

2.4

Trends, Interpolation, and Extrapolation

Strand:
Linear Relations

Student Text Pages
68 to 76

Suggested Timing
80 min

Tools
• grid paper

Technology Tools
• graphing calculators
• *Fathom*[™]
• computers

Related Resources
BLM G10 Grid Paper
BLM T6 *Fathom*[™]
BLM 2.4.1 Practice: Trends, Interpolation, and Extrapolation
BLM A10 Observation General Scoring Rubric
BLM 2.4.2 Achievement Check Rubric

Mathematical Process Expectations Emphasis

- Problem Solving
- Reasoning and Proving
- Reflecting
- Selecting Tools and Computational Strategies
- Connecting
- Representing
- Communicating

Specific Expectations

Using Data Management to Investigate Relationships

RE1.04 describe trends and relationships observed in data, make inferences from data, compare the inferences with hypotheses about the data, and explain any differences between the inferences and the hypotheses (e.g., describe the trend observed in the data. Does a relationship seem to exist? Of what sort? Is the outcome consistent with your hypothesis? Identify and explain any outlying pieces of data. Suggest a formula that relates the variables. How might you vary this experiment to examine other relationships?);

Understanding Characteristics of Linear Relations

RE2.01 construct tables of values, graphs, and equations, using a variety of tools (e.g., graphing calculators, spreadsheets, graphing software, paper and pencil), to represent linear relations derived from descriptions of realistic situations;

RE2.02 construct tables of values, scatter plots, and lines or curves of best fit as appropriate, using a variety of tools (e.g., spreadsheets, graphing software, graphing calculators, paper and pencil), for linearly related and non-linearly related data collected from a variety of sources (e.g., experiments, electronic secondary sources, patterning with concrete materials);

Connecting Various Representations of Linear Relations

RE3.01 determine values of a linear relation by using a table of values, by using the equation of the relation, and by interpolating or extrapolating from the graph of the relation.

Link to Get Ready

The Get Ready segment Bar Graphs provides the needed skills for this section. You may wish to have the students complete Get Ready questions 1 and 2 before starting this section.

Teaching Suggestions

- In this section students investigate trends by making and reading bar graphs and scatter plots. Students learn when to interpolate and extrapolate. You may wish to use **BLM G10 Grid Paper** for this section.
- As a class, read the introductory paragraph and have a short discussion on the meaning of the word *trend*. Explain to students that a trend is a pattern in data that has occurred over a period of time, or a general tendency of an event. It may or may not be extrapolated into the future. (2 min)
- If students have skills in using graphing calculators or *Fathom*[™], using technology allows the students to concentrate on the analysis of the data and observe trends. This also invites a good discussion on when and whether to use interpolation and extrapolation. You may wish to use **BLM T6 Fathom**[™] for this activity. (15 min)
- The Example reinforces the same skills as the Investigate. If you choose to use graphing calculators or *Fathom*[™], have the students enter only the end year of each interval. You may experience some difficulties if you enter the range of years (e.g., 2002–2003). Further information on movie attendance can be found at these web sites: <http://www.mptac.ca/stats>.

Common Errors

- Some students may extrapolate trends indefinitely.

R_x Have students consider the Investigate and predict the temperature in June and October, based on the trend. Explain that other factors, or variables, may influence the dependent variable outside the given time span.

Ongoing Assessment

Use Achievement Check question 8 to monitor student success. See the Achievement Check Answers and **BLM 2.4.2 Achievement Check Rubric** to assist you in assessing your students.

Communicate Your Understanding questions can be used as quizzes to assess student Communication skills (see **BLM 2.4.2 Achievement Check Rubric** for levels).

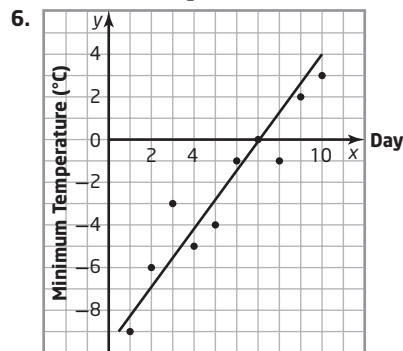
html, <http://www.mptac.ca/statistics.html>, and <http://www.statcan.ca/english/freepub/87F0009XIE/2005001/sumtable.htm>. (10 min)

- Review the vocabulary, **interpolate** and **extrapolate**, before assigning the exercises. (2 min)
- Assign Communicate Your Understanding questions C1 and C2, and Practise questions 1 and 2. (15 min)
- Further data for question C2 can be found at this web site: <http://www.vs.gov.bc.ca/stats/annual/2001/tab03.html>.
- You may wish to use **BLM 2.4.1 Practice: Trends, Interpolation, and Extrapolation** for remediation or extra practice.
- You may wish to use **BLM A10 Observation General Scoring Rubric** at any point during this section to assist you in assessing your students.

Investigate Answers (page 68)

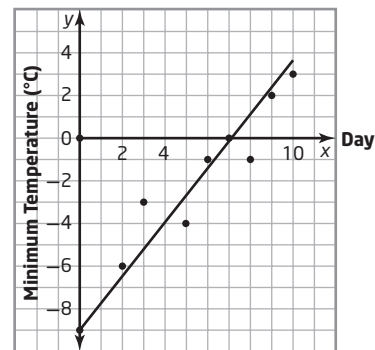
Method 1

5. The horizontal axis represents the days and the vertical axis represents the minimum temperatures.



7. Answers will vary. The minimum temperatures later in the 10 days were generally higher than the temperatures earlier in the 10 days. The minimum temperatures gradually rose over the 10 days.

8. Answers will vary. To predict temperatures outside of the dates that were surveyed, create a line of best fit (trend line) that gives a good approximation of the pattern. From this trend line, it seems that on March 11 the minimum temperature will be close to 4°C. On March 12, it will be close to 5°C. The minimum temperature on February 26 can be estimated by extending the trend line to the left and looking at its Minimum Temperature value on Day -2.

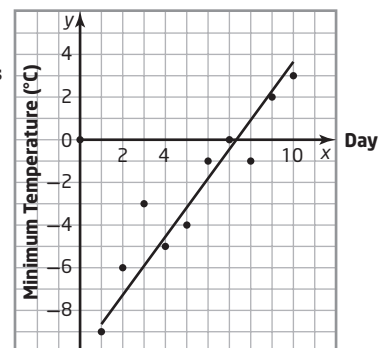


Method 2

4. The horizontal axis represents the days and the vertical axis represents the minimum temperatures.

6. Answers will vary. The minimum temperatures later in the 10 days were generally higher than the temperatures earlier in the 10 days. The minimum temperatures gradually rose over the 10 days.

7. Answers will vary. To predict temperatures outside of the dates that were surveyed, create a line of best fit (trend line) that gives a good approximation of the pattern. From this trend line, it seems that on March 11 the minimum temperature will be close to 4°C. On March 12, it will be close to 5°C. The minimum temperature on February 26 can be estimated by extending the trend line to the left and looking at its Minimum Temperature value on Day -2.



Accommodations

Gifted and Enrichment—Give students opportunities to research data on the Internet for the class to graph.

Motor—Let students use enlarged grid paper when creating graphs using pencil and paper.

Student Success

Have students role play conducting a survey for a market research company. Pose questions, collect data from classmates, analyse and present the results.

Communicate Your Understanding Responses (page 72)

- C1.** Scatter plot. It is good to show a relationship between the data.
- C2. a)** Yes. If you follow a trend line it looks like there might be a fertility rate of zero.
- b)** If you follow a curve pattern, the fertility rate might be 0.81 in 2030.

Practise

For question 1, further information from the City of Guelph's Planning and Building Services can be found at this web site: http://www.guelph.ca/uploads/PBS_Dept/planning/documents/stats_housing.pdf.

In question 2c), the predicted value is not evident. This may provide an opportunity to discuss what factors may contribute to the stabilization of the world's population. Students may suggest saturation, e.g., the limit to the amount of food, water, and land available for increasing numbers of people; people having fewer children; epidemics, etc. Further information on the United Nations' report can be found at these web sites: <http://www.chem.brown.edu/chem12/un%20population/unPopulation.html>; <http://www.un.org/esa/population/publications/longrange2/2004worldpop2300reportfinalc.pdf>, and <http://www.un.org/esa/population/publications/sixbillion/sixbilpart1.pdf>.

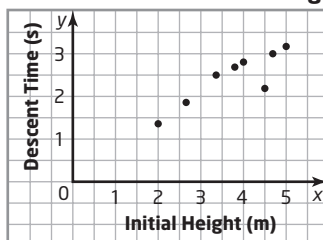
Connect and Apply

Most questions are straightforward in their graphing and interpretation of the data. Answers will vary for the reasons behind trends or relationships. For further information, you may wish to visit these web sites: <http://www.givingandvolunteering.ca/factsheets.asp> (question 5); and <http://www.cria.ca/stats.php> (question 7). For question 8, you may wish to use **BLM 2.4.2 Achievement Check Rubric** to assist you in assessing your students. You may also wish to use **BLM G10 Grid Paper** for any or all of the questions in this exercise.

Achievement Check Answers (page 75)

- 8. a)** Independent: initial height; dependent: descent time. The time it takes to get to the bottom of the ramp will depend on where the skateboarder starts.

b) Descent Times at Various Heights



- c)** As the initial height increases, so does the descent time.
- d)** Point (4.5, 2.2) is an outlier. I would check this data point by performing the experiment again before excluding it.
- e)** 2.5 m, if (4.5, 2.2) is excluded from the data set.

Extend

Question 9 involves multiple relationships from the same chart. For further information, you may wish to visit this web site: <http://www.givingandvolunteering.ca/factsheets.asp>.

Question 10 involves research in the library or on the Internet to critically

analyse a prediction regarding world growth. Consider having a class discussion on Internet web sites and appropriate sources. Remind students that anyone can create a web site on any topic on the Internet. Ask students to raise their hands if they have a personal web site or keep an Internet journal (a *blog*). Explain that web sites like these contain personal opinions and information contained on them should be looked at critically. You may wish to review the vocabulary from Section 2.1 on primary and secondary data. This also may provide an opportunity to remind students that personal information should never be revealed over e-mail, in an on-line journal, or a chat-room and that anything that makes them uncomfortable should be reported immediately to their parent or guardian.

Exercise Guide

Category	Question Number
Minimum (essential questions for all students to cover the expectations)	1–4, 6
Typical	1–7
Extension	9–12