

Name:

Date:

Thinking with Models _ Gradient

Investigation Task: Gradient Between Points on a Line

Assessment Criterion: B and C



Inquiry Question

How can identifying and representing patterns in coordinate geometry help us understand and communicate mathematical relationships that explain real-world changes and movements?



Objective: Students will investigate patterns in coordinate geometry by calculating and analyzing gradients between points on a line.

Context:

A group of students wanted to understand how the **gradient (slope)** changes between different points on the same straight line. They recorded several pairs of coordinates that lie on the line and calculated the gradient between consecutive points.



Tasks:



ATL Skills:

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

Self-Management Skills: Organization: Record data systematically in tables and check calculations.

Communication Skills:Use appropriate mathematical language to express ideas

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Context: A group of students wanted to understand how the **gradient (slope)** changes between different points on the same straight line. They recorded several pairs of coordinates that lie on the line and calculated the gradient between consecutive points.

Your task is to **investigate the relationship (pattern)** between the coordinates and the gradient.

| Point A (x_1, y_1) | Point B (x_2, y_2) | Gradient (m) $\frac{y_2 - y_1}{x_2 - x_1}$ |
|---------------------------|---------------------------|---|
| (1, 3) | (2, 5) | |
| (2, 5) | (3, 7) | |
| (3, 7) | (4, 9) | |
| (4, 9) | (5, 11) | |

1. **Calculate:**

Complete the above table by calculating the gradient between each pair of points.

2. **Identify:**

Identify any **patterns** you notice in the gradient values.

What do you observe about the gradient between any two points on this line?

3. **Frame a Rule:**

Based on your observations, **frame a general rule** or **formula** for the gradient of this line.

4. **Verify:**

Choose two new points on the same line (for example, (6, 13) and (8, 17)) and **verify** your rule by checking if it works.

5. **Justify: Justify** your reasoning with mathematical evidence.

6. **Explain** why your pattern and rule make sense using the definition of gradient.

Conceptual Understanding Framework

| Key Concepts | Related Concepts | Global Context | Statement of Inquiry (SOI) |
|---------------|------------------|-------------------------------------|---|
| Relationships | Pattern | Scientific and Technical Innovation | <i>Discovering relationships between variables helps us understand how patterns explain real-world phenomena.</i> |
| Logic | Representation | Orientation in Space and Time | <i>Using logical reasoning and representations allows us to describe spatial relationships and movement accurately.</i> |
| Communication | Generalization | Identities and Relationships | <i>Communicating mathematical generalizations supports understanding and connection between ideas.</i> |

| ATL Category | Specific ATL Skill | How It's Applied in the Task |
|---|--|---|
| Thinking Skills (Critical Thinking) | Identify patterns and make generalizations | Students analyze gradients to recognize the constant rate of change and formulate a general rule. |
| Communication Skills | Use appropriate mathematical language to express ideas | Students communicate reasoning using precise terms like <i>gradient</i> , <i>linear equation</i> , <i>constant rate of change</i> . |
| Research or Self-Management Skills (Organization) | Plan and organize work effectively | Students record data in structured tables, show calculations clearly, and present findings logically. |

GRASPS

| Element | According to Task |
|--------------------------------|--|
| G – Goal | Investigate patterns in coordinate geometry by calculating gradients between points, identify consistent relationships, formulate a general rule, and justify findings. |
| R – Role | You are a mathematician analyzing data to discover linear patterns and express mathematical relationships clearly. |
| A – Audience | Your teacher, classmates, and anyone interested in understanding the relationship between coordinates and gradients. |
| S – Situation | A table of coordinates is given, representing points on a line. You must explore the data, find patterns in gradients, and determine a rule that predicts y-values for any x-value. |
| P – Product/Performance | A completed investigation including: <ul style="list-style-type: none"> • Table of gradients • Identified pattern • General rule (equation of the line) • Verification using new points • Justified reasoning and clear explanation of findings. |
| S – Standards | Success is measured by: <ul style="list-style-type: none"> • Accuracy in gradient calculations • Correct identification of patterns • Clear and logical general rule • Coherent reasoning and justification • Proper use of mathematical language and representations (table, formula, verbal explanation). |