# Secondary 3 Additional Mathematics Performance Task

**Instructions to students:**

- This is a group task. Each group consists of 3 to 4 members.
- Issued on **1 February 2021, Monday**.
- Deadline: **Your presentation has to be submitted to your Additional Mathematics teacher by 19 February 2021, Friday 1500 hours.**
- **Name your INDIVIDUAL presentation as 2021 Sec 3 AM PT_S3-0 _(INDEX NUMBER) [NAME OF STUDENT]. Give your teacher the rights to comment.**
- **Name your GROUP presentation as 2021 Sec 3 AM PT_GROUP_ S3-0 _[GROUP NUMBER]. Give your teacher the rights to comment.**
- There will be a penalty for late-submission. Students who submit the task within 7 days (inclusive of the 7th day) after the deadline will be awarded 50% of the marks scored. A zero mark will be awarded if the task is submitted beyond 7 days after the deadline. Students are still expected to complete and submit the task even after 7 days of the deadline.

| **Declaration and statement of authorship:** |
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| 1. This assignment is our original work and no part of it has been copied from any other student's work or from any other source except where due acknowledgment is made.<br>2. We understand that plagiarism is the presentation of the work, idea or creation of another person as though it is my own. It is a form of cheating and is a very serious academic offence. Plagiarised material can be drawn from, and presented in, written, graphic and visual form, including electronic data, and oral presentations. Plagiarism occurs when the origin of the material used is not appropriately cited. |

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| **Class** | |
| **Group Members (Name and Index No.)** | |
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| **Date of Submission** | 18 Feb 2021 |
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**LEARNING OBJECTIVES**

Students will be able to

- apply mathematical methodologies to real-world problems.
- recognise real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems.
- recognise and appreciate the connections between theory and applications.

**CHECKPOINTS**

| **Date** | **Task(s) to be completed** |
|---|---|
| 1 February 2021 (Monday) | Issue performance task (PT) to the whole level in Google Classroom. |
| 1 February 2021 (Monday)<br>to<br>2 February 2021 (Tuesday) | A Math teacher goes through the PT Part 1 (Pre-task) with class.<br>A Math teacher briefs students about the PT in class.<br>A Math teacher splits class into groups.<br>If there is sufficient time, allow the groups to start discussion on PT. |
| 8 February 2021 (Monday)<br>to<br>10 February 2021 (Wednesday) | Each individual submits draft 1 of Part 2A (Individual task) to A Math teacher in the Google Classroom Assignment created.<br>A Math teacher gives feedback to each individual.<br>Group can decide on whether to use or synthesise ideas from individual task.<br>Group discussion during 1 A Math lesson. |
| 19 February 2021 (Friday)<br>1500 hours | Group submits final completed PT documents in the Google Classroom Assignment created. Submission of the PT documents by 1 student of each group is sufficient. |

## GRADING AND EVALUATION

*For official use by Math teachers only*

| **Marks** (For Official Use) | | |
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| **Part 1** | Pre-task | **No marks.**<br>**To complete as the teacher goes through in class.** |
| **TOTAL (Part 2A - Individual)** | | **/ 6** |
| **TOTAL (Part 2B - Group)** | | **/ 9** |
| **TOTAL (Part 3 - Personal Reflection)** | | **/ 3** |
| **TOTAL (Part 3 - Peer Evaluation)** | | **/ 2** |
| **TOTAL** | | **/ 20** |
| **COMMENTS (if any)** | | |

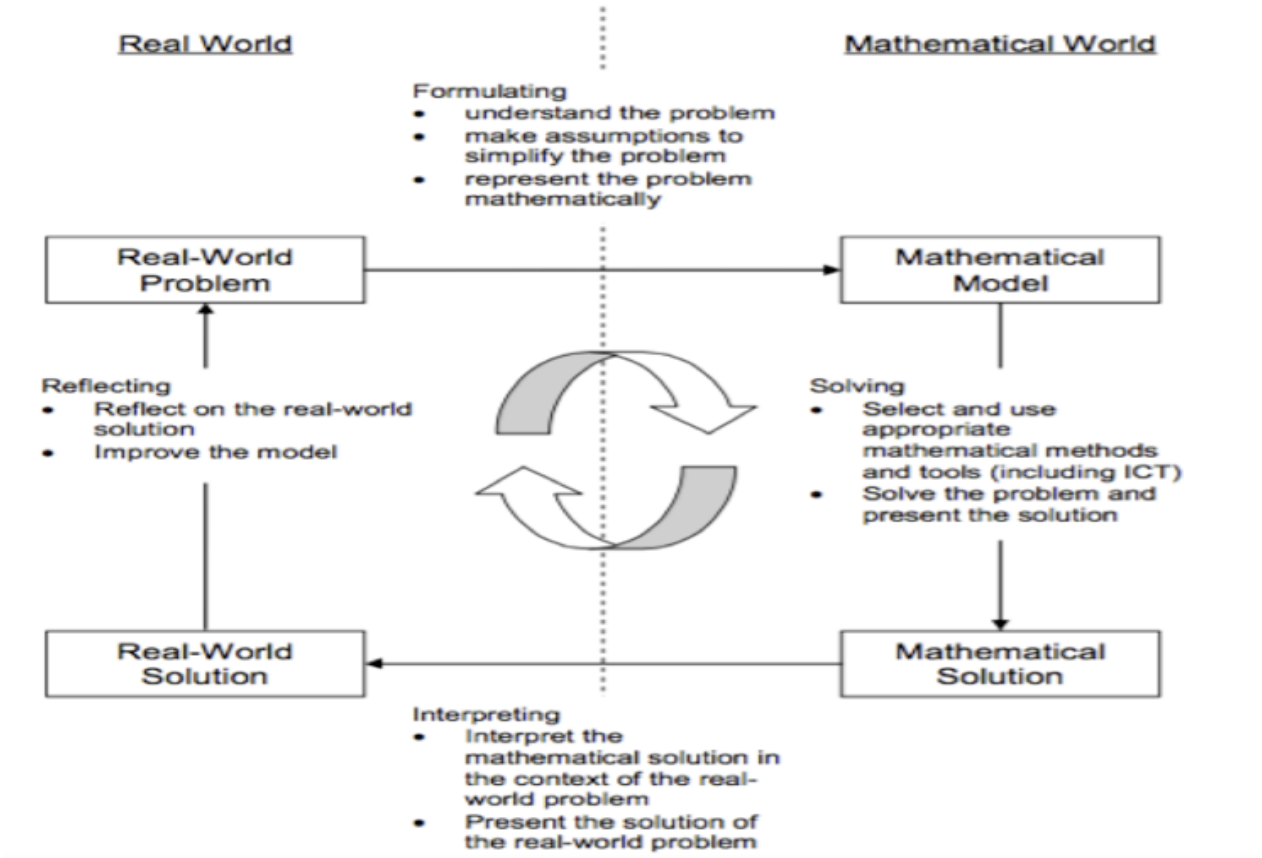
# Part 1: Pre-Task

Before you embark on the performance task, you will go through this pre-task with your teacher.

The objective of the pre-task is to have a clear understanding of what is mathematical modelling of real-world problems.

## INTRODUCTION TO MATHEMATICAL MODELLING

Mathematical modelling[1] is a process of representing real world problems in mathematical terms in an attempt to find solutions to the problems. It often involves creating an abstract model using mathematical language to describe the behaviour of a system that is occurring in real life. Watch these videos on mathematical modelling.



[1] https://www.mathsisfun.com/algebra/mathematical-models.html

# Part 2: Mathematical Model

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**GOAL**

The goal is to

1. Propose some/ a possible model(s) for the cover of a sheltered walkway in SST in order to solve the current situation stated below.
2. Prepare a presentation to the school with your analysis and assumptions, mathematical modelling and calculations, and your suggested design with proposed measurements.

**ROLE**

You are a team of student advocates of the school.

**AUDIENCE**

School Management

**SITUATION**

In SST, the walkway leading from the school gate to the General Office is not sheltered. This makes it challenging and inconvenient for students to reach the school building on rainy days. Some of the existing covered walkways in the school may also not be useful in sheltering students during rainy days.

# Part 2A: Individual Component

Complete the mathematical modelling task individually by considering the following points and/ or questions:

1. By using mathematical modelling and mathematical concepts, propose a possible design for the covered walkway.
2. What are some of the factors and variables you considered in selecting your design?
3. How do you simplify the problem using mathematical modelling?
4. What are some of your assumptions and calculations in your design?

# Part 2B: Group Component

Complete the mathematical modelling task as a group by considering the following points and/ or questions:

1. Compare and contrast the different designs from your team members and decide on the best possible design based on the team's data analysis, research and assumptions.
2. What are some of the factors and variables the team considered in designing a covered walkway?
3. How does the team simplify the problem using mathematical modelling?
4. What are some of the assumptions and calculations involved in the design chosen?

Your team's presentation can be in any technical form, for example, Pages, Notes, Google Slides, iMovie, etc, or any combinations of these applications. It should include your **analysis, assumptions, mathematical modelling, calculations,** and your **suggested design with proposed measurements**.

**RESOURCES**

1. [LINK 1]
2. [LINK 2]

# Part 3: Personal Reflection & Peer Evaluation

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**(A)** Each student is to submit a Personal Reflection Google Form of their learning experience in this Performance Task.

Your personal reflection should address the following points or questions:

1. How has the task helped you to gain a deeper understanding of the topic, Functions?
2. How has the learning experience enabled you to extend your knowledge to other topics or real-world applications?
3. Provide relevant evidence or examples to illustrate your points in (1) and (2).

**(B)** Each student is to refer to the Peer Evaluation Rubric on P.10 and complete the Peer Evaluation Google Form for two members of the group. Each student should not evaluate more than 2 students or himself/ herself.

## Part 2A Scoring Rubric

| Scoring Rubrics (Part 2A) | | | | |
|---|---|---|---|---|
| **Criteria** | **3 Excellent** | **2 Proficient** | **1 Adequate** | **0 Limited** |
| **Use of mathematical terminology and notation.** | Use precise and appropriate and accurate mathematical terminology and notation.<br>Mostly correct. | Use appropriate mathematical terminology and notation.<br>No glaring misconceptions. | Use appropriate mathematical terminology and notation with some errors. | Use inappropriate and / or inaccurate mathematical terminology and notation. |
| **Model Formulation: Identify variables and assumptions** | Suggest a model of the covered walkway using an appropriate function<br><br>Identify independent and dependent variables that are essential to the problem.<br><br>Variables used are properly defined with appropriate symbols assigned.<br><br>Identify assumptions that are valid and comprehensive in simplifying the problem. | Suggest a model of the covered walkway using an appropriate function<br><br>Identify independent and dependent variables that are relevant to the problem.<br><br>Variables used are properly defined with appropriate symbols assigned.<br><br>Identify assumptions that are valid and appropriate in simplifying the problem. | Suggest a model of the covered walkway using an appropriate function<br><br>Identify independent and dependent variables that are relevant to the problem.<br><br>Variables used are not properly defined or do not have appropriate symbols assigned.<br><br>Identify assumptions that are either invalid or do not aid in simplifying the problem. | Not able to suggest a model of the covered walkway using an appropriate function |

## Part 2B Scoring Rubric

| Scoring Rubrics (Part 2B) | | | | |
|---|---|---|---|---|
| **Criteria** | **3 Excellent** | **2 Proficient** | **1 Adequate** | **0 Limited** |
| **Information organisation and analysis** | Presentation of information and function includes all headings, units, and is organised in a way that is easy to understand and analyse.<br><br>Analysis, explanation and reasonings are clear, logical and organised. | Presentation of information and function includes most headings, units, and is organised in a way that is easy to understand and analyse.<br><br>Analysis, explanation and reasonings are mostly clear, logical and organised. | Presentation of information and function lacks headings and units and is organised in a way that is difficult to understand and analyse.<br><br>Analysis, explanation and reasonings are brief. | The information and function are not organised<br><br>The information and function is incomplete or not sufficient.<br><br>Analysis, explanation and reasonings are unclear, illogical and disorganised. |
| **Model Solution: Graphical solution** | Use appropriate graphing software to present graphical solution. The link to the graph is included.<br><br>The image of the graphical solution is presented with the function and at least 5 plotted points.<br><br>The graph image included all headings, units, and data in an organised way that is easy to understand and analyse.<br><br>The graphical solution is logical in the context of the problem. | Use appropriate graphing software to present graphical solution. The link to the graph is included.<br><br>The image of the graphical solution is presented with the function and at least 5 plotted points.<br><br>The graph image included most headings, units, and data in an organised way that is easy to understand and analyse.<br><br>Some parts of the graphical solution are not logical in the context of the problem. | Use appropriate graphing software to present graphical solution. The link to the graph is included.<br><br>The image of the graphical solution is presented does not include the function or has less than 5 plotted points.<br><br>The graph image is lacking headings, units, and data and is difficult to understand and analyse.<br><br>The graphical solution is not logical in the context of the problem. | Did not use graphing software to present graphical solution. |

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| **Model Solution: Develop a model and make conclusions** | Variables used are properly defined with appropriate symbols assigned.<br><br>The data analysis is well-organised and shows the proposed function relating the variables.<br><br>Assumptions are valid and comprehensive in simplifying the problem.<br><br>The progression to the function is clear and coherent.<br><br>The conclusion demonstrates purposeful coherence and includes a well-executed progression of ideas, making it easy to comprehend.<br><br>All calculations are properly presented. | Variables used are properly defined with appropriate symbols assigned.<br><br>The data analysis is organised and shows the proposed function relating the variables.<br><br>Assumptions are valid and appropriate in simplifying the problem.<br><br>The progression to the function is sufficient.<br><br>The conclusion demonstrates coherence and includes a well-executed progression of ideas, making it easy to comprehend.<br><br>Most calculations are properly presented. | Variables used are not properly defined or do not have appropriate symbols assigned.<br><br>The data analysis is organised.<br><br>Assumptions are either invalid or do not aid in simplifying the problem.<br><br>The progression to the function is not seen clearly.<br><br>The conclusion demonstrates limited coherence, clarity and cohesion, making it hard to comprehend.<br><br>Some calculations are presented. | Variables are irrelevant to the problem.<br><br>Did not identify assumptions to simplify the problem.<br><br>The data analysis is not organised.<br><br>The progression to the function is not seen.<br><br>The conclusion demonstrates a lack of coherence, clarity and not supported by any data.<br><br>Calculations are inaccurate or incomplete. |

## Part 3 - Personal Reflection Scoring Rubric

| Personal Reflection<br>Scoring Rubrics (Part 3) | | | | |
|---|---|---|---|---|
| **Criteria** | **3 Excellent** | **2 Proficient** | **1 Adequate** | **0 Limited** |
| **Personal Reflection** | Response demonstrates an in-depth reflection on the mathematical concepts, and/or strategies presented.<br><br>Viewpoints and interpretations are insightful and well supported. Clear, detailed examples are provided, as applicable. | Response demonstrates a general reflection on the mathematical concepts, and/or strategies presented.<br><br>Viewpoints and interpretations are supported. Appropriate examples are provided, as applicable. | Response demonstrates a minimal reflection on the mathematical concepts, and/or strategies presented.<br><br>Viewpoints and interpretations are unsupported or supported with flawed arguments. Examples, when applicable, are not provided or are irrelevant. | Response demonstrates a lack of reflection on the mathematical concepts, and/or strategies presented.<br><br>Viewpoints and interpretations are missing, inappropriate, and/or unsupported. Examples, when applicable, are not provided. |

## Part 3 - Peer Evaluation Scoring Rubric

| Peer Evaluation<br>Scoring Rubrics (Part 3) | | | |
|---|---|---|---|
| **Criteria** | **2 Excellent** | **1 Adequate** | **0 Limited** |
| **Contributions & Attitude** | Always cooperative. Routinely offers useful ideas. Always displays a positive attitude. | Sometimes cooperative. Sometimes offers useful ideas. Rarely displays a positive attitude. | Never cooperative. Rarely offers useful ideas. Is disruptive. |
| **Cooperation with Others** | Did more than others. Highly productive. Works extremely well with others. | Does not cause problems in the group. Focuses on the task most of the time. Can count on this person. | Did not do any work. Does not contribute. Does not work well with others. |
| **Focus, Commitments** | Tries to keep people working together. Almost always focused on the task. Is very self-directed. | Sometimes focuses on the task. Not always a good team member. Must be prodded and reminded to keep on task. | Often is not a good team member. Does not focus on the task. Lets others do the work. |
| **Team Role Fulfillment** | Participates in all group meetings. Assumes leadership role. Does the work that is assigned by the group. | Participates in some group meetings. Provides some leadership. Does some of the work assigned by the group. | Participates in few or no group meetings. Provides no leadership. Does little or no work assigned by the group. |
| **Ability to Communicate** | Always listens to, shares with, and supports the efforts of others. Provides effective feedback. Relays a lot of relevant information. | Often listens to, shares with, and supports the efforts of others. Usually does most of the talking. Rarely listens to others. Provides little feedback. Relays very little information that relates to the topic. | Rarely listens to, shares with, or supports the efforts of others. Is always talking and never listens to others. Provides no feedback. Does not relay any information to teammates. |

*Adapted from https://teaching.cornell.edu/resource/group-work-how-evaluate-it*