**Stage 2 Essential Mathematics**

**Assessment Type 1: Skills and Applications Tasks**

**Topic 1: Scales, Plans, and Models**

**Purpose**

To demonstrate your ability to:

* understand mathematical concepts and relationships from Topic 1: Scales, Plans, and Models
* select and apply mathematical techniques and algorithms to find solutions to problems
* interpret results, draw conclusions, and consider the reasonableness of solutions in context
* communicate mathematically and develop logical arguments..

**Assessment conditions**

This is a supervised assessment.

NO CALCULATOR, ELECTRONIC TECHNOLOGY or NOTES are to be used.

Provide complete working for all calculations.

This task is of 40 minutes duration.

**Assessment Design Criteria**

**Concepts and Techniques**

CT 1 Knowledge and understanding of concepts and relationships

CT 2 Selection and application of mathematical techniques and algorithms to find solutions to problems in a variety of contexts

**Reasoning and Communication**

RC 1 Interpretation of mathematical results

RC 2 Drawing conclusions from mathematical results, with an understanding of their reasonableness and limitations

RC 3 Use of appropriate notations, representations, and terminology

RC 4 Communication of mathematical ideas and reasoning to develop logical arguments

Performance Standards for Stage 2 Essential Mathematics

| - | **Concepts and Techniques** | **Reasoning and Communication** |
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| **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. |

**Stage 2 Essential Mathematics**

**Assessment Type 1: Skills and Applications Tasks**

**Topic 1: Scales, Plans, and Models**

**Total [ /36]**

Answer all questions in the spaces provided, showing all calculations.

NO CALCULATOR, ELECTRONIC TECHNOLOGY or NOTES are to be used.

**QUESTION 1**

Consider the shapes below:

A B C D

1. Is shape C a rhombus, parallelogram, ellipse or none of these? Give a reason for your choice. [ /2]

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1. Which shape is a trapezium? [ /1]
2. Shape D is the cross section of which 3D solid? [ /1]
3. Name shape B if all of the sides are the same length.

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1. Explain the difference between a prism and a pyramid. [ /2]

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**QUESTION 2**

Go-Green Gardens sells parts for frames that vines can be grown over to provide shelter in summer. The frame’s ends form a regular hexagon and the overall frame forms a prism once constructed. All sections of the frame are metal tubing, each section being 2.5m long. The metal tubing sections are joined with connectors which are purchased separately.

1. Sketch a perspective diagram of the frame that will be constructed from the information provided.

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[ /4]

1. Each connector allows three pieces of frame to be connected together forming the vertices of the prism. How many connectors will need to be purchased? [ /1]
2. The ends are regular hexagons. What shape are all other faces? [ /1]
3. If the metal tubing for a complete frame costs $81, how much would it cost to replace one damaged edge? Justify. [ /3]

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1. You decide instead of growing vines over the frame that you will cover the top and sides with shade cloth, and purchase a water-proof lining for the base. You need to make a pattern to work out how much shade cloth and water-proof lining to buy. Construct a scale drawing of the net you’d apply as a pattern. Use a scale of 1:50. [ /5]

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**QUESTION 3**

City **B** is due east of city **A**. The mine **M** is north of both cities as shown on the scale diagram below.

The scale is 1cm = 50km.

**M**

**•**

**A** **B**

1. Use the scale diagram to show the bearing from the mine **M** to city **A** is approximately 210oT.

[ /1]

1. Town **C**, the site of the mine worker’s camp, is 50km **south east** of the mine. Locate town **C** on the scale diagram above.

[ /1]

1. An emergency happens at the mine workers’ camp. Using the scale diagram, determine which city, **A** or **B**, is located closest to the mine workers’ camp to send its rescue helicopter? Show any working out below. [ /3]

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1. What factors affect the reasonableness of your results in b) and c)? [ /2]

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1. What bearing will the helicopter fly to reach the injured/sick worker at the mine workers’ camp? Show construction lines on the scale diagram. [ /2]

Bearing: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Show the possible lines of flight of the helicopter if the pilot’s bearing has a ±5o error.

[ /2]

1. Approximately how far away from the mine will the helicopter be when it is either directly east or west of the mine workers’ camp, if it is flying along the possible lines of flight in   
   part (f)? Is the distance the same both to the East and to the West? [ /3]

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