**STAGE 2 ESSENTIAL MATHEMATICS**

**ASSESSMENT TYPE 2: FOLIO**

**Topic 3: Business Applications**

**Break-even Analysis**

http://www.stockfreeimages.com/Biscuits-thumb13892113.jpg

**Introduction**

In this task you are to investigate the costs involved in making a product that could be sold at a country market or other market-style location. You investigate the costs involved in making the product, carry out a break-even analysis and investigate the number of the product that you need to sell to reach varying levels of profit.

Assume that you will make and sell the product for a full year. Some examples of the type of products to consider are:

* making and selling biscuits using a favourite family recipe
* making a simple item for a house or garden (e.g. a craft item or novelty garden item)
* making a pet product (e.g. a cat scratching pole)
* making a particular kind of gift basket.

**Note:** Pinterest or similar websites are a great place to find ideas for products that can be made.

You carry out the mathematical investigations described in parts 1 to 9 on the following page, and then prepare a response which, excluding bibliography and appendices if used, must be a maximum of 8 single-sided A4 pages if written, or the equivalent in multimodal form.

The folio task response may take a variety of forms, but should include the following:

* an outline of the problem to be explored
* the method used to find a solution
* the application of the mathematics, including, for example:
* generation or collection of relevant data and/or information, with a summary of the process of collection
* 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.

**http://www.stockfreeimages.com/17717871/Colorful-bird-houses-under-the-roof.html**

**Mathematical Investigations**

1. Carry out some basic research and decide on the product that you will investigate making.

2. Create a list of all of the components needed to make your product (e.g. ingredients or products required for construction such as wood, nails, glue, etc.) and investigate their costs. Use this information to determine the **Variable Cost** for the product you are selling.

**Note:** If you are making a product in which you will sell a number of the item at a time (e.g. making and selling biscuits in packets of four), the variable cost will need to cover the cost of making the number of items sold in the one product (e.g. one packet of four biscuits).

3. Decide on a **Selling Price** for your product. **Predict** how many you would need to sell at this price to break-even.

4. List the fixed costs that are likely to contribute to the costs of producing your chosen product (e.g. electricity if baking or using power tools, purchase of equipment needed for making the items etc.) and determine a reasonable **Fixed Cost** for a whole year.

5. Determine the number of your product you will need to sell over the year to break even using the figures that you have determined in parts 2 to 4.

6. Discuss the reasonableness of the answer that you calculated in part 5. Consider:

* how close your prediction in part 3 was to the calculated break even number
* the number of your product that you will need to make and sell each week or month
* the assumptions you made when calculating the variable and fixed costs
* limitations of the model that you are using.

7. Now, considering the variable costs from above, **make a prediction** about how many of your product you would need to sell to make a profit in each of the following categories. Specify the profit you will make for each category, and how many you think you will need to sell to make that profit. Do not carry out break-even calculations.

a) Between $100 and $500 profit

b) Between $1 000 and $5 000 profit

c) Over $10 000 profit.

Describe how you made these predictions. How accurate do you think your predictions are?

8. Use calculations to determine the actual number of your product that needs to be sold to make the profits of your choice in each category above. How close were your predictions?

9. Next, calculate the profit or loss made when considering changes to the original scenario. For each scenario you investigate, describe the change that you are making in a real life context. In each of these investigations the number of your product that you sell will remain the same. Choose the number that you will sell from those you calculated in part 7 a) or b).

You should investigate:

* varying the selling price of your product
* finding a cheaper way of making your product (buying items on special or in bulk so that the variable price decreases)
* the cost of one of your variable items increasing
* a combination of two or more of these changes.

10. In your conclusion, discuss the viability of making money from selling your product at markets.

Performance Standards for Stage 2 Essential 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.  Successful 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 some contexts.  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. |