**STAGE 2 GENERAL MATHEMATICS**

**Assessment Type 2: Mathematical Investigation**

**Modelling with Transition Matrices**

**Introduction**

Transition matrices allow us to make predictions about what may happen in the future based on what has happened in the past.

**Your unique information**

There are currently 3 similar fruit and vegetable shops in one area – shop A, shop B and Shop C.

The initial market share of shop A = \_\_\_\_\_\_\_\_\_\_%

The initial market share of shop B = \_\_\_\_\_\_\_\_\_\_%

The initial market share of shop C = \_\_\_\_\_\_\_\_\_\_%

A survey of customers carrying out their weekly grocery shopping at each shop revealed that:

* Customers buying their weekly groceries at shop A intended to do their grocery shopping at shop A \_\_\_\_\_\_% of the time, Shop B \_\_\_\_\_\_%
* Customers buying their weekly groceries at shop B intended to do their grocery shopping at shop B \_\_\_\_\_\_% of the time, Shop C \_\_\_\_\_\_%
* Customers buying their weekly groceries at shop C intended to do their grocery shopping at shop A \_\_\_\_\_\_% of the time, Shop C \_\_\_\_\_\_%

**Key information about predictions RC5:**

Students are required to make and test at least two predictions based on the mathematics that they are using to consider scenarios.

In the process of forming and testing predictions, students will need to:

* State the prediction
* Test the prediction mathematically
* Discuss the outcome of testing the prediction.

To reach the A grade band for RC5, students need to form and test more than one appropriate prediction.

**Part A**

Consider the unique values for your shop A, B and C provided to you. Use it to demonstrate your knowledge with respect to transition matrices.

Concepts to include:

* Elements of a matrix e.g size, key features
* Transition Matrix
* Initial Matrix $S\_{0}$
* Calculating the market Share after 1, 2, 3, 4 and 5 weeks
* Calculating the steady state including the length of time it takes to reach it

**Part B**

Consider changes to your matrices from Part A. Include a prediction of what will happen to both the long term share for each shop as well as the length of time it will take to reach the steady state before you begin. Give a complete interpretation of the impact of each change, including changes to long term steady state share and the length of time it takes to reach it.

Concepts to include:

* Changing your initial state matrix
* Changing your initial transition matrix
* Chaing the size of your transition and state matrix
* Explain what might cause changes to state, transition and size of matrix in real life.
* Assumptions and limitations of your results

**Part C**

Create your own real life scenario where you are able to incorporate all of the above, in context discussion.

Predict and analyse complex changes that have impacts to showcase your knowledge and comment on the reasonableness of each outcome. Relate your predictions back to the outcomes in part B.

Business implications should be addressed. Be sure to comment on any limitations of the model in this investigation that could influence your results.

**Report**

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

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.

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. |