Critiquing Data Presentation

1.3

***MathLinks 8*, pages 28–35**

Suggested Timing
80–100 minutes

Materials
- grid paper
- ruler
- coloured pencils
- compass
- protractor

Blackline Masters
Master 2 Two Stars and One Wish
Master 8 Centimetre Grid Paper
Master 9 0.5 Centimetre Grid Paper
Master 12 Percent Circles (optional)
Master 16 KWL Chart
BLM 1–4 Chapter 1 Warm-Up
BLM 1–12 Section 1.3 Extra Practice
BLM 1–13 Section 1.3 Math Link

Mathematical Processes
- ☑ Communication (C)
- ☑ Connections (CN)
- ☐ Mental Mathematics and Estimation (ME)
- ☑ Problem Solving (PS)
- ☑ Reasoning (R)
- ☑ Technology (T)
- ☑ Visualization (V)

Specific Outcomes
SP1 Critique ways in which data is presented.

Category	Question Numbers
Essential (minimum questions to cover the outcomes)	1–4, 6, 8, 10, Math Link
Typical	1, 3, 4–6, 7–10, Math Link
Extension/Enrichment	1, 3, 11–13, Math Link

1.3 Critiquing Data Presentation

THE DAILY NEWS
Sept 24 2007

DNA Testing Helps Commercial Fishers

Thanks to DNA testing, B.C.'s commercial fishers can expect to catch as much as 90% of their quota of chinook salmon this year.

Since 2002, scientists have been using DNA testing to determine accurately where fish are originally from. As a result, fishery officials can better manage the fish stocks by setting specific harvest targets to protect the weaker stocks and allow more fishing of the stronger ones.

Between 1995 and 2001, fisheries used coded-wire tags inserted into salmon to estimate the populations of different runs of salmon. They used this information to limit the catch and the areas open to fishing for the following year. Using this method, only about 15% of the available quota was harvested in 2001.

Focus on...
After this lesson, you will be able to...
- explain how a graph is used to represent the data from a given situation

Did You Know?
A *run* refers to a group of salmon that were hatched in the same place. During the salmon run, the fish swim back up rivers to their birthplace to spawn.

Tyler is presenting his current events report to his grade 8 Social Studies class. His report includes a newspaper article about chinook salmon and the bar graph shown. Does the bar graph support the story?

DNA Testing Increases Chinook Catch

Explore the Math

Literacy Link
A *stacked bar graph* has bars stacked instead of side-by-side.

Does the graph represent what it says it does?

1. Examine the graph about the chinook salmon catch. Why do you think the author used a stacked bar graph? Is it effective?
2. Decide if the graph is misleading.
   a) Examine the scales on the vertical and horizontal axes. What do you notice?
   b) How could you make the graph easier to understand?
3. The genetic testing of salmon began in 2002. The graph shows the quotas and catches since 1995. Use the graph and the information in the article to help answer the following questions.

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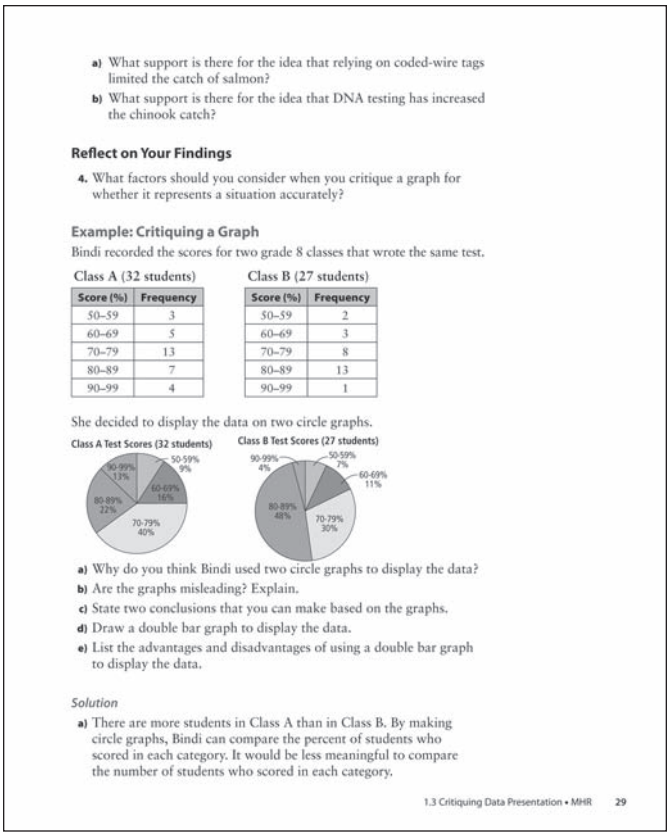
Planning Notes

Have students complete the warm-up questions on **BLM 1–4 Chapter 1 Warm-Up**.

Use the introduction as a lead-in to the Explore the Math.

Literacy Link At the beginning of section 1.3, read and discuss the section title, opening paragraph, opening article, and large question in the Explore the Math. Direct students to the Did You Know? to clarify the meaning of *run*. Then, have students use **Master 16 KWL Chart** to identify what they know and want to know about critiquing data presentations.

Ask students what is different about the bars in the graph (stacked bars). Point out the Literacy Link on page 28 that explains the term *stacked bar graph*.



a) What support is there for the idea that relying on coded-wire tags limited the catch of salmon?

b) What support is there for the idea that DNA testing has increased the chinook catch?

Reflect on Your Findings

4. What factors should you consider when you critique a graph for whether it represents a situation accurately?

Example: Critiquing a Graph

Bindi recorded the scores for two grade 8 classes that wrote the same test.

Class A (32 students)

Score (%)	Frequency
50–59	3
60–69	5
70–79	13
80–89	7
90–99	4

Class B (27 students)

Score (%)	Frequency
50–59	2
60–69	3
70–79	8
80–89	13
90–99	1

She decided to display the data on two circle graphs.

Class A Test Scores (32 students)

Class B Test Scores (27 students)

a) Why do you think Bindi used two circle graphs to display the data?

b) Are the graphs misleading? Explain.

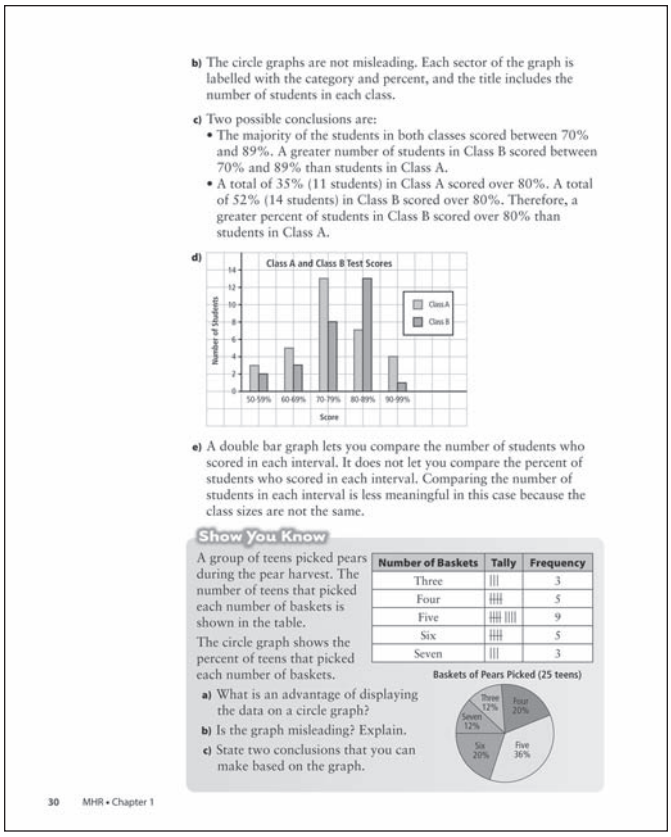
c) State two conclusions that you can make based on the graphs.

d) Draw a double bar graph to display the data.

e) List the advantages and disadvantages of using a double bar graph to display the data.

Solution

a) There are more students in Class A than in Class B. By making circle graphs, Bindi can compare the percent of students who scored in each category. It would be less meaningful to compare the number of students who scored in each category.



b) The circle graphs are not misleading. Each sector of the graph is labelled with the category and percent, and the title includes the number of students in each class.

c) Two possible conclusions are:
- The majority of the students in both classes scored between 70% and 89%. A greater number of students in Class B scored between 70% and 89% than students in Class A.
- A total of 35% (11 students) in Class A scored over 80%. A total of 52% (14 students) in Class B scored over 80%. Therefore, a greater percent of students in Class B scored over 80% than students in Class A.

d)

e) A double bar graph lets you compare the number of students who scored in each interval. It does not let you compare the percent of students who scored in each interval. Comparing the number of students in each interval is less meaningful in this case because the class sizes are not the same.

Show You Know

A group of teens picked pears during the pear harvest. The number of teens that picked each number of baskets is shown in the table.

Number of Baskets	Tally	Frequency
Three	|||	3
Four	𝍸	5
Five	𝍸 ||||	9
Six	𝍸	5
Seven	|||	3

The circle graph shows the percent of teens that picked each number of baskets.

Baskets of Pears Picked (25 teens)

a) What is an advantage of displaying the data on a circle graph?

b) Is the graph misleading? Explain.

c) State two conclusions that you can make based on the graph.

Explore the Math

In this exploration, students analyse a graph to determine if it represents a given situation.

Method 1 Have students work in pairs to reread the article and answer the questions. Have students discuss their findings in small groups before sharing with the class.

Method 2 Invite a fisheries biologist to talk to the class about DNA testing and how it can help improve fish stocks. If there is a local fish species that has been improved this way, you may wish to provide a different graph to students. Have students study the graph in small groups and then discuss their findings as a class.

Example

The example illustrates critiquing a graph. Before working through the example as a class, it may be helpful for students to work in small groups, review the different types of graphs, and identify which ones display certain types of data better. Summarize the groups' discussions as a class. Ensure that students understand the different information that the circle graphs and the double bar graph provide.

Meeting Student Needs

- Consider using another example and modelling how to critique a graph.
- Be sensitive to students who may hesitate to critique or judge. Emphasize that they are critiquing the way the information is represented, not the information itself. Encourage them to word their critique in positive ways that can help make the message clearer.

ELL

- English language learners may have difficulty with terms such as *DNA testing*, *commercial fishers*, *quota*, *chinook salmon*, *fish stocks*, *harvest targets*, *weaker stocks*, *coded-wire tags*, *examine*, *vertical and horizontal axis*, *critique*, *category*, *majority*, *pears*, and *baskets*. Consider having a volunteer retell the main points in the news article using his or her own words. If possible, show a visual of a Chinook salmon.

Answers

Explore the Math

1. Answers will vary. Example: The author used a stacked bar graph to show a comparison between population quotas and catches. It is effective.

2. a) Answers will vary. Example: The graph is not misleading. The graph uses a continuous scale starting at 0, with intervals of 50 units on the vertical axis. There is a uniform scale of 1-year units from 1995 to 2005, with no break, on the horizontal axis.

b) Answers will vary. Example: You could use a double bar graph to show quota and catch beside each other in each year.

3. a) Answers may vary. Example: The catches were significantly lower from 1995 to 2001, when the coded-wire tags were used.

b) Answers will vary. Example: The graph shows that the catches were significantly higher from 2002 to 2005, when DNA testing was used.

4. Accept any reasonable factor. Examples:
- Determine if the type of graph is the best choice to represent the data.
- Determine if the type of graph is designed to represent the data accurately.
- Determine if the graph supports a claim or an argument, or is informative.

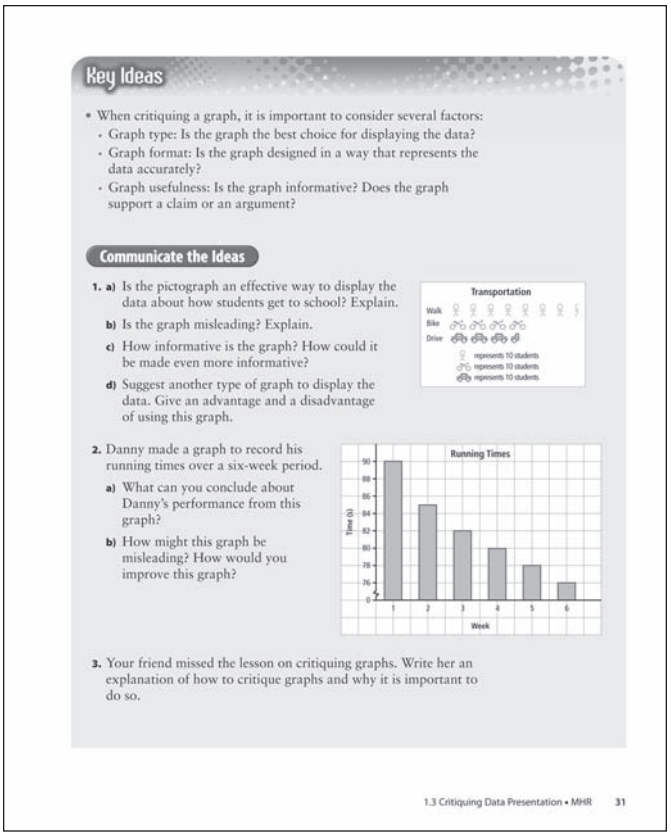
Show You Know: Example

a) Answers will vary. Example: The circle graph compares the percent of teens that picked a specific number of baskets to the total number of teens.

b) The graph is not misleading. Explanations may vary. Example: It indicates the total number of teens, represents each percent accurately, and the percents total 100%.

c) Look for two accurate conclusions. Examples:
- The majority of teens picked between 4 and 6 baskets.
- The same number of teens picked 4 baskets as 6 baskets.

Assessment	Supporting Learning
Assessment *for* Learning	
At the beginning of section 1.3, have students use a KWL chart to identify what they know and want to learn about critiquing data presentations. After completing the section, have them list what they have learned.	• Review the What I **Know** column to assess students' prior knowledge related to the topic. • In the What I **Want** to Know column, have students list at least three things they want to know related to critiquing data presentations. • When filling out the What I **Learned** column, discuss how students might now answer their questions in the What I **Want** to Know column and which ones still need to be answered.
Assessment *as* Learning	
Reflect on Your Findings Listen as students discuss what they discovered during the Explore the Math. Try to have students generalize the factors for critiquing a graph for representing a situation accurately and contribute their ideas to a master list for the class.	• Have students brainstorm features of effective graphs and record their ideas on the board. As a group, develop a master list for critiquing a graph. Include the following headings: graph type, graph format, and graph usefulness. • Check that students have considered factors for critiquing a graph such as whether the type of graph and the format of the graph (e.g., intervals) are appropriate to represent the data, and what information can be obtained from the graph. Prompt students if necessary. • It may be valuable to help students recall the types of graphs that best represent certain types of data.
Assessment *for* Learning	
Example Have students do the Show You Know related to the Example.	• Encourage students to verbalize their thinking. • You may wish to have students work with a partner. After they have discussed their answers, have students move to small groups and share their conclusions. Sharing their conclusions may help clarify any misunderstandings and broaden students' understanding. • Give students a similar problem to solve. Allow them to work with a partner and talk through their thinking.



Key Ideas

- When critiquing a graph, it is important to consider several factors:
  - Graph type: Is the graph the best choice for displaying the data?
  - Graph format: Is the graph designed in a way that represents the data accurately?
  - Graph usefulness: Is the graph informative? Does the graph support a claim or an argument?

Communicate the Ideas

1. a) Is the pictograph an effective way to display the data about how students get to school? Explain.

b) Is the graph misleading? Explain.

c) How informative is the graph? How could it be made even more informative?

d) Suggest another type of graph to display the data. Give an advantage and a disadvantage of using this graph.

Transportation

Walk

Bike

Drive

represents 10 students

represents 10 students

represents 10 students

2. Danny made a graph to record his running times over a six-week period.

a) What can you conclude about Danny's performance from this graph?

b) How might this graph be misleading? How would you improve this graph?

Running Times

Time (s)

Week

3. Your friend missed the lesson on critiquing graphs. Write her an explanation of how to critique graphs and why it is important to do so.

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The Key Ideas summarize three factors to consider when critiquing a graph. For each factor, consider either providing an example from the student resource or having students develop their own examples and critiques that you post around the room.

Have students prepare their own checklist of the three factors including an example for each, and store it in their chapter Foldable.

Communicate the Ideas

These questions encourage students to verbalize their understanding of critiquing graphs. For #1 and #2, students analyse graphs. For #3, they explain how to critique a graph in general terms. Encourage students to be specific and write in their own words. Have them exchange their responses with a partner, give each other constructive feedback, and revise their own response.

Meeting Student Needs

ELL

- If several students share a common first language, consider having them discuss the response to #3 in their first language. This offers them the opportunity to activate their knowledge using familiar language. Afterwards, it may be easier for students to ask for the missing vocabulary to express their thinking in English.

Answers

Communicate the Ideas

1. a) Yes, the pictograph is an effective way to display the data. Explanations may vary. Example: The data can be easily counted and the symbols are appropriate to represent the data.

b) Answers may vary. Examples:
- The graph is not misleading because each symbol is approximately the same size, with symbols equally spaced.
- The graph is misleading because the symbol for walking is smaller than the biking and driving symbols.

c) Answers will vary. Example: The graph is informative because it allows the reader to determine the number of students using each type of transportation. The graph could be more informative by showing how many of the students who bike or drive are within walking distance.

d) Answers will vary. Look for an advantage and a disadvantage for a different type of graph. Examples:
- A bar graph could be used. An advantage is that a bar graph allows for a more accurate reading.
- A disadvantage is that it may be more difficult for younger children to interpret the data on a bar graph than a pictograph.

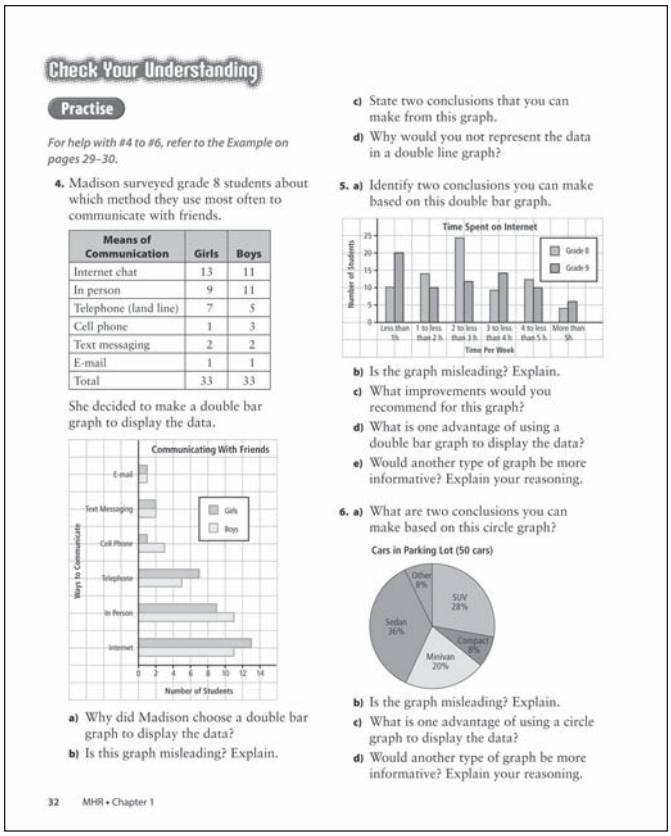
2. a) Answers will vary. Example: Danny is running faster each week.

b) The vertical axis on the graph has a break. It could be improved by using a continuous scale of 0 to 90 on the vertical axis, with no break.

3. Look for three factors to consider when critiquing a graph. Example:
- The type of graph should be the best choice for displaying the data.
- The graph should be designed in a way that represents the data accurately.
- The graph should be informative and support a claim or an argument.

Critiquing graphs is important to ensure you understand the actual data that a graph presents.

Assessment	Supporting Learning
Assessment *as* Learning	
Communicate the Ideas Have students complete #1 and #3.	• Check each student's answers to #1 and #3. Make sure students understand how to critique a graph. Look for descriptors about graph type, graph format, and graph usefulness. • Having students share their response to #3 may help clarify understandings. • Use **Master 2 Two Stars and One Wish** to have students critique other students' writing pieces. This master allows students to write two things they like about a piece and one thing they would like to see improved. • Students who need coaching with #1 might try #2 once they have received the coaching. This second question will help them consolidate their learning.



Check Your Understanding

Practise

For help with #4 to #6, refer to the Example on pages 29–30.

4. Madison surveyed grade 8 students about which method they use most often to communicate with friends.

Means of Communication	Girls	Boys
Internet chat	13	11
In person	9	11
Telephone (land line)	7	5
Cell phone	1	3
Text messaging	2	2
E-mail	1	1
Total	33	33

She decided to make a double bar graph to display the data.

Communicating With Friends

a) Why did Madison choose a double bar graph to display the data?

b) Is this graph misleading? Explain.

c) State two conclusions that you can make from this graph.

d) Why would you not represent the data in a double line graph?

5. a) Identify two conclusions you can make based on this double bar graph.

Time Spent on Internet

b) Is the graph misleading? Explain.

c) What improvements would you recommend for this graph?

d) What is one advantage of using a double bar graph to display the data?

e) Would another type of graph be more informative? Explain your reasoning.

6. a) What are two conclusions you can make based on this circle graph?

Cars in Parking Lot (50 cars)

b) Is the graph misleading? Explain.

c) What is one advantage of using a circle graph to display the data?

d) Would another type of graph be more informative? Explain your reasoning.

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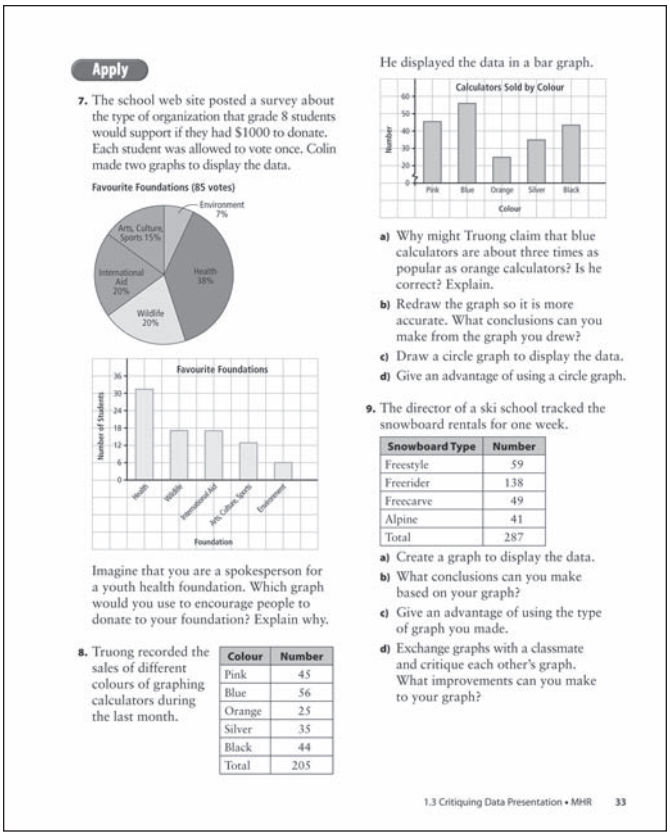

Apply

7. The school web site posted a survey about the type of organization that grade 8 students would support if they had $1000 to donate. Each student was allowed to vote once. Colin made two graphs to display the data.

Favourite Foundations (85 votes)

Favourite Foundations

Imagine that you are a spokesperson for a youth health foundation. Which graph would you use to encourage people to donate to your foundation? Explain why.

8. Truong recorded the sales of different colours of graphing calculators during the last month.

Colour	Number
Pink	45
Blue	56
Orange	25
Silver	35
Black	44
Total	205

He displayed the data in a bar graph.

Calculators Sold by Colour

a) Why might Truong claim that blue calculators are about three times as popular as orange calculators? Is he correct? Explain.

b) Redraw the graph so it is more accurate. What conclusions can you make from the graph you drew?

c) Draw a circle graph to display the data.

d) Give an advantage of using a circle graph.

9. The director of a ski school tracked the snowboard rentals for one week.

Snowboard Type	Number
Freestyle	59
Freerider	138
Freecarve	49
Alpine	41
Total	287

a) Create a graph to display the data.

b) What conclusions can you make based on your graph?

c) Give an advantage of using the type of graph you made.

d) Exchange graphs with a classmate and critique each other's graph. What improvements can you make to your graph?

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Check Your Understanding

Make copies of **Master 8 Centimetre Grid Paper**, **Master 9 0.5 Centimetre Grid Paper**, and **Master 12 Percent Circles** available for students to create their graphs in this section.

Practise

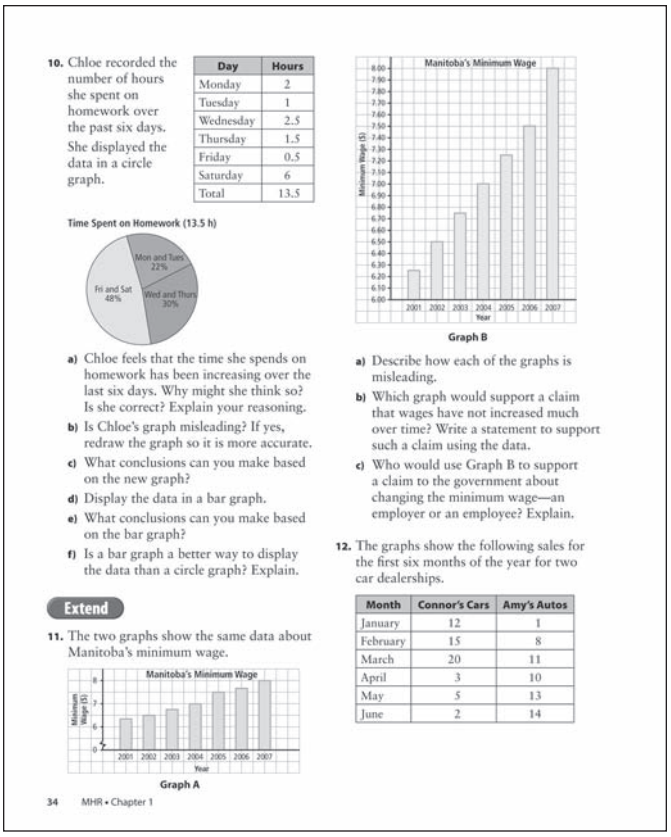
These questions reinforce students' understanding about critiquing a graph. When students are asked if another type of graph would be more informative, refer them back to their notes and the master list that the class developed.

Apply

These questions provide a range of contexts for students to critique graphs. For #9, allow time for students to exchange their graph with a classmate and critique each other's graph. It may be useful to have students refer to a posted list of factors or the checklist in their Foldable.

Extend

These questions allow students to critique graphs that are deliberately misleading. For #11, students write a statement to support a claim. Consider having them draw a new graph that is more accurate. For #12, have students identify any misleading features and suggest how to redraw the graph to make it more accurate.



10. Chloe recorded the number of hours she spent on homework over the past six days. She displayed the data in a circle graph.

Day	Hours
Monday	2
Tuesday	1
Wednesday	2.5
Thursday	1.5
Friday	0.5
Saturday	6
Total	13.5

Time Spent on Homework (13.5 h)

a) Chloe feels that the time she spends on homework has been increasing over the last six days. Why might she think so? Is she correct? Explain your reasoning.
b) Is Chloe's graph misleading? If yes, redraw the graph so it is more accurate.
c) What conclusions can you make based on the new graph?
d) Display the data in a bar graph.
e) What conclusions can you make based on the bar graph?
f) Is a bar graph a better way to display the data than a circle graph? Explain.

Extend

11. The two graphs show the same data about Manitoba's minimum wage.

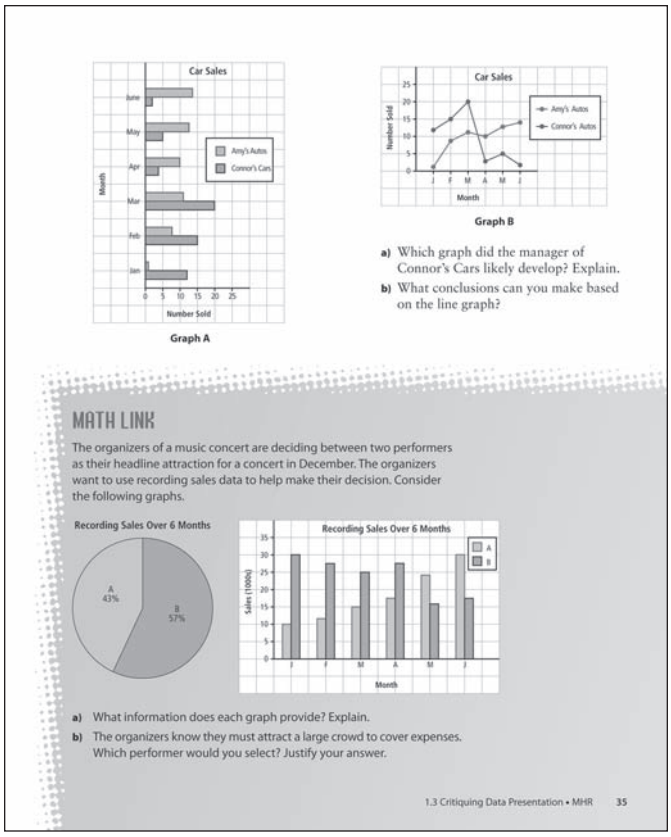
Graph A

Graph B

a) Describe how each of the graphs is misleading.
b) Which graph would support a claim that wages have not increased much over time? Write a statement to support such a claim using the data.
c) Who would use Graph B to support a claim to the government about changing the minimum wage—an employer or an employee? Explain.

12. The graphs show the following sales for the first six months of the year for two car dealerships.

Month	Connor's Cars	Amy's Autos
January	12	1
February	15	8
March	20	11
April	3	10
May	5	13
June	2	14



Graph A

Graph B

a) Which graph did the manager of Connor's Cars likely develop? Explain.
b) What conclusions can you make based on the line graph?

MATH LINK

The organizers of a music concert are deciding between two performers as their headline attraction for a concert in December. The organizers want to use recording sales data to help make their decision. Consider the following graphs.

Recording Sales Over 6 Months

a) What information does each graph provide? Explain.
b) The organizers know they must attract a large crowd to cover expenses. Which performer would you select? Justify your answer.

Math Link

The Math Link provides an opportunity for students to analyse the information provided by two different graphs and then use the information to make a decision. Encourage students to share their answers in a small group.

Meeting Student Needs

- Consider allowing students to use spreadsheet software to create graphs.
- Provide **BLM 1–12 Section 1.3 Extra Practice** to students who would benefit from more practice.

ELL

- English language learners may have difficulty with terms such as *donate* and *vote* in #7, and *car dealership* in #12.
- For #9, have students familiar with snowboards explain each type of snowboard using visuals, if possible.

Gifted and Enrichment

- Challenge students to develop and conduct a survey of their classmates. Make sure that students get your approval for any survey question before they proceed. Have students create multiple graphs that distort the results in favour of one response over others. Using the results from the survey, have students explore chart options for representing the data using spreadsheet software.

Answers

Math Link

a) The circle graph shows what percent each performer's sales are of the total sales. The double bar graph shows the number of sales for each performer in each month of a six-month period.

b) Answers will vary. Example: Performer A seems to be gaining popularity, and could well be the better choice even though performer B has sold more albums over the six-month period.

Assessment	Supporting Learning
Assessment *for* Learning	
Practise Have students do #4 and #6. Students who have no problems with these questions can go on to the Apply questions.	• Students who have problems with #4 and #6 may need additional coaching with the Example. Have students explain their thinking; clarify any misunderstandings. Have them consider the factors for critiquing a graph to help answer the questions. If students are uncertain about the appropriateness of graph types, refer them to the Key Ideas on page 31. Coach students through #4 and #6, and then have them complete #5 on their own.
Math Link The Math Link on page 35 is intended to help students work toward the chapter problem wrap-up titled Wrap It Up! on page 39.	• It is recommended that all students complete the Math Link. • Students who need help getting started could use **BLM 1–13 Section 1.3 Math Link**, which provides scaffolding.
Assessment *as* Learning	
Math Learning Log Have students choose one of the graphs they researched earlier in the chapter and critique it by answering the following questions: • Is the graph the best choice for displaying the data? Explain. • Is the graph designed in a way that represents the data accurately? Explain. • What claim or argument does the graph support?	• Depending on students' learning style, have them provide oral or written answers. • Encourage students to use the What I Need to Work On section of their chapter Foldable to note what they continue to have difficulties with.