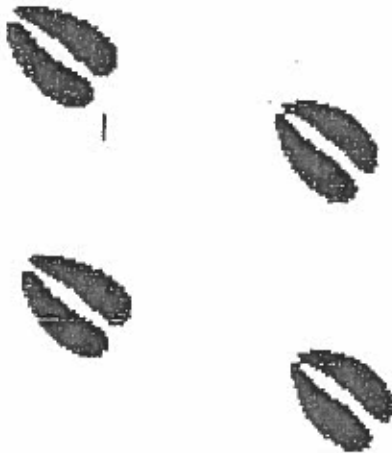
Example:   hiking shoe- lots of deep tread  
               Dress shoe- no tread

Looking at the direction of the shoeprints and the depth of the shoe prints can help investigators figure out which direction the person was going.

Looking at the spacing between the shoeprints can tell investigators if the person was running (large space) or walking (smaller space) →

Running	Walking
<ul style="list-style-type: none"> <li>◆ Large space between prints</li> <li>◆ Deeper prints</li> <li>◆ Outline may not be as clear (dirt kicked up)</li> <li>◆ Line of prints are straighter- no as parallel</li> </ul>	<ul style="list-style-type: none"> <li>◆ Smaller spaces between prints</li> <li>◆ Shallower prints</li> <li>◆ Outline clearer</li> <li>◆ Less of a straight line – more parallel</li> </ul>

Animal prints can also be identified based on the pattern left in the soil.

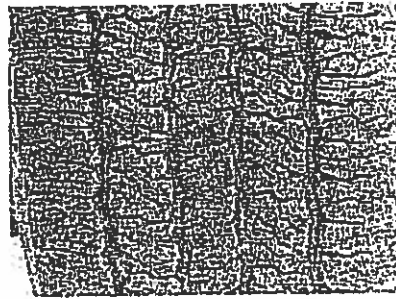


Observation	Inference
<ul style="list-style-type: none"> <li>† Hoofed animal</li> <li>† 2 hooves on foot</li> <li>† 4 feet same size</li> </ul>	Deer

## Tire tracks

Tire tracks can be classified based on

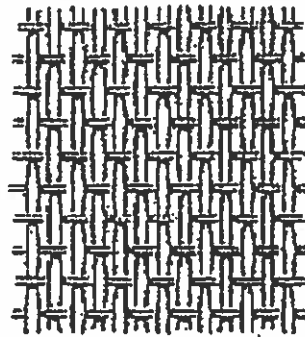
- ◆ type of tread
- ◆ size of tread
- ◆ wear of tread



## Fibers and Fabric

Investigators classify fibers and fabrics by:

- ◆ color
- ◆ pattern of weave
- ◆ texture
- ◆ strength
- ◆ flammability



## Soil samples

Soil samples can be classified based on:

- ◆ color
- ◆ pH
- ◆ smell
- ◆ make up (composition)
- ◆ size of particles

## Handwriting Samples

Handwriting samples can be compared by looking at:

- ◆ the loops in the letters
- ◆ the crosses on the t
- ◆ the spaces between the letters and the words
- ◆ the slant of the letters
- ◆ the size of the letters
- ◆ the dotting of letters ( i , j )
- ◆ a combination of writing and printing
- ◆ the pressure on the page

Investigators can also use **chromatography** to compare sample of ink by separating them into the colors that they are made up of.

Permanent inks (**solute**) will not separate in water (**solvent**). Permanent inks are **insoluble** in water. They will separate in other solvents.

Non-permanent inks( **solute**) will separate in water (**solvent**). Non-permanent inks are **soluble** in water.

Witness identification uses the characteristics of a person to help identify him or her. These characteristics might include:

- ◆ hair color
- ◆ eye color
- ◆ height
- ◆ shape of face
- ◆ weight
- ◆ distinguishing marks (tattoos, scars)

Use the following information to answer question 27.

A student lists some of the variables in a chromatography experiment he conducts.

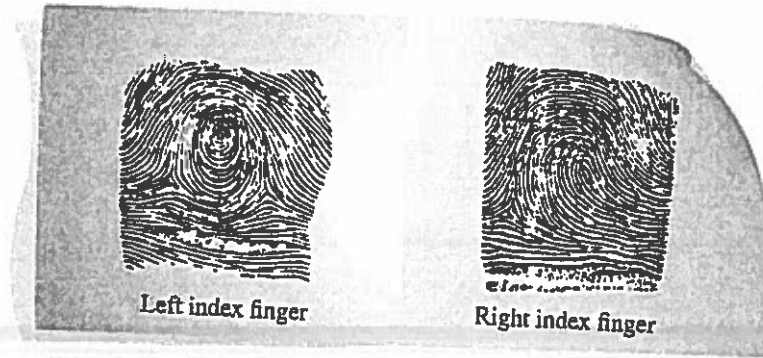
- Type of marker tested
- Volume of water used
- Length of line placed on paper
- Separation of the ink

27. Which of the following rows identifies the manipulated variable and the responding variable in this experiment?

Row	Manipulated Variable	Responding Variable
A.	Type of marker tested	Separation of the ink
B.	Type of marker tested	Volume of water used
C.	Length of line placed on paper	Separation of the ink
D.	Length of line placed on paper	Volume of water used

Use the following information to answer question 28.

Andrea enlarges fingerprints of her left index finger and of her right index finger.

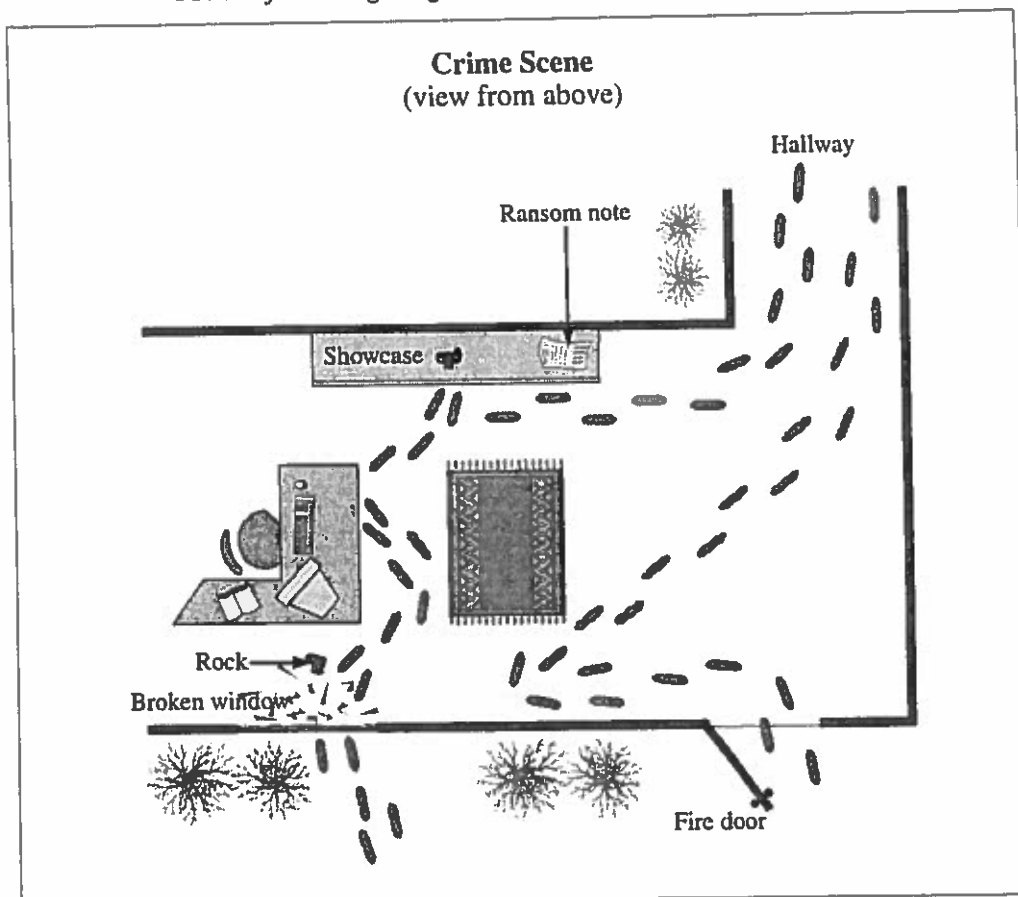


28. Which of the following rows identifies the fingerprint patterns on Andrea's left and right index fingers?

Row	Left Index Finger	Right Index Finger
A.	Whorl	Arch
B.	Whorl	Loop
C.	Arch	Whorl
D.	Arch	Loop



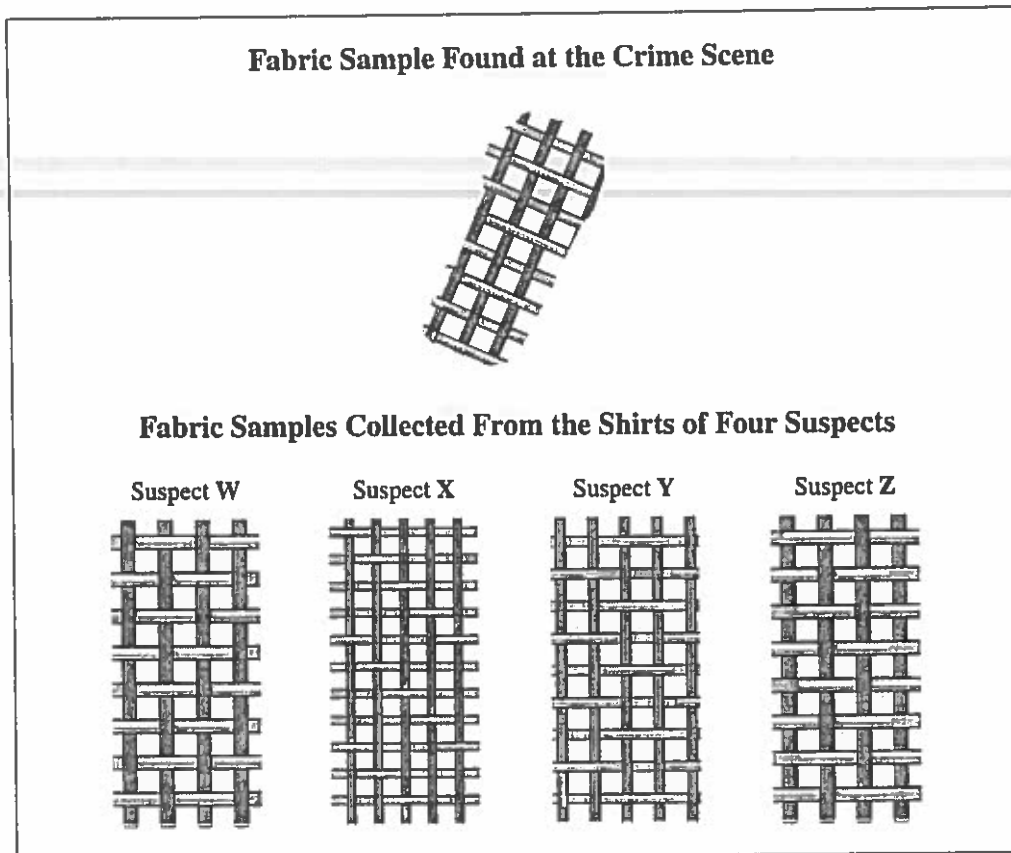
Use the following diagram to answer questions 29 to 31.



29. An inference that can be made about the crime scene shown above is that the suspect **most likely** entered through the
- A. fire door and exited through the window
  - B. window and exited through the fire door
  - C. fire door and exited from the hallway
  - D. window and exited from the hallway

30. A piece of fabric that was found at the crime scene was **most likely** found beside the
- A. desk
  - B. window
  - C. fire door
  - D. showcase

*Use the following additional information to answer question 31.*



31. Which suspect's fabric sample **most closely** resembles the fabric found at the crime scene?
- A. Suspect W
  - B. Suspect X
  - C. Suspect Y
  - D. Suspect Z

Use the following information to answer question 32.

Jackson's running shoes were missing from his gym locker at school. He found the following note on his locker door.

*Your running shoes are now mine!*

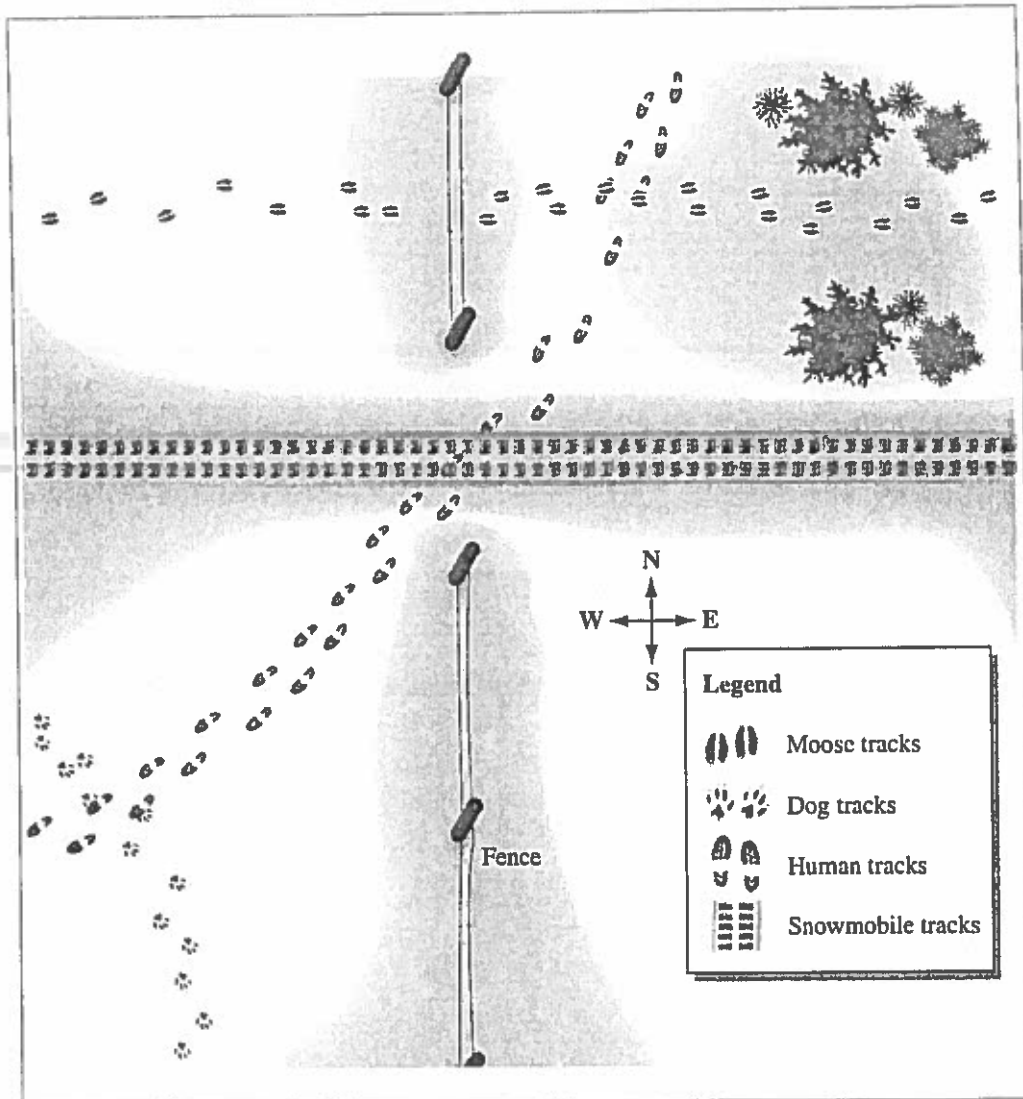
Jackson lists the following characteristics which could be used to help compare handwriting samples.

Characteristics	
1	The slant of the letters
2	How specific letters are formed
3	The colour of the ink
4	The size of the letters
5	The brand name of the pen

32. Which of the following lists identifies the characteristics that Jackson should use to compare handwriting samples from students in his class to the sample he found on his locker door?

- A. Characteristics 1, 2, and 4
- B. Characteristics 2, 4, and 5
- C. Characteristics 1, 3, and 4
- D. Characteristics 2, 3, and 5

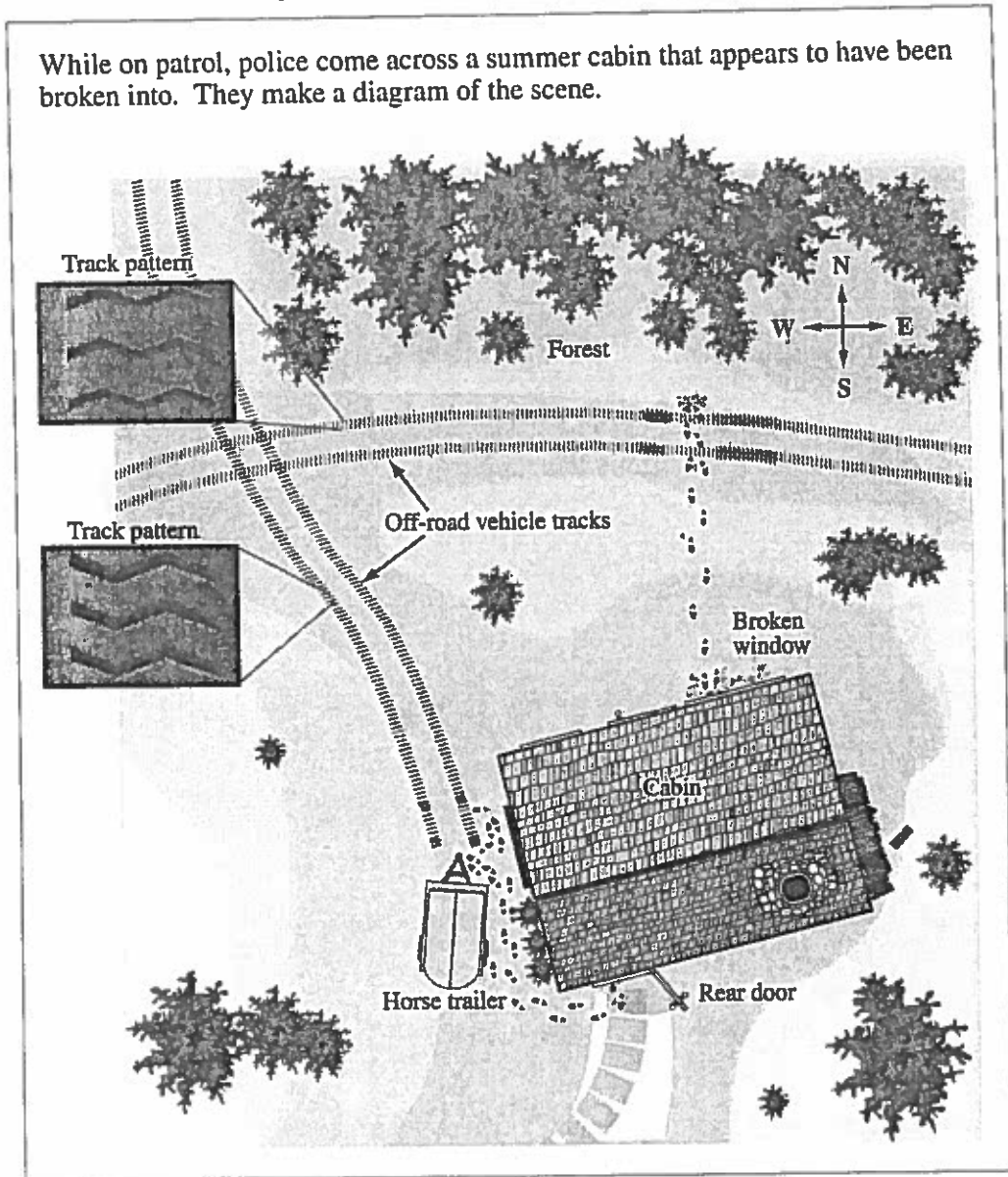
Use the following diagram to answer question 33.



33. For which of the tracks above would it be **most** difficult to determine the direction of travel?
- A. Dog
  - B. Moose
  - C. Human
  - D. Snowmobile

Use the following information to answer question 34.

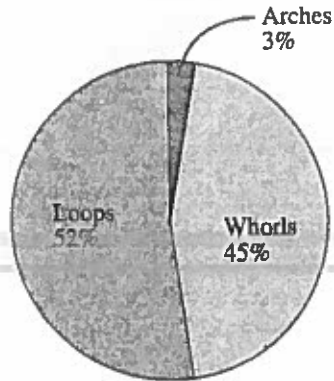
While on patrol, police come across a summer cabin that appears to have been broken into. They make a diagram of the scene.



34. Which of the following statements is an observation that can be made from the diagram?
- A. The rear door of the cabin is open.
  - B. The window was broken with a rock.
  - C. The off-road vehicle tracks were made by the same vehicle.
  - D. The robber could not hook up the horse trailer to the vehicle.

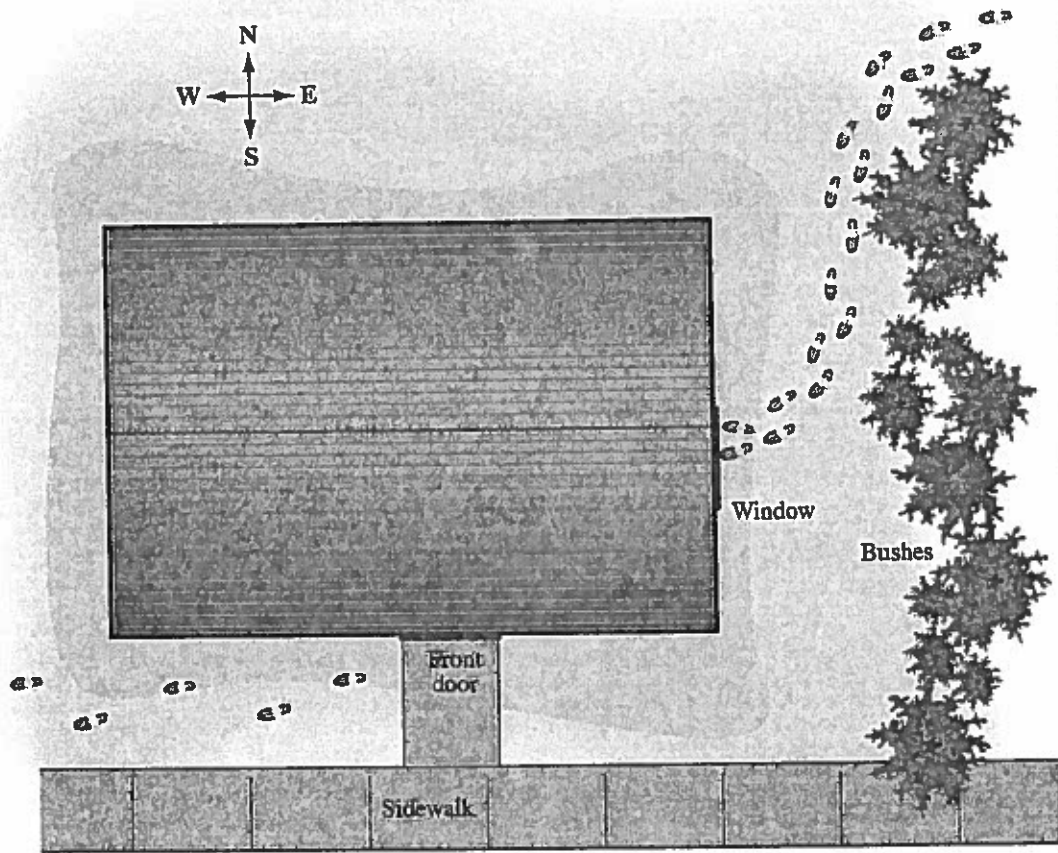
Use the following information to answer question 35.

A student completes a study to determine which fingerprint pattern is found most commonly on the right index fingers of the 500 students in her school. Using an ink pad and white paper, the student takes the right index fingerprint of 33 students. The results are shown below.



35. To obtain more accurate results in a repeat of this experiment, the student should
- A. take fingerprints from a different finger
  - B. take the fingerprints of students from a different grade
  - C. obtain more fingerprints from other students in the school
  - D. use a different procedure to obtain fingerprints from students in the school

Use the following information to answer question 36.



36. Which of the following rows correctly identifies the direction and speed of travel for the set of footprints exiting the house above?

Row	Direction	Type of Stride
A.	West	Running
B.	West	Walking
C.	East	Running
D.	East	Walking

Use the following information to answer question 37.

A clothes designer wants to determine the best fabric to make a hiking jacket he is designing. He needs to determine which fabric will be most effective at keeping a person dry, warm, and protected from the wind.

**Types of Fabric**

<b>Fabric Sample</b>	<b>Elasticity of Fabric</b>	<b>Moisture Absorption</b>	<b>Weave Pattern</b>
<b>I</b>	Inelastic	Yes	Tight
<b>II</b>	Inelastic	No	Loose
<b>III</b>	Elastic	Yes	Loose
<b>IV</b>	Elastic	No	Tight

37. Which fabric is most suitable for the hiking jacket?

- A. I
- B. II
- C. III
- D. IV