**Stage 2 General Mathematics**

**AT2: Mathematical Investigation**

**Critical Path Analysis**

**Introduction**

Select a task in a context with which you are familiar. The task must be one in which several activities can be done simultaneously and it must be reasonably complex.

**Mathematical Investigations**

1. Identify all of the individual activities involved in completing the task. Give a brief description of each.
2. Indicate the length of time it takes for each of the activities to be completed.
3. State the precedence activities for each individual activity, with a brief explanation of why they are a precedence activity.
4. Construct a table containing all of the information about the individual tasks including:

* the time the activity takes
* the precedence of the activities.

1. Construct a network diagram to represent the above information and find:

* the minimum completion time for the task
* the critical path for the task and identify the individual activities that make up the critical path
* the earliest and latest starting times for each individual activity.

1. Decide on a reasonable change to the model and predict the possible effect of that change on the minimum completion time and the critical path. Mathematically investigate the effect of the changes and compare it with your prediction. At least two changes should be considered in this manner.

Some examples of changes to consider:

* purchasing some of the items already prepared
* having one or more people assist in some of the individual activities
* identifying individual activities that are not necessary for the successful completion of the task and removing them.

**Analysis / Conclusion**

Critically analyse your results, considering:

* a comparison of the different scenarios investigated
* optimal solution obtained
* the reasonableness of the optimal solution
* the best scenario for the efficient completion of the task
* the limitations of the model used.

**The investigation report should be a maximum of 12 single-sided A4 pages if written, or the equivalent in multimodal form.**

**Report Format**

The report may take a variety of forms, but would usually include the following:

* an outline of the problem and context
* the method required to find a solution, in terms of the mathematical model or strategy used
* the application of the mathematical model or strategy, including
  + relevant data and/or information
  + mathematical calculations and results using appropriate representations
  + discussion and interpretation of results, including consideration of the reasonableness and limitations of the results
* the results and conclusions in the context of the problem.

A bibliography and appendices, as appropriate, may be used.

The format of an investigation report may be written or multimodal.

**Notes to teacher:**

1. The selection of activities that students choose to investigate in this task should be discussed with the teacher to enable achievement to the highest level of the performance standards.
2. Students may select an activity that is part of the context being studied, for example:

* setting up for and providing a performance
* planning an Outdoor Education journey
* planning and hosting a dinner party for a group of friends
* planning for and constructing an appropriate object.

**Performance Standards for Stage 2 General Mathematics**

| - | **Concepts and Techniques** | **Reasoning and Communication** |
| --- | --- | --- |
| **A** | Comprehensive knowledge and understanding of concepts and relationships.  Highly effective selection and application of mathematical techniques and algorithms to find efficient and accurate solutions to routine and complex problems in a variety of contexts.  Successful development and application of mathematical models to find concise and accurate solutions.  Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems. | Comprehensive interpretation of mathematical results in the context of the problem.  Drawing logical conclusions from mathematical results, with a comprehensive understanding of their reasonableness and limitations.  Proficient and accurate use of appropriate mathematical notation, representations, and terminology.  Highly effective communication of mathematical ideas and reasoning to develop logical and concise arguments.  Formation and testing of appropriate predictions, using sound mathematical evidence. |
| **B** | Some depth of knowledge and understanding of concepts and relationships.  Mostly effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine and some complex problems in a variety of contexts.  Attempted development and successful application of mathematical models to find mostly accurate solutions.  Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems. | Mostly appropriate interpretation of mathematical results in the context of the problem.  Drawing mostly logical conclusions from mathematical results, with some depth of understanding of their reasonableness and limitations.  Mostly accurate use of appropriate mathematical notation, representations, and terminology.  Mostly effective communication of mathematical ideas and reasoning to develop mostly logical arguments.  Formation and testing of mostly appropriate predictions, using some mathematical evidence. |
| **C** | Generally competent knowledge and understanding of concepts and relationships.  Generally effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine problems in different contexts.  Application of mathematical models to find generally accurate solutions.  Generally appropriate and effective use of electronic technology to find mostly accurate solutions to routine problems. | Generally appropriate interpretation of mathematical results in the context of the problem.  Drawing some logical conclusions from mathematical results, with some understanding of their reasonableness and limitations.  Generally appropriate use of mathematical notation, representations, and terminology, with reasonable accuracy.  Generally effective communication of mathematical ideas and reasoning to develop some logical arguments.  Formation of an appropriate prediction and some attempt to test it using mathematical evidence. |
| **D** | Basic knowledge and some understanding of concepts and relationships.  Some selection and application of mathematical techniques and algorithms to find some accurate solutions to routine problems in context.  Some application of mathematical models to find some accurate or partially accurate solutions.  Some appropriate use of electronic technology to find some accurate solutions to routine problems. | Some interpretation of mathematical results.  Drawing some conclusions from mathematical results, with some awareness of their reasonableness.  Some appropriate use of mathematical notation, representations, and terminology, with some accuracy.  Some communication of mathematical ideas, with attempted reasoning and/or arguments.  Attempted formation of a prediction with limited attempt to test it using mathematical evidence. |
| **E** | Limited knowledge or understanding of concepts and relationships.  Attempted selection and limited application of mathematical techniques or algorithms, with limited accuracy in solving routine problems.  Attempted application of mathematical models, with limited accuracy.  Attempted use of electronic technology, with limited accuracy in solving routine problems. | Limited interpretation of mathematical results.  Limited understanding of the meaning of mathematical results, their reasonableness or limitations.  Limited use of appropriate mathematical notation, representations, or terminology, with limited accuracy.  Attempted communication of mathematical ideas, with limited reasoning.  Limited attempt to form or test a prediction. |