

Footprints on the Road

The Task

This task required students to:

- engage in small group and whole class discussions to generate problems involving the investigation of relationships between things like foot size, stride, leg length, and/or height;
- engage in whole class activity to identify data needed for the investigations, to collect the data from the whole class, and to prepare a class summary sheet of data;
- work individually to select a problem, analyse the data, and write a report.

Each student analysed a set of data and wrote a report. The report included a clear statement of the problem, a hypothesis of the solution, an explanation of factors that might have affected the validity and accuracy of the data gathered, a table of values and a scatter plot, a description of the dispersion of the data in the scatter plot, a conclusion that made direct reference to the analysis of the data, and reference to another situation involving a relationship between two variables.

Expectations

This task gave students the opportunity to demonstrate achievement of the following selected expectations from the Relationships strand.

Relationships

Students will:

1. determine relationships between two variables by collecting and analysing data;
2. compare the graphs of linear and non-linear relations;
3. describe the connections between various representations of relations;
4. pose problems, identify variables, and formulate hypotheses associated with relationships;
5. demonstrate an understanding of some principles of sampling and surveying and apply the principles in designing and carrying out experiments to investigate the relationships between variables;
6. collect data, using appropriate equipment and/or technology;
7. organize and analyse data, using appropriate techniques and technology;
8. describe trends and relationships observed in data, make inferences from data, compare the inferences with hypotheses about the data, and explain the differences between the inferences and the hypotheses;
9. communicate the findings of an experiment clearly and concisely, using appropriate mathematical forms;
10. demonstrate an understanding that straight lines represent linear relations and curves represent non-linear relations.

Prior Knowledge and Skills

To complete this task, students were expected to have some knowledge or skills relating to the following:

- the ability to describe relationships
- a knowledge of variables that can affect relationships
- the ability to construct graphs by hand
- a knowledge of scatter plots and their interpretation
- the ability to write reports

For information on the process used to prepare students for the task and on the materials and resources required, see the Teacher Package reproduced on pages 67–71 of this document.

Task Rubric – Footprints on the Road

Expectations*	Criteria	Level 1	Level 2	Level 3	Level 4
Knowledge / Understanding					
	The student:				
5, 10	<ul style="list-style-type: none"> demonstrates understanding of a mathematical relation by stating a working hypothesis identifies and explains factors that might affect the validity and accuracy of the data collected 	<ul style="list-style-type: none"> demonstrates a limited understanding of a relational hypothesis identifies factors and explains them with a limited rationale 	<ul style="list-style-type: none"> demonstrates some understanding of a relational hypothesis identifies factors and explains them with a somewhat effective rationale 	<ul style="list-style-type: none"> demonstrates considerable understanding of a relational hypothesis identifies factors and explains them with a considerably effective rationale 	<ul style="list-style-type: none"> demonstrates a thorough understanding of a relational hypotheses identifies factors and explains them with a highly effective rationale
Thinking / Inquiry / Problem Solving					
	The student:				
1, 3, 7, 8	<ul style="list-style-type: none"> describes the dispersion of the data with reference to trends and relationships draws a valid conclusion and makes an argument for the relationship stated 	<ul style="list-style-type: none"> describes the dispersion of the data with limited accuracy and detail makes an argument for the relationship in the conclusion in limited detail 	<ul style="list-style-type: none"> describes the dispersion of the data with some accuracy and detail makes an argument for the relationship in the conclusion in some detail 	<ul style="list-style-type: none"> describes the dispersion of the data with considerable accuracy and detail makes an argument for the relationship in the conclusion in considerable detail 	<ul style="list-style-type: none"> describes the dispersion of the data with a high degree of accuracy and detail makes an argument for the relationship in the conclusion in a high degree of detail
Communication					
	The student:				
7, 9	<ul style="list-style-type: none"> prepares an organized and clear report, using appropriate mathematical forms communicates graphically, using proper form 	<ul style="list-style-type: none"> demonstrates limited organization and clarity communicates graphically, demonstrating limited skill in the use of proper form 	<ul style="list-style-type: none"> demonstrates some organization and clarity communicates graphically, demonstrating some skill in the use of proper form 	<ul style="list-style-type: none"> demonstrates considerable organization and clarity communicates graphically, demonstrating considerable skill in the use of proper form 	<ul style="list-style-type: none"> demonstrates a high degree of organization and clarity communicates graphically, demonstrating a high degree of skill in the use of proper form
Application					
	The student:				
6	<ul style="list-style-type: none"> identifies and describes a realistic application 	<ul style="list-style-type: none"> identifies and describes a realistic application in limited detail 	<ul style="list-style-type: none"> identifies and describes a realistic application in some detail 	<ul style="list-style-type: none"> identifies and describes a realistic application in considerable detail 	<ul style="list-style-type: none"> identifies and describes a realistic application in thorough detail

* The expectations that correspond to the numbers given in this chart are listed on page 44. Note that, although all of the expectations listed there were addressed through instruction relating to the task, student achievement of expectations 2 and 4 was not assessed in the final product.

Note: A student whose overall achievement at the end of a course is below level 1 (that is, below 50%) will not obtain a credit for the course.

Student Instructions

Part I: Read the following text

Two friends, Henri and Kim, were walking along a dirt road after a heavy rain. They noticed that they were leaving well-defined sets of footprints and began talking about the differences in their tracks.

"Our footprints are about the same size," said Henri, "but my stride is longer than yours."

"That's true," replied Kim, "but notice that I am keeping up with you while we walk."

The two friends continued walking and talking, discussing the information that might be gained about someone, just by examining their footprints in the dirt.

- In your group of three or four students, brainstorm at least three questions that could be answered through further investigation, based on the conversation between Henri and Kim.
- Share these questions with the whole class.
- As part of a whole class discussion, identify problems for research arising from the discussions.
- Participate in gathering data relevant to the problems for the class summary data sheet.

Part II: Final Report

Hand in a written report containing the information required in each step below. Do all work in good form and write all explanations in complete sentences.

1. a) Select one of the approved research problems identified from the discussions in Part 1. Make a clear statement of the problem.
b) Hypothesize a solution to the problem.
c) Include an explanation of factors that might affect the validity and accuracy of the data gathered.
2. a) Construct a table of values and a scatter plot.
b) Describe the dispersion of the data in the scatter plot (i.e., do the pieces of data cluster into a recognizable trend or are they randomly distributed?). If you see a trend, identify it. Explain the presence of any pieces of data that do not fit the trend.
3. a) Write a conclusion to the problem, making direct reference to your analysis of the data.
b) If you believe a relationship exists, describe it as completely as possible, so that someone reading your work could make a prediction about himself/herself.
4. You have examined a relationship between the two variables. Describe another situation in which it would be important to identify a relationship between two variables, and explain the importance.