

Name:

Date:

Thinking with models _ Linear Functions

Investigation Task: Ice Cream

Assessment Criterion: B and C

Key concept :
Relationships, Change , Form

Related Concept :
Pattern, Model and
Representation

Global context:
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 be 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.

The total cost increases at a constant rate as the number of ice creams increases.

2. Calculate the increase in cost for every additional 10 ice creams.

for every additional 10 ice creams, the cost increases by 30.

$$80 - 50 = 30$$

$$110 - 80 = 30$$

$$140 - 110 = 30$$

3. Explain why this pattern suggests a linear relationship.

Because the increases in cost is constant, the relationship between x and y is linear.

Find the Rule

1. Determine the value of m (the slope).

Slope (m)

Increase in cost = 30

Increase in ice creams = 10

$$m = \frac{30}{10} = 3$$

2. Identify the value of c (the y-intercept).

y intercept

when $x = 0$; $y = 50$; $c = 50$

3. Write the linear rule in the form $y = mx + c$.

Linear Rule

$$y = 3x + 50$$

Verify the Rule

1. Substitute $x = 20$ into your equation and show your working.

Let $x = 20$

$$y = 3(20) + 50$$

$$y = 60 + 50$$

$$y = 110$$

2. Compare your calculated value with the value in the table.

✓ -

calculated value 110 matches the value in the table

3. Test one more value of x from the table to confirm your rule.

Verify with $n=40$

$$\begin{aligned}y &= 3(40) + 50 \\&= 120 + 50 \\&= 170\end{aligned}$$

This matches the table value,
so the rule is verified

Justify the Rule

1. Explain what the value of m represents in the context of the ice cream business.

The value of $m=3$ represents the cost of
Producing one ice cream

2. Explain what the value of c represents in the context of the ice cream business.

The value of $c=50$ represents the fixed cost of
Setting up the ice cream stall.

3. Justify why a linear model is appropriate for this situation.

A linear model is appropriate because
both the cost per ice cream and the
fixed cost remain constant.