

# GETTING STARTED

## AN INTRODUCTION TO COLLISION SCENE INVESTIGATION

*Collision Scene Investigation* (CSI) is a Science-In-A-Crate program that encourages participants to develop an understanding of the role of a collision reconstructionist. The CSI crate provides an introduction to the techniques involved in collecting and evaluating evidence left at the scene of a collision. Through seven hands-on inquiries, students will assume the role of a collision reconstructionist, employing the scientific principles and mathematical practices used at present-day collision scenes. After evidence has been collected and analyzed, students will answer questions that challenge them to make interpretations on the data they have obtained.

In *Collision Scene Investigation*, the scenario involves the reconstruction of a collision that has occurred at the intersection of a north-south gravel and an east-west paved road. There were several vehicles and occupants involved. A collision reconstruction team is called upon to study the evidence to determine the sequence of events leading up to the collision, and therefore, determine who was ultimately at fault. Through the completion of the seven inquiries students will make use of mathematical analysis techniques, including interpreting and drawing graphs, identifying relations and functions and manipulating formulae to determine an unknown quantity, such as vehicle speed, the occupants' level of impairment (if any), who was driving each vehicle and whether or not each occupant gave accurate statements.

The *Collision Scene Investigation* crate meets many of the outcomes in the Relations and Functions unit of the Applied and Pure Math 10 curricula, as well as components of other math and physics curricula. The crate also has extension questions and an enrichment component. This activity guide provides the background information necessary for teaching about collision scene reconstruction calculations as well as detailed instructions and answers for each activity. The activity topics are as follows:

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| Inquiry # 1 | <ul style="list-style-type: none"> <li>• Students will experimentally determine the coefficient of friction between a cyclist wearing jeans and various road surfaces.</li> <li>• Students will compute cyclist speed using graphical analysis and combined speed formulae.</li> </ul> |
| Inquiry # 2 | <ul style="list-style-type: none"> <li>• Students will measure tire marks left by a yawing SUV, using a scaled collision reconstruction map.</li> <li>• Students will use evidence to calculate the SUV's turn radius and speed, using yaw formulae.</li> </ul>                        |

- Inquiry # 3
- Students will measure skid marks left by a braking car using a scaled collision reconstruction map.
  - Students will use evidence to calculate the car's speed from slide to stop and combined speed formulae.
- Inquiry # 4
- Students will analyze a truck's "black box."
  - Students will carry out graphical analysis of a step function to determine who was the vehicle's driver.
- Inquiry # 5
- Students will experimentally determine the angle of projection required for maximum distance when cargo is vaulted from a braking vehicle.
  - Students will use evidence to calculate the truck's speed, using projectile motion formulae.
- Inquiry # 6
- Students will analyze the relationship between vehicle speed and stopping distance through graphical analysis.
  - Students will use evidence to determine if vehicle speed was accurately reported by the occupants in their statements.
- Inquiry # 7
- Students will compare occupant Breathalyser samples to a control set of known Blood-Alcohol Concentrations (BAC).
  - Students will identify occupant samples by calculating Blood-Alcohol Concentrations, using a formula.
  - Students will investigate the relationship between variables in the BAC formula as variables are manipulated and controlled.

There are many different ways to use a crate. Crates can be used as a general overview of a unit, incorporated into a unit, or used as review. Individual inquiries can be used where appropriate or the crate theme can be followed through to its entirety over the course of several classes.

Crates are designed to have real-life applications. The CSI crate was developed with the guidance of the Collision Reconstruction Unit at the Calgary Police Service. Since the theme of Collision Scene Investigation involves students collecting and analyzing clues at each station, it is best to complete all inquiries together (albeit over several class periods). The theme, collision reconstruction may include unfamiliar physics concepts and formulae. It is a good idea for students using this crate to have some prior knowledge of manipulating formulae and graphing techniques.