

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 learned 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

$$c = \text{fixed cost}$$

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 increase 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.