



Participant Package **Escape Room: Crime** **and Trigonometry**

Continuing Education
(Glendon Campus)

Running Time: 75 minutes



GLENDON



Introduction

Workshop description

Escape Room: Crime and Trigonometry

This workshop has been created for 11th grade students who are in a mathematics course. It is a fun way to challenge yourself and apply the knowledge you've gained through your mathematics class in the context of a game. The workshop focuses primarily on the trigonometry unit. Throughout the workshop, you will review the process of solving for angles or side lengths of a variety of triangles using diverse techniques. These techniques include:

- Special triangles
- SOHCAHTOA
- Trigonometric ratios
- Sine and Cosine laws

The workshop takes the form of an escape room, which means that you will have to solve a sequence of problems to move from room to room before being able to “escape”. You will work in groups, to successfully complete the escape room.

Running Time: 75 minutes

About the Authors of This Workshop

Professor Samia Challal is an associate professor with the Department of Mathematics at Glendon Campus, York University. Her research interests include homogenization, optimization, free boundary problems, partial differential equations and problems arising from mechanics.

Professor Samia Challal holds a master's degree from Rennes University, France, where she was initiated for the first time to continuum mechanics and modelling. She then pursued a PhD at Metz University, France, and worked in the field of homogenization theory – a mathematical tool studying the macroscopic properties of a heterogeneous medium from its description at the microscopical state. Professor Challal then explored the area of non-linear partial differential equations of filtration of a liquid or two through porous media and the study of regularity of solutions for obstacle problems. In her teaching, she is particularly motivated in bridging the mathematical tools introduced and their applications through modelling and numerical analysis.

York's Experiential Education

This workshop was developed by Tylar Robin, a second year Glendon student studying Mathematics with a minor in Philosophy. She intends on pursuing a career as a high school teacher. For this reason, when she completes her degree in mathematics, she will continue on to study Education.

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✖ Objective

TRIGONOMETRY ESCAPE ROOM
Learning objectives: • Develop problem-solving skills • Review previously learned concepts in trigonometry • Identify and apply the correct strategies to solve a series of trigonometry-based problems, including: • Special triangles • SOHCAHTOA • Sine and Cosine laws • Pythagorean Theorem
Materials required: • Computer or tablet with access to the Internet • Zoom • Scrap paper and pencils
Running Time: 75 minutes

✖ Agenda

TIME	ACTIVITY
5 minutes	Introduction
	Part 1 - Introduction of the game
10 minutes	Brief review lesson of the contents
	Part 2 - Escape room
15 minutes	Activity 1 - Special triangles
15 minutes	Activity 2 - SOHCAHTOA
15 minutes	Activity 3 - Sine and cosine laws
	Part 3 - Discussion
10 minutes	Discuss the activities present in the escape room
	Conclusion
5 minutes	Questions et survey
Running Time: 75 minutes	

Workshop Outline

INTRODUCTION: 5 minutes

- **Objective:** Create a comfortable environment before beginning the escape room and identify real-life applications of trigonometry.
- **Description:** Facilitators will present themselves and then give you the opportunity to present yourself through a short icebreaker activity.

PART 1 – INTRODUCTION OF THE GAME: 10 minutes

- **Objective:** Explain the rules of the escape room game and review the math skills that will be necessary.
- **Description:** This part consists of a short lesson to outline the knowledge necessary to solve the problems within the escape room. You will be given a sheet with the formulas on it to use if necessary.

PART 2 – ESCAPE ROOM: 45 minutes

- **Objective:** Review and reinforce the skills you acquired during your 11th grade trigonometry unit.
- **Description:** You will use the knowledge you gained in your math course to solve a series of problems in the form of an escape room-style game. In order to solve each problem, you will need to determine the appropriate trigonometry technique to use and apply it. Working in groups, you will solve problems related to the following concepts: triangles solved using special triangles, triangles solved using SOHCAHTOA, and triangles solved using the sine and cosine laws.

PART 3 – DISCUSSION: 10 minutes

- **Objective:** Clarify any problems from the escape room that were difficult and review key concepts.
- **Description:** Once you complete the escape room, you will have an opportunity to ask for explanations of difficult problems and the facilitator will go through some of the key concepts from the game. You will be asked to think of how trigonometry can be used in real-life.

CONCLUSION: 5 minutes

- **Objective:** You will be given the opportunity to ask any final questions or make any comments.
- **Description:** You will share any remaining questions or comments and be asked to complete a short participation survey.

✖ Equation Sheet

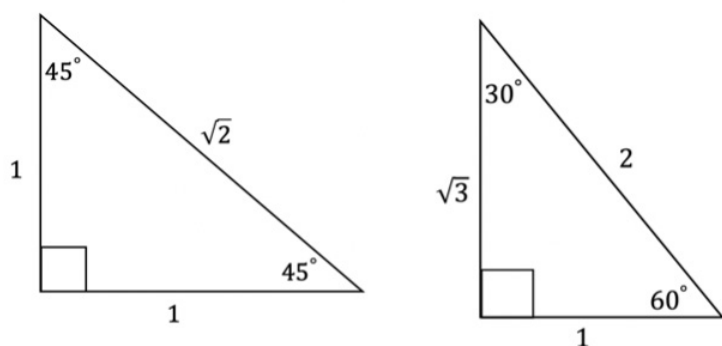
This equation sheet contains the necessary trigonometric formulas and information to complete the escape room. It also includes a description of each formula and its uses, to help you correctly apply the information presented.

Special Triangles:

Special triangles are certain right triangles that have special proportions for their sides that make calculations easier. They are commonly found in trigonometry and when recognized can be used to solve triangles instead of making additional calculations.

When to use:

- When you have a triangle with identical angles and proportions to the following triangles.



Sine Law:

The Sine Law is a formula that represents the ratio between the sine of the angles and the lengths of a non-right triangle. It can be used to solve for the angles or lengths of non-right angles where a , b , and c represent the sides and A , B , and C represent the corresponding angles.

$$a \div \sin(A) = b \div \sin(B) = c \div \sin(C)$$

$$\sin(A) \div a = \sin(B) \div b = \sin(C) \div c$$

When to use:

- When you have a non-right triangle and are given either:
 - a) two angles and one side opposite to one of those angles
 - b) two sides and an angle opposite one of those sides

Cosine Law:

The Cosine Law is a formula that correlates the cosine of the angles and the lengths of a non-right triangle. It can be used to solve for the angles or lengths of a non-right triangle where a, b, and c represent the sides and A, B, and C represent the corresponding angles.

$$a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos(A)$$

$$\cos(A) = (b^2 + c^2 - a^2) \div 2 \cdot b \cdot c$$

When to use:

- When you have a non-right triangle and are given either:
 - a) three sides
 - b) two sides and the angle between them

SOHCAHTOA:

SOHCAHTOA is a mnemonic device used to remember the definitions of the trigonometric functions sine, cosine, and tangent. It is used for right triangles and it represents the following relations: SOH is **S**ine equals **O**pposite over **H**ypotenuse, CAH is **C**osine equals **A**djacent over **H**ypotenuse, and TOA is **T**an equals **O**pposite over **A**djacent.

$$\sin\theta = \text{opposite} \div \text{hypotenuse}$$

$$\cos\theta = \text{adjacent} \div \text{hypotenuse}$$

$$\tan\theta = \text{opposite} \div \text{adjacent}$$

When to use:

- When you have a right-angled triangle that is not a special triangle.

Pythagorean Theorem:

The Pythagorean Theorem is an equation that describes the relationship between the three sides of a right triangle. It states that the square of the length of the hypotenuse of a right triangle equals the sum of the squares of the lengths of the two other sides.

When to use:

- When you know the length of two sides of a right triangle and want to know the length of the third side.

$$a^2 + b^2 = c^2$$

Resources & Information

Special triangles:

Khan Academy: Trig Ratios of Special Triangles

<https://www.khanacademy.org/math/trigonometry/trigonometry-right-triangles/sine-and-cosine-of-complementary-angles/a/trig-ratios-of-special-triangles>

- > This website describes special triangles and how to use them.

SOHCAHTOA:

Education Is Around: SOHCAHTOA

<https://educationisaround.com/sohcahtoa/>

- > Describes SOHCAHTOA and how to use it.

Sine and cosine laws:

Mathematics Online: Law of Sines and Cosines, Explanation

<https://www.youtube.com/watch?v=3jBMymLI8ls>

- > Explains the sine and cosine laws and how they are used.

Review of triangles:

New World Encyclopedia: Triangle

<https://www.newworldencyclopedia.org/entry/Triangle>

- > Gives an overview of types of triangles and the field of trigonometry.

Glossary

Adjacent: Having a common edge or boundary.

Angle: The space between two intersecting lines or planes.

Cosine: The ratio of a given angle's adjacent side and the hypotenuse in a right-angled triangle.

Equilateral: A triangle where all three of its sides (and angles) are equal.

Hypotenuse: The side of a triangle that is opposite the right angle in a triangle.

Isosceles: A triangle where two of its sides (and angles) are equal.

Opposite: The side of a triangle that is opposite to a given angle.

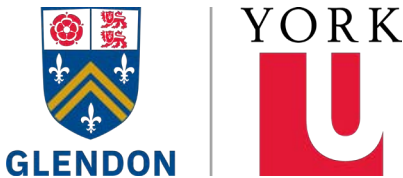
Right-angled triangle: A triangle with one right angle (90 degrees).

Scalene: A triangle where all three of its sides (and angles) are different.

Sine: The ratio of a given angle's opposite side and the hypotenuse in a right-angled triangle.

Tangent: The ratio of a given angle's opposite side and adjacent side in a right-angled triangle.

Trigonometry: The branch of mathematics that deals with the relationship between the sides and angles of triangles.



York University's Glendon Campus has been offering exceptional bilingual university education unique in Canada for over fifty years. Our commitment to education and bilingualism also extends to our bilingual transitional programming for high school students. Learning a language is rewarding and fun, even if it can sometimes be frustrating. Our programming is designed to give students an opportunity to expand their vocabulary and learn important skills and competencies by participating in interactive workshops on financial literacy, leadership, urban geography, biology, psychology and a wide range of topics in the social sciences.

Our programming can be delivered to Francophone or Anglophone students in their mother tongue, or to Francophone and Anglophone students seeking to improve their second language learning (FSL or ESL).

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