Crime Scene Investigation

Primary (ages 10 – 11)	Mathematics

Students arrive at a crime scene, and try to find the murderer by using their knowledge of geometry. They propose solutions to the mystery by analysing the scene and available data. Students work in groups and convince each other which geometrical figures to construct to solve the problem. They need to construct figures, including editing angles and squares and halving lines. They also need to work out independently which editing style to use from the prompts and their own analysis, and to reflect on the implications of their calculations to propose potential solutions to the mystery.

Time allocation	1 or 2 lesson periods
Subject content	Discover the possible uses of geometric knowledge Develop accurate and appropriate use of geometric construction and editing methods
Creativity and critical thinking	This unit has a **creativity** and **critical thinking** focus: • Make connections between maths concepts and the ability to solve real-life problems • Generate and play with ideas for how to solve a problem • Check accuracy and gaps in knowledge, reflect on, and evaluate alternative theories and perspectives
Other skills	Collaboration
Key words	geometry; angles; editing; measuring; measuring; calculations

Products and processes to assess

In order to solve the problem, students need to accurately analyse the situation and draw conclusions from the given information. The objective of the exercise – apart from practicing geometrical construction and editing – is to develop their observation and analytical skills. At the highest levels of achievement, students are willing to generate and explore a variety of ideas and connections. Not only do they experiment with different editing of geometrical figures, they are also able to articulate their reasoning, and show a clear understanding of the strengths and limitations of their own and alternative positions whilst being open to the ideas and feedback of others.

This plan suggests potential steps for implementing the activity. Teachers can introduce as many modifications as they see fit to adapt the activity to their teaching context.

Step	Duration	Teacher and student roles	Subject content	Creativity and critical thinking
1	Preparation	Children arrive at the crime scene, therefore it is important to draw the outline of a body in advance. The outline of a body is drawn onto the pavement with a piece of chalk. A dot is drawn onto the body's head and stomach. These are dots A and C. Then we draw two other dots onto his shoulders, these are dots C and B. (If we connect the four dots, it should form a cross. Do not connect them yet, the children will have to do it!) Next to the body outline, on its four sides, we draw four AB segments (see appendix). We number them for the four groups, because the groups will need to edit different things on the scene. We draw another dot somewhere next to the body's head, but not too close to it. This marks the location of the gun. As part of the preparation phase, teachers may make the problem more complex to solve by drawing additional dots on the pavement or adding pieces of information: these can act either as potential distractions that children will have to discard, or as evidence that will justify alternative answers or solutions to the crime mystery. For instance, different dots may serve to build different hypotheses about the location for the murderer or the victim, as well as to rule out potential solutions if the evidence becomes inconsistent.		
2	Lesson period 1	We introduce the process to the children. After preparations, we split them into four groups. We give each of them instructions, which they can use to determine where the murderer stood, where the bullet fell, and where the victim stood.		Observing relevant experience and information Understanding the context/frame and limits of the exercise

		Children receive a piece of chalk, some string and a long wooden ruler. They need to work with these.		
3	Lesson period 1	We inspect the scene together. The teacher may use prompts such as: From what you see here where do you think the murderer shot? Does everybody agree? The teacher can then guide students to start their inquiry: -You will find dots within the body outline. Connect the AC and BC dots! (Or any other dots that the teacher may have added to the original design). The murderer shot where the two lines cross each other. Students then split into their groups and continue to work by the four lines.	Discovering the possible uses of geometric knowledge	Examining alternative theories/opinions, comparing it with other problems, and finding other perspectives Analysing the scene Using different approaches to find possible solutions
4	Lesson period 1 or 2	Students now form investigation groups. Each group should be encouraged to discuss their problem and to consider the evidence and argue for and evaluate different possible methods of exploring their part of the problem, as well as considering that that they may have to co-operate with other groups. Again, the teacher can offer prompts such as the ones below as necessary. Investigation group 1: Where could the murderer have been standing? -First, construct a triangle with the segments within the body outline. -Connect the point of intersection on the body with the dot of the gun, then halve the line by editing. The murderer might have stood at this point. You will be able to determine the murderer's exact location with the help of the other investigation team. Investigation group 2: Where could the bullet have dropped? -First, construct a triangle with the segments within the body outline. -Then make an axial reflection of the triangle on the AB segment, and you will get the location of the fallen bullet. Investigation group 3: Where did the victim stand? -First, construct a triangle with the segments within the body outline.	Geometrical constructions Performing accurate calculations Halving a line Axial reflections Creating accurate geometric constructions	Coming up and playing with unusual/risky, even radical ideas Making connections between a real-life problem and maths concepts in order to generate ideas Posing and envisioning how to solve meaningfully a maths problem in a personally novel way Examining alternative theories/opinions, comparing it with other problems, and finding other perspectives Developing working strategies for cooperation between team-members and between teams

		-We do not have sufficient information; therefore, the victim might have stood at various places. So first, construct a rectangle, which gives you the approximate location. The shorter side of the rectangle is the BC side of your triangle, the longer side is the AB segment. Investigation group 4: Where did the murderer exactly stand? -First, construct a triangle within the outline of the body so that the C dot does not point towards the body! -Edit a 60-degree angle from point A. Continue the line of the angle until you meet the halving point of the other group. This will show you the exact location of the murderer.	Measuring and using angles	Communicating and considering the strengths and weaknesses of the arguments and suggestions of different team members
5	Lesson period 2	The groups share their findings and discuss the results. The teacher may ask students to reflect (either orally or in writing) on questions such as: What do we know for certain about the location of the murderer and victim? What is uncertain? How strong was our evidence? What mathematical knowledge did we use? Why was it important to put the information found by the different investigation groups together? What did you learn? What did you do really well? What could you have done better?		Evaluating the novelty/possible consequences of solutions Challenging assumptions, checking and analysing missing pieces of knowledge Reflection, challenging and interpreting results

Resources and examples for inspiration

Web and print

> Printing individual worksheets

Other

> Chalk
> String
> Wooden ruler
> Asphalt course

Opportunities to adapt, extend, and enrich

> Further activities could look at forensics, fingerprints, the nature of evidence, murder mystery activities, and historical events

	CREATIVITY Coming up with new ideas and solutions	Steps	CRITICAL THINKING Questioning and evaluating ideas and solutions	Steps
Creativity and critical thinking rubric for mathematics	•Mapping of the different steps of the lesson plan against the OECD rubric to identify the creative and/or critical thinking skills the different parts of the lesson aim to develop			
INQUIRING	Make connections to other maths concepts or to ideas from other disciplines	2,3,4	Identify and question assumptions and generally accepted ways to pose or solve a maths problem	2,5
IMAGINING	Generate and play with several approaches to pose or solve a maths problem	3,4	Consider several perspectives on approaching a maths problem	4,5
DOING	Pose and envision how to solve meaningfully a maths problem in a personally novel way	4	Explain both strengths and limitations of different ways of posing or solving a math problem based on logical and possibly other criteria	3,4
REFLECTING	Reflect on steps taken to pose and solve a maths problem	5	Reflect on the chosen maths approach and solution relative to possible alternatives	5