Name: ……. Date: ……..

Thinking with models _ Linear Functions

Investigation Task: Ice Cream Assessment Criterion: B and C

Key concept :	Related Concept :	Global context:
Relationships, Change , Form	Pattern, Model and Representation	Fairness and Development

Inquiry Question

How can identifying patterns in real-life data help us create, verify, and justify mathematical models to make informed decisions?

Objective: Students will able to identify patterns in data, formulate a linear rule of the form y = mx+c, verify the rule using mathematical reasoning, and justify the suitability of the rule in a real-life context involving costs.

Context: In this task, students investigate the cost of producing ice creams at a stall. Using given data, students analyze how total cost changes with the number of ice creams produced. They identify patterns, find a linear rule, verify the rule using substitution, and justify why a linear model is appropriate.

Tasks:

Identify → Solve → Verify → Justify → Frame a general rule

ATL Skills:

Thinking Skills: Critical thinking: Identify patterns, frame rules, justify reasoning.

Transfer Skills: Applying linear functions learners in class to a real life business context.

Communication Skills: Explaining mathematical thinking clearly using appropriate language and representations.

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Context: You run a small ice cream stall at a school fair. You notice that the total cost of producing ice creams increases in a regular way depending on how many ice creams you make.

- There is a fixed cost for setting up the stall (rent, electricity, freezer).
- There is a variable cost for each ice cream (cone, ice cream scoop, toppings).

You decide to investigate whether this situation can be modeled using a linear function of the form:

$$y = mx + c$$

Where: x = number of ice creams made , y = total cost (in dollars) ,m = cost per ice cream

c = fixed cost

Given Data: The table below shows the total cost for producing different numbers of ice creams:

Number of Ice Creams (x)	Total Cost ($) (y)
0	50
10	80
20	110
30	140
40	170

Identify the Pattern

1. Describe how the total cost changes as the number of ice creams increases.
2. Calculate the increase in cost for every additional 10 ice creams.
3. Explain why this pattern suggests a linear relationship.

Find the Rule

1. Determine the value of **m** (the slope).
2. Identify the value of **c** (the y-intercept).
3. Write the linear rule in the form **y = mx + c**.

Verify the Rule

1. Substitute **x = 20** into your equation and show your working.
2. Compare your calculated value with the value in the table.
3. Test one more value of *x* from the table to confirm your rule.

Justify the Rule

1. Explain what the value of **m** represents in the context of the ice cream business.
2. Explain what the value of **c** represents in the context of the ice cream business.
3. Justify why a linear model is appropriate for this situation.

Curriculum framework

Key Concepts

1. **Relationships:** The task explores the relationship between the number of ice creams produced and the total cost.
2. **Representation:** Mathematical ideas are represented using tables, equations, and written explanations to model the situation.
3. **Logic:** Logical reasoning is used to move from identifying patterns to verifying and justifying a general rule.

Related Concepts

1. **Pattern:** A consistent increase in total cost as the number of ice creams increases.
2. **Model:** A linear equation used to represent the real-life cost situation mathematically.
3. **Generalization:** Writing a rule that applies to all values, not just specific examples from the table.

Global Contexts

1. **Scientific and Technical Innovation:** Using mathematical models to predict outcomes and support decision-making.
2. **Globalization and Sustainability:** Understanding production costs to support efficient and sustainable business practices.
3. **Fairness and Development:** Using cost models to justify fair pricing and economic decisions.

Statements of Inquiry

1. **Scientific and Technical Innovation:** *Mathematical models help us understand patterns and make accurate predictions in real-world situations.*
2. **Globalization and Sustainability:** *Identifying cost patterns supports sustainable production and responsible resource use.*
3. **Fairness and Development:** *Linear relationships can be used to justify fair and informed economic decisions.*

GRASPS – Ice Cream Linear Functions Investigation

G – Goal

To analyze cost data from an ice cream stall in order to **identify a pattern**, **develop a linear rule of the form y= mx+c**, **verify the rule using mathematical reasoning**, and **justify why the rule is appropriate** for the situation.

R – Role

You are a **small ice cream stall owner** who needs to understand how production costs change as more ice creams are made.

A – Audience

Your **business partner** (or teacher) who needs a clear and accurate explanation of the cost model to support decision-making.

S – Situation

You are given data showing the **number of ice creams produced and the total cost**. You must investigate the data to determine whether a **linear relationship** exists and explain how this model can be used to predict future costs.

P – Product / Performance

A **mathematical investigation** that includes:

- identification of the pattern in the data
- a linear rule written as y=mx+c
- verification of the rule using substitution
- a justification explaining the meaning of mmm and ccc in context

S – Standards / Success Criteria

Your work will be assessed using **MYP Mathematics Criteria B (Investigating Patterns)** and **C (Communicating)**, focusing on:

- accuracy of the pattern and rule
- verification and justification
- clarity of mathematical communication and organization