#8873

PRO MATH:
CRIME STOPPERS

Grade Levels: 7-12
26 minutes
HUMAN RELATIONS MEDIA 1997
3 Instructional Graphics Enclosed

DESCRIPTION

Introduces viewers to the world of crime-fighting and how mathematical concepts are intrinsically tied to a crime's solution. Law enforcement officials explain how they use math to find angles of trajectory, distance, time, data analysis, probability, and statistics to solve crimes of murder, embezzlement, traffic accidents, bombings, etc. Stresses the real and practical applications of math in law enforcement.

ACADEMIC STANDARDS

Subject Area: Mathematics

- Standard: Understands the general nature and uses of mathematics
  - Benchmark: Understands that mathematics provides a precise system to describe objects, events, and relationships and to construct logical arguments
- Standard: Uses a variety of strategies in the problem-solving process
  - Benchmark: Understands the components of mathematical modeling (i.e., problem formulation, mathematical model, solution within the model, interpretation of solution within the model, validation in original real-world problem situation)

INSTRUCTIONAL GOALS

1. To illustrate how math is connected to the world outside the classroom.
2. To stimulate the investigation of problems and formulation of answers.
3. To illustrate how estimation and measurement are used to solve problems.
4. To develop logic and observational skills.
5. To study the use of percentages, probability and ratios to solve problems.
6. To stimulate communication about and discussion of mathematical concepts and ideas.

VOCABULARY

1. forensic science
2. logic
3. matrix
4. observation
5. probability
6. trajectory

Captioned Media Program
VOICE 800-237-6213 – TTY 800-237-6819 – FAX 800-538-5636 – WEB www.cfv.org
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AFTER SHOWING

Applications and Activities

1. Observe current events that relate to the crime-solving techniques studied. Create a folder of references noted in the local or national news.
2. Create a Crime Stoppers bulletin board, using interesting news articles that are found in the media. Make embellishments throughout the school year.
3. Analyze the evidence and answer questions for the following:
   a. A year ago, crime was out of control in the town of Birnum Bluff. A committee was formed to track crime in different areas of the city. More officers patrolled areas with high crime and residents were encouraged to watch for suspicious activities. A few months after the committee was formed, Birnum Bluff's crime rate began to drop. Use the statistics below to find out more about the crime rates of Birnum Bluff.
      1) If Birnum Bluff's annual murder rate is 16, and the neighborhood of Glen Fields accounts for 12.5% of the murders, what is the annual murder rate of the other neighborhoods in Birnum Bluff? (14 murders)
      2) There were 15 arsons reported in Birnum Bluff two years ago. Last year, the arson rate dropped by 20%. If Derby Lake reported 4 arsons, how much arson did the other areas of Birnum Bluff report? (8 arsons)
      3) Last year, the number of drug arrests in Glen Fields was 40% less than the number of drug arrests in Derby Lake. The total number of drug arrests in both areas was 49. How many drug arrests took place in Derby Lake last year? (35 drug arrests)
      4) Do you think more police were sent to patrol Glen Fields or Derby Lake? Why? (Derby Lake has a consistently higher crime rate, and would need to be patrolled more heavily)
   b. Actress and singer Delva Pierce was assaulted and stabbed to death in her Hollywood condominium. Investigators found several clues at the scene. In addition, an eyewitness described a male suspect who was seen leaving the house. Use probability to estimate the chances of a suspect's guilt. By multiplying probabilities together, they can find out the chances of any set of characteristics.
      1) The suspect in this case was described as having red hair and a limp. If 1/6 of the population has red hair, and 1/90 of the population has a limp, what are the chances that someone with red hair will have a limp? (1/540)
      2) Investigators found both Type A blood, belonging to the victim, and Type O blood, probably belonging to the suspect. If Type O blood is found in 45% of the population, what is the probability that someone will have red hair, a limp, and Type O blood? (1/1200)

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3) The suspect was described as wearing a red jacket and blue running shoes. If 1/13 of the population owns a red jacket, and 1/377 of the population owns both a red jacket and blue running shoes, what is the probability that someone owns blue running shoes? (1/29)

4) Police located a redheaded man with a limp. He is wearing blue running shoes, and there is a red jacket on his front seat. If tests show that the man has Type O blood, what is the probability that his similarity to the suspect is purely accidental? (1/452,400)

4. Use observation skills to analyze the patterns of blood splatters and help solve a crime. (See INSTRUCTIONAL GRAPHICS.)
5. Use evidence found at fictitious crime scenes to solve crimes. (See INSTRUCTIONAL GRAPHICS.)
6. Discuss how the laws for deaf people have changed in relation to serving on juries.
7. Discuss the meaning of "Rob Peter to pay Paul."
8. Read some Sherlock Holmes stories or view CMP video #8560: *Sherlock Holmes and the Secret Weapon* or #8354: *Sherlock Holmes: The Great Detective.* Point out areas where Holmes used observation, probability and logic to solve crimes.

SUMMARY

This visual documentary-style video uses interviews, true crime stories, reenactments and narration to explain how numbers can help solve a crime.

As the video opens, we see the reenactment of s suspicious shooting incident. Later, we see how the angle of the bullet path proved that the shooting was a murder. Several criminal investigators, including world-renowned forensic scientist Dr. Henry Lee and former New York City Police Commissioner William Bratton, describe crime situations that were unraveled using simple mathematical principles. Many crime-fighting techniques that utilize math, such as DNA testing, estimation of vehicle speed, and three-dimensional measurements, are also discussed. In the process, a variety of concepts are introduced including probability, statistics, angle measurement and the use of formulas.

In addition to basic mathematics, logical and critical thinking are required to solve many of the activities. Most important, students will learn that working with numbers can be fun and rewarding.

RELATED RESOURCES

Captioned Media Program

- Math in Automotive Technology #8321
- Welcome to Math: You Gotta Start Somewhere #3680

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World Wide Web

The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and "kid-safe" sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.

- **MYSTERIES**

http://www.connectingstudents.com/themes/mystery.htm

Provides numerous links, such as "Forensics Websites," "FBI for Kids Crime Detection," and more. Click on age-appropriate solve-it-yourself games or lesson guides.

- **THE MATH FORUM**

http://www.mathforum.com/

The forum's goals include making math-related resources more accessible, providing high quality math and math education content and provide model interactive projects.

- **ASK DR. MATH**

http://www.mathforum.com/dr.math/

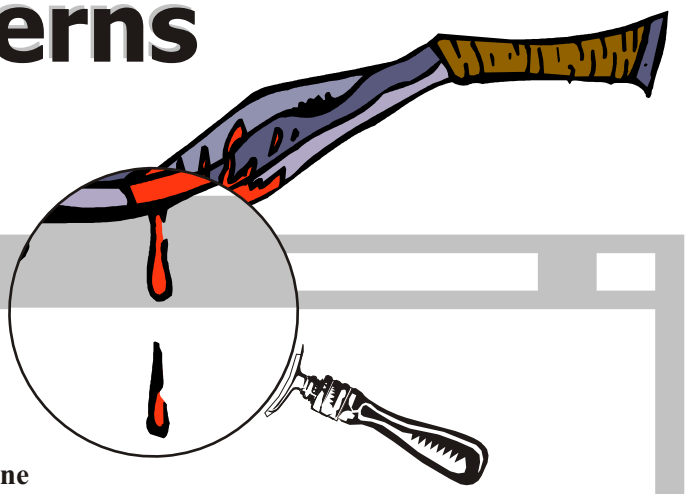
From Swarthmore College, provides answers for math questions submitted by K – 12 students. Volunteer "doctors" from all corners of the globe assist in answering questions.

INSTRUCTIONAL GRAPHICS

- BLOOD PATTERNS
- CRIME SCENE
- ANSWER SHEET

Name _____ Date _____

Blood Patterns



Need to Know:
Logic and Observation Skills

CASE #0010

Crime: Homicide
Weapon: Knife
Location: 4th St. and Avondale Lane

Case Report: A man was killed in a knife fight at 12:13 a.m. The man responsible for the murder claims it was self-defense. Since there were no witnesses, investigators must use blood drops found at the scene to understand what happened.

Assignment: The pattern and shape of blood drops can reveal how far the blood has fallen and from what angle. The blood drops on this page were photographed at the crime scene. As a forensic lab worker, use the drops to answer the questions below.

1. Which drop fell from a height of 3 feet?

2. Which drop traveled to the left and hit the wall at an angle?

3. Which drops fell from the knife as the killer left the scene?

4. Which drop fell from a height of 4 inches?

5. Which drops were caused by the knife being swung through the air?

BONUS: After finding the answer for #5, can you tell how many times the victim was stabbed?

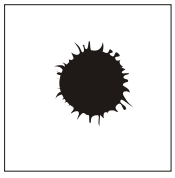


Exhibit A

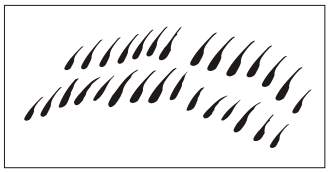


Exhibit B

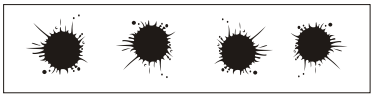


Exhibit C

Exhibit D

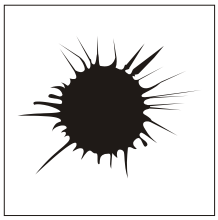


Exhibit E

Trails of blood can be very useful in re-creating a crime scene. What could be the difference between a trail of long and thin blood drops, several feet apart, and a trail of round blood drops close together?

Name _____ Date _____

Crime Scene

Trail of Death

Four hikers, Al, Bob, Carl, and Dave left a rest area at 1 p.m. and headed due south. Checking his pedometer, Al saw that he was walking 2 miles per hour. At 3 p.m., he reached a turn that led due east. One and a half hours later, he found Bob murdered on the trail.

Al took the straightest path back to the rest area to report the murder. No other hikers had come back to the rest stop.

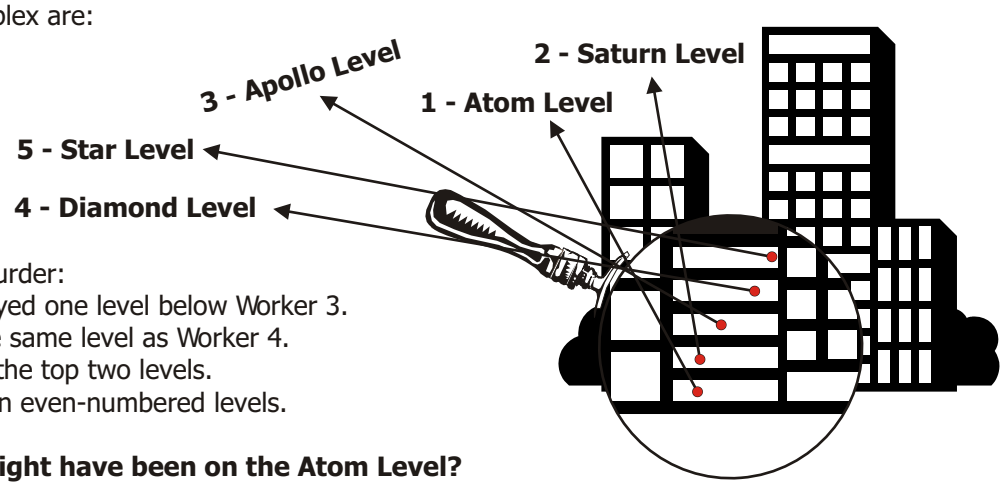
Carl reached the eastward turn at 1:48 p.m. When Bob reached the eastward turn, he was 2 miles ahead of Al. At 2:40 p.m., Dave was one mile past the eastward turn.

1. **How fast was Carl hiking?**
2. **When did Bob reach the site of his murder?**
3. **How far did Al walk to get back to the rest stop?**
4. **Which hiker most likely killed Bob?**

Homicide Highrise

Renowned research scientist Dr. Theodore Tiachi was murdered at his five-story laboratory complex. Investigators suspect that the murder was committed by a lab worker. Tiachi was working on the Apollo Level when someone turned on his radiospectramagraph, giving him a fatal dose of radiation.

The levels of the complex are:



On the night of the murder:
- Worker 1 always stayed one level below Worker 3.
- Worker 2 was on the same level as Worker 4.
- Worker 3 stayed on the top two levels.
- Worker 4 was only on even-numbered levels.

1. **Which worker might have been on the Atom Level?**
2. **Which workers couldn't have been on the Saturn Level?**
3. **Which levels might have been occupied by more than one worker?**
4. **Could the Star and Apollo Levels have been empty at the same time?**
5. **Could all 4 workers be on one level at the same time? Which level?**
6. **Which worker could have been on the same level as Dr. Tiachi?**

Answers

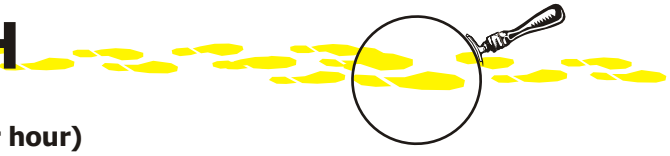
CASE #0010

1. Which drop fell from a height of 3 feet? **(E)**
2. Which drop traveled to the left and hit the wall at an angle? **(D)**
3. Which drops fell from the knife as the killer left the scene? **(C)**
4. Which drop fell from a height of 4 inches? **(A)**
5. Which drops were caused by the knife being swung through the air? **(B)**

BONUS: After finding the answer for #5, can you tell how many times the victim was stabbed? **(Two times; there are two rows of blood drops, one for each time the knife was swung.)**

Trails of blood can be very useful in re-creating a crime scene. What could be the difference between a trail of long and thin blood drops, several feet apart, and a trail of round blood drops close together? **(The first trail was probably made by someone who was running, the second trail by someone who was walking.)**

TRAIL OF DEATH



1. How fast was Carl hiking? **(5 miles per hour)**
2. When did Bob reach the site of his murder? **(2:45 p.m.)**
3. How far did Al walk to get back to the rest stop? **(5 miles)**
4. Which hiker most likely killed Bob? **(If Carl had killed Bob, Dave would have come upon the body first. However, Al did not see Dave backtrack on the trail and Dave did not go to the rest area for help. Therefore, Dave is the strongest suspect.)**

HOMICIDE HIGHRISE

1. Which worker might have been on the Atom Level? **(None of the workers)**
2. Which workers couldn't have been on the Saturn Level? **(4 and 2)**
3. Which levels might have been occupied by more than one worker? **(Diamond and Saturn)**
4. Could the Star and Apollo Levels have been empty at the same time? **(No)**
5. Could all 4 workers be on one level at the same time? Which level? **(Yes, on the Diamond Level)**
6. Which worker could have been on the same level as Dr. Tiachi? **(1)**