

Name: _____



ADULT BOOKLET

Showtime is in a couple of hours and the artists are rehearsing. At least a hundred people are working to get the venue and stage ready in time. Everyone is focused on their task and the adrenaline is at full speed. Everyone has a role and responsibility and each is crucial to the success of the show.

In this learning and evaluation situation, you will play the role of the Artistic Director in which you will design some light and party effects.

MTH4173- Geometric Representation in a Fundamental Context 1

*Created by Lisa Parente
English Montreal School Board (2017)*

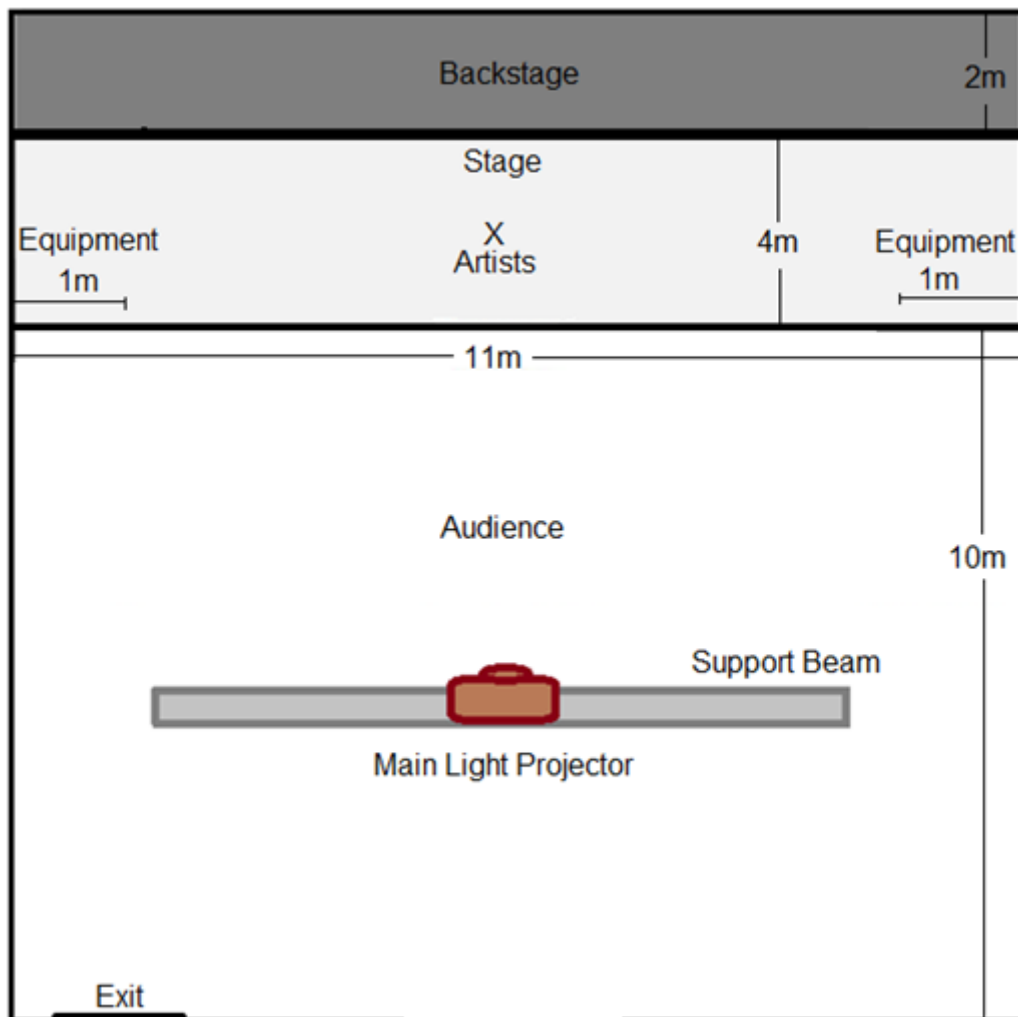
C.1 Uses strategies to solve situational problems

C.2 Uses mathematical reasoning

TASK 1- STAGE ILLUMINATION

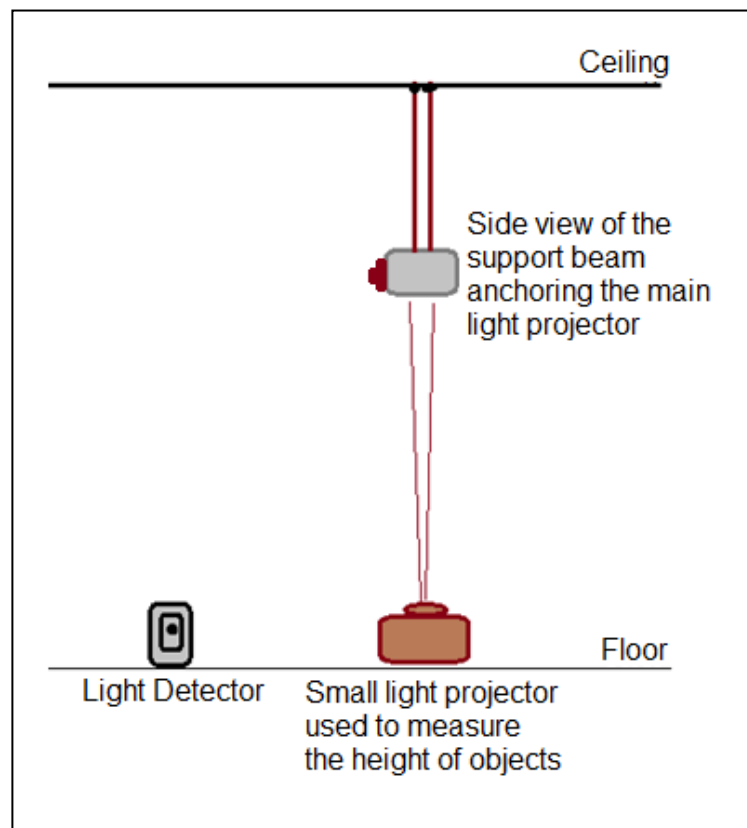
BACKGROUND INFORMATION

Below is the top view of the music concert venue. It is **not** drawn to scale.

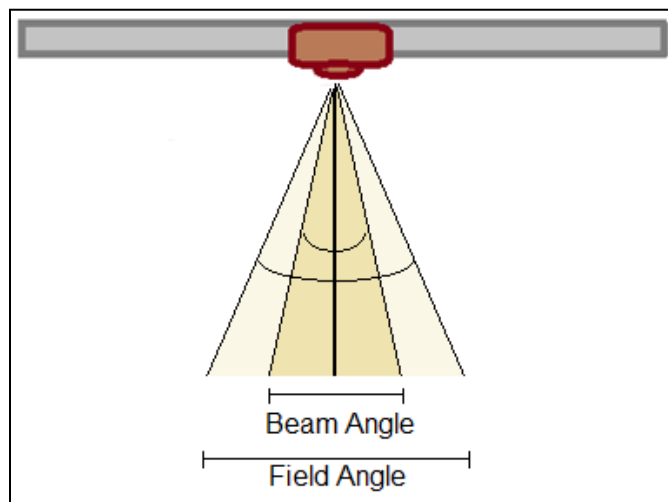


The main light projector is anchored to a support beam. This support beam can be placed anywhere in the venue, above the stage or audience, depending on the instructions that you give to the light technician. Its vertical height is fixed.

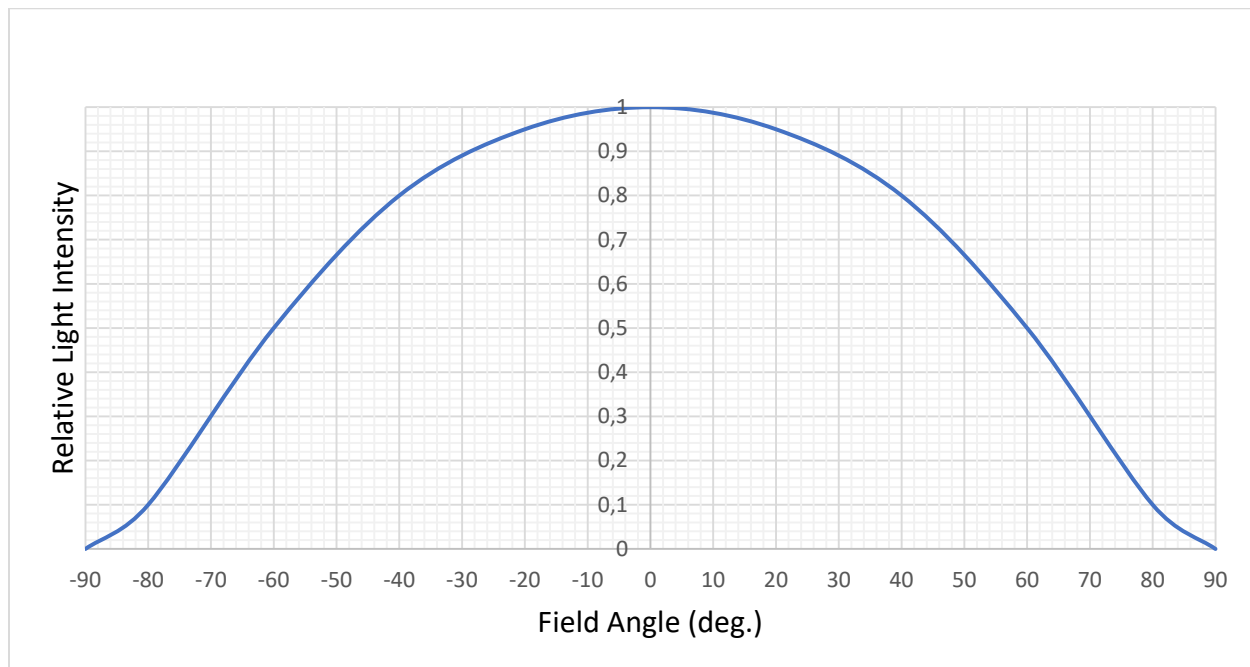
Finding the height of objects can be difficult when you can't physically use a tape measure or measuring stick. One method of measuring objects that are out of reach is using a system that uses light detectors. Along a horizontal plane, a small light projector is placed so that its light beam is directed vertically and casts a light on the object for which you want to determine its height. The light detector provides the angle of inclination with reference to this illuminated spot. In this situation, the detector was placed 2m from the small light projector and detected an angle of inclination of 71.6° with reference to the support beam. The support beam is anchored to the ceiling with chains and its height cannot be adjusted. See the figure to the right, which is not to scale.



Through experience with working with light projectors, you know that the intensity of light is strongest at the center of the beam of light and decreases as the beam and field angle increases. To the right is a figure that is familiar to you.



You then look up the specification sheet of the manufacturer's guide for the LED lights that will be used in the main light projector. With this particular model, the field angle can be adjusted to the desired light intensity at the edges of the field of light. This is what you find:



Graph 1: Luminous lighting intensity for Seoul Semiconductor's AX32X1 lighting module.

<https://www.digikey.com/en/articles/techzone/2012/may/decoding-luminous-intensity-distribution-data-for-led-modules>. Copyright © 1995-2007 Digi-Key Electronics. 701 Brooks Ave S., Thief River Falls, MN, 56701 USA

A lot goes into a music concert, especially one that is produced with microphones and amplifiers. There are rolls of electrical wiring, instrument stands, ropes and pulleys and most of this equipment is placed on stage right and left. You do not wish to illuminate this equipment, only the artists on stage. The marked "X" on stage is where you want the central beam of light to hit. This mark is 5 feet from the edge of the stage and the audience. The stage is 3 feet high. You decide the field angle of the main light projector should be adjusted so that the edges of the field of light have 80% intensity.

*Note: 1 ft = 0.305 m

Task 1- You will produce a set of instructions, written and schematic, to be given to the light technician. These instructions provide the location of the main light projector, which is anchored to a support beam, in the venue.

UNDERSTANDING THE SITUATION (C.1)

Write in your words the specific instruction must you give to the light technician?

In your own words, write a list of the measures and angles you must find in order to complete the previous question.

Write the pertinent information you found in the section *Background Information* that you will use to calculate your measures from the previous question.

Before you begin your calculations, ask yourself which mathematical concepts or strategies you already know will help you solve the problem. Can you put these concepts or tools into words? If so, write them down as you progress through your solution. Be mindful; there will be new ideas learned...

CALCULATIONS AND SIMPLE DIAGRAMS (C.2)

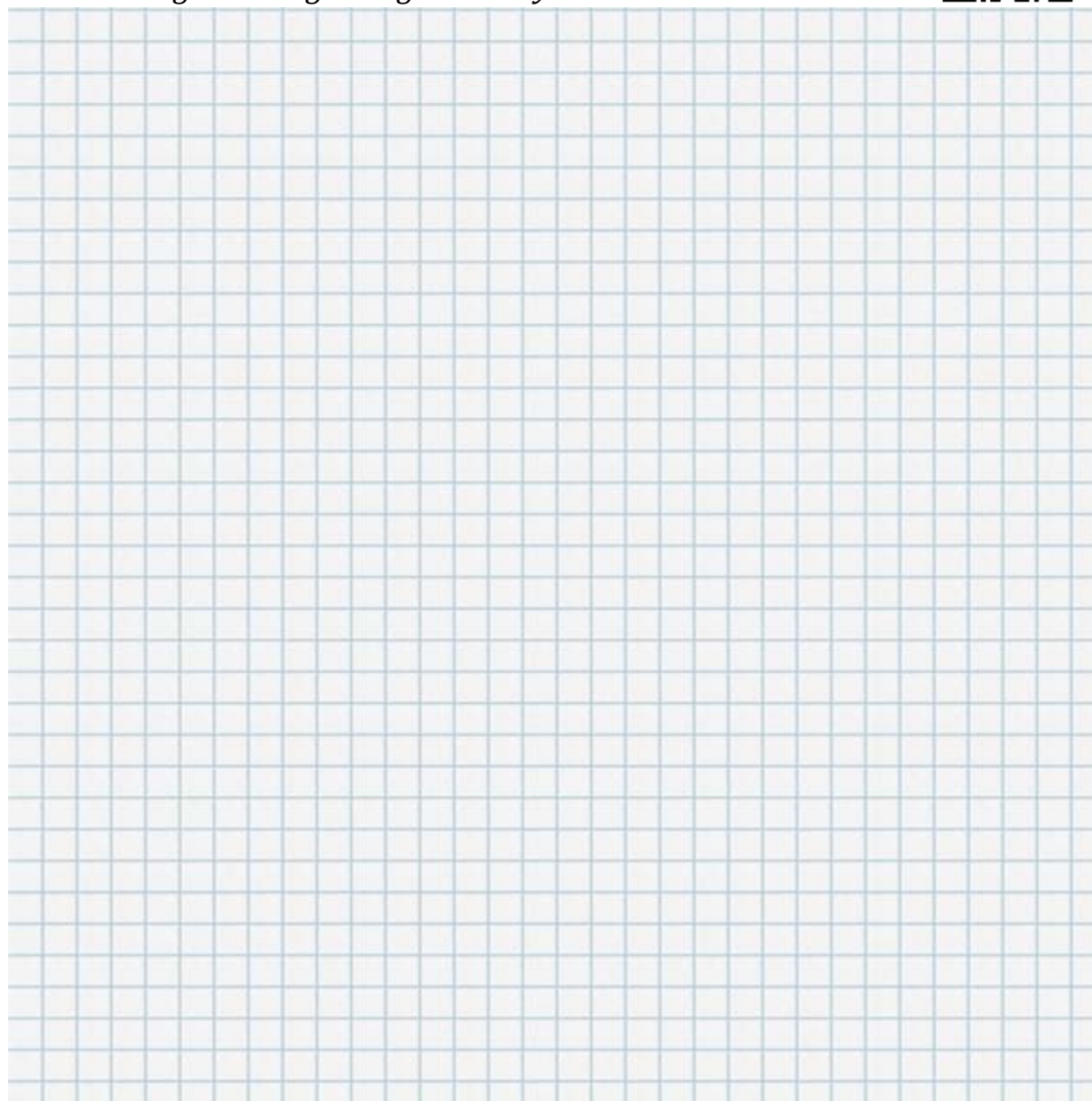
Present your work in an organized manner.

Include units and round your measures to the hundredth.

You can use GeoGebra to help you draw your triangles.

Scan this QR code to access:

Right Triangle Trigonometry: Intro

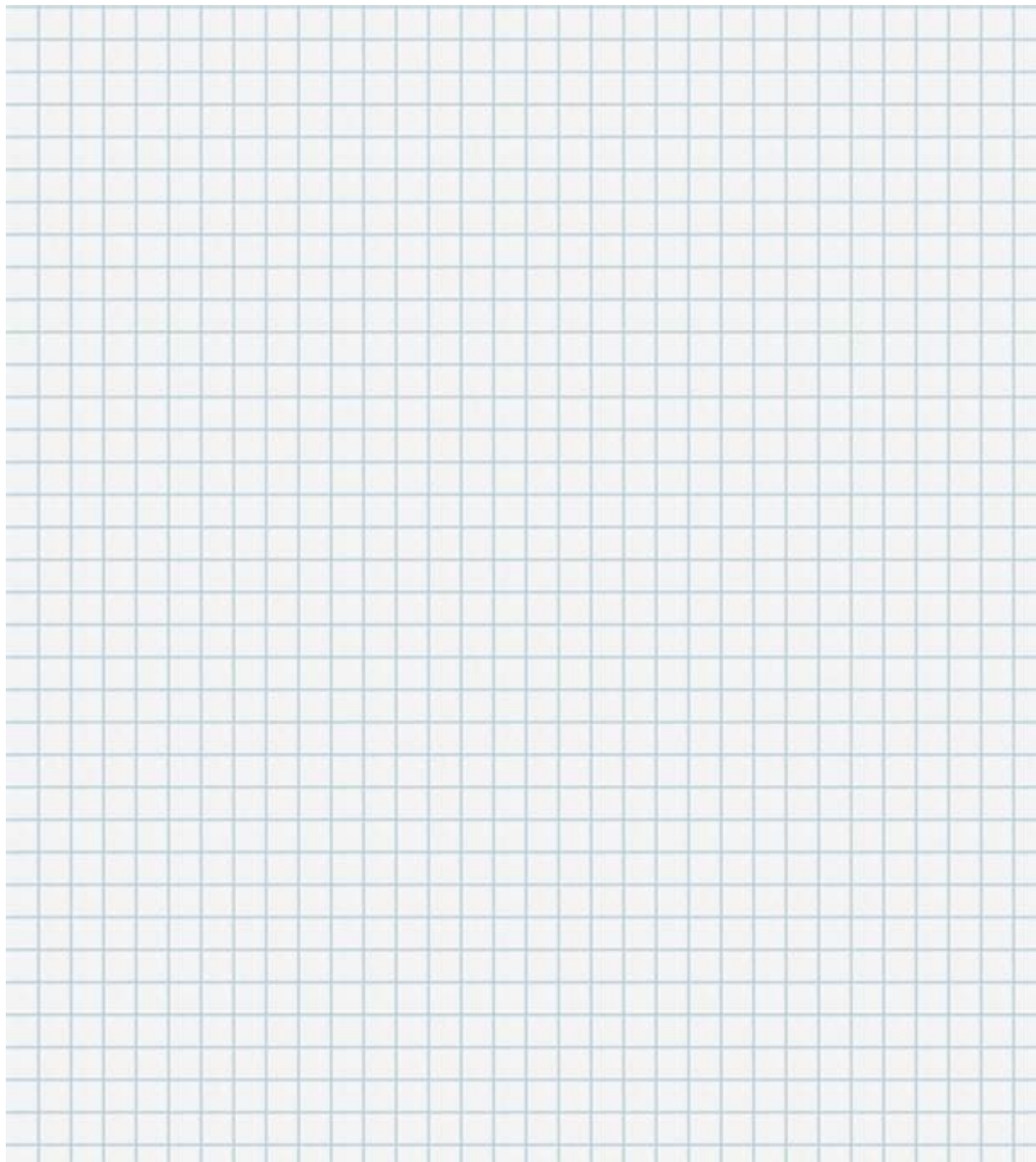


WRITTEN AND SCHEMATIC INSTRUCTIONS (C.2)

Write clear and short sentences.

The diagram must be to scale and include all measures with units.

Identify the perspective used (top, side, front) and the scale of the diagram.



REFLECTION

Identify the mathematical concepts you used to find your solution.

Which of these concepts did you already know?

Which of these concepts were new to you?

Which of the above concepts did you find difficult?

Ask for help if you still need it and update your **memory aid** 😊.

INTEGRATION

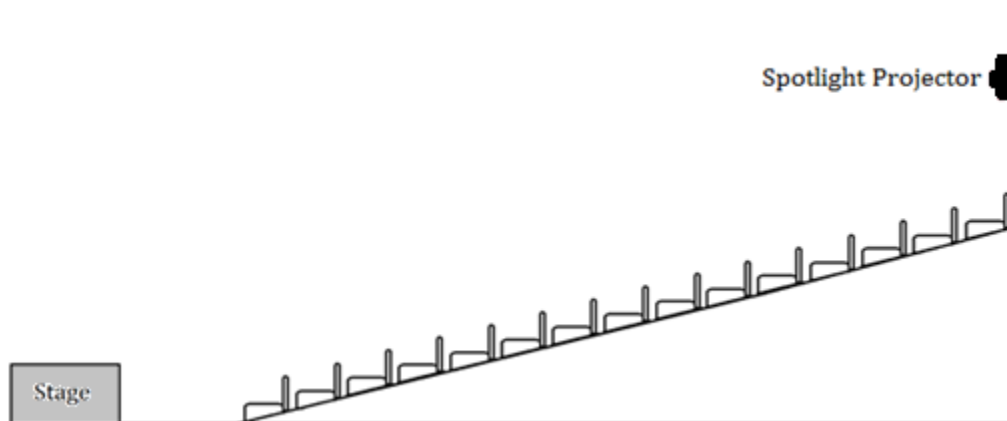
Try creating new examples with a different context to test out the new concepts learned.

TASK 2- PUT ON THE SPOT

BACKGROUND INFORMATION

During tonight's show, the drummer asks that everyone sings Happy Birthday to his mother, who will be sitting in the audience, just before intermission. You want to cast a light on her at that moment and assure that the placement of the spotlight projector on the back wall of the venue can allow this. However, the light technician who operates the spotlight will not be around for another couple of hours. You begin by taking some measurements and writing down what you know about the situation.

- You use a digital protractor and determine that the angle of elevation of the audience seated rows is 40° .
- The drummer's mother will be sitting in the 5th row.
- You use a meter measuring wheel and determine that the 5th row is 5m from the bottom along the incline of the audience. There are a total of 15 rows and the back wall is 15m from the bottom along the incline of the audience.
- The manufacturer's guide of the spotlight projector says that the maximum angle of depression is 60° .
- The spotlight projector is digitally operated and is anchored to the back wall of the venue. Its height is 2.5m from the ceiling.
- You use a light detector and determine that the height of the ceiling from the floor is 58 feet.
- You imagine the side view of the venue (see below)



Task 2- You will determine if the location of the spotlight projector can allow a light to be cast on the drummer's mother during the show.

UNDERSTANDING THE SITUATION (C.1)

Find in the situation the right, oblique and similar triangles that will allow you to complete your task.

Draw a diagram of the situation and be sure to include labels of the vertices and horizontal and vertical parallel lines for reference.

You can use GeoGebra to help you draw your triangles.

Scan this QR code to access:

Sine Law Investigation



Then find the pertinent measures and angles provided in the background information and include them in your diagram.

Before starting, ask yourself which mathematical concepts and strategies you already possess to solve the problem.

CALCULATIONS (C.2)

Show all your formulas, calculations and units.

Add to your diagram on page 10 all new measures and angles that you found using a different colored pen or pencil.

You may choose to compute your solution in feet or in meters.

Round your results to the nearest hundredth.

Clearly present your answer.

REFLECTION

Identify the mathematical concepts you used to find your solution.

Which of these concepts did you already know?

Which of these concepts were new to you?

Which of the above concepts did you find difficult?

Ask for help if you still need it and update your **memory aid** 😊

INTEGRATION

Try creating new examples with a different context to test out the new concepts learned.

TASK 3- THE FINALE

BACKGROUND INFORMATION

During the last song of the night, you wish to project confetti onto the audience to give a grand effect. This confetti is made of small pieces of colorful paper. When the confetti is projected from above the audience, it disperses in all directions in the shape of a cone. The small opening of the projector where the confetti escapes has an angle of 60° . The projector is anchored to the ceiling of the venue with a set of chains and can only be placed in the centre of the audience inclined seated floor.

Task 3- You wish to determine the height of the confetti projector so that the entire audience will be showered with confetti. To do this you remind yourself of all the information you have from the other tasks. Provide written and schematic instructions to the set technician.

REFLECTION

Look back at the solutions you provided for the three tasks. Can you say that your work is clear, organized and can be understood by another person reading them? Can you say that you are competent in playing the role of the Artistic Director? Elaborate.
