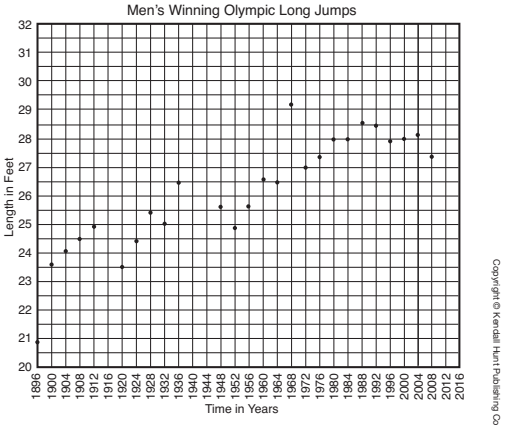
## Predictions from Graphs

Graphs can tell stories. The following graph tells a story about the men's long jump competition in the Olympics. Contestants in the long jump try to jump as far as possible with a running start.






1. **A.** What variable is on the horizontal axis?
   **B.** What variable is on the vertical axis?



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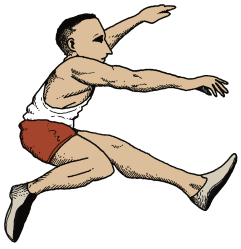
2. Jesse Owens won the long jump competition in 1936.
   **A.** How far did he jump?
   **B.** Is the distance Jesse Owens jumped longer or shorter than the length of your classroom?
   **C.** How many years passed before someone jumped farther than Jesse Owens in the Olympics?
3. **A.** Describe the graph. What does it look like?
   **B.** If you read the graph from left to right, do the points tend to go uphill or downhill?
   **C.** What does the graph tell you about the winning long jumps in the Olympics?



4. In 1968 Bob Beamon of the United States won the long jump competition.
   **A.** How far did Beamon jump?
   **B.** What is unusual about this point on the graph?
   **C.** Do you think the winner in 2016 will jump as far as Bob Beamon jumped in 1968? Why or why not?





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## Student Guide

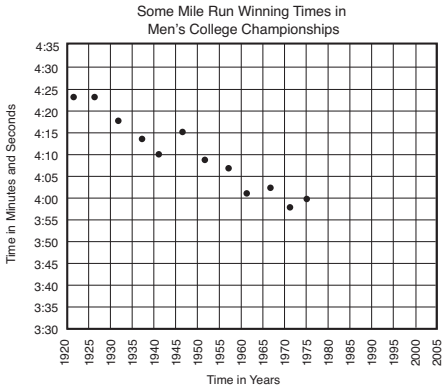
### Questions 1–12 (SG pp. 164–168)

1. **A.** Time in years
   **B.** Length in feet
2. **A.** About 26 $\frac{1}{2}$ feet or 26 feet 6 inches
   **B.** Answers will vary.
   **C.** 24 years
3. **A.*** Possible response: The points go up and then down and then back up again.
   **B.*** They tend to go up.
   **C.*** The length of the jumps is getting longer.
4. **A.*** Approximately 29 feet 2 inches
   **B.** It is more than 2 feet longer than any previous jump.
   **C.*** Possible response: The best-fit line shows that in 2016 the length of the jump could be longer than Bob Beaman's. But since he jumped, all of the distances have been lower, so it may not happen.

***Answers and/or discussion are included in the lesson.**

5. **A.** Time in Years
   **B.** Time in Minutes and Seconds
6. 4 minutes and 10 seconds
7. 1971
8. **A.** Answers will vary. The points form a "bumpy" line.
   **B.** Downhill
   **C.** The winning time for running the mile decreased over the years.
9. **A.*** The line is drawn to fit the points as closely as possible.
   **B.*** 3
   **C.*** 5
   **D.*** 4
10. * Between 4 minutes and 5 seconds and 4 minutes and 10 seconds
11. * Under 3 minutes and 45 seconds
12. **A.*** Interpolation
    **B.*** Extrapolation
    **C.*** Possible response: Interpolation because as you get further from the actual data the predictions are not as close. The time may not be realistic.

The graph below shows the history of the mile run in college championship races. Runners do not run the mile anymore in these track meets because the distances are measured using the metric system. Contestants now run 1500 meters, which is a little shorter than a mile.




**5. A.** What variable is on the horizontal axis?
**B.** What variable is on the vertical axis?

**6.** What was the winning time for running the mile in 1941?

**7.** Find the data point which shows a time for the mile race which is less than 4 minutes. What is the year for this data point?

**8. A.** Describe the graph. What does it look like?
**B.** If you read the graph from left to right, do the points tend to go uphill or downhill?
**C.** What does the graph tell you about the winning times for the mile run?



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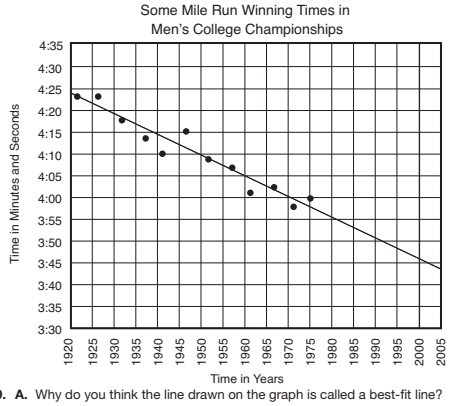
If the points on a graph lie close to a line, you can draw a line to help you make predictions. This line is called a **best-fit line.**




**9. A.** Why do you think the line drawn on the graph is called a best-fit line?
**B.** How many points on the graph are above the line?
**C.** How many points are on the line?
**D.** How many points are below the line?

**10.** Use this graph to estimate the winning time for the mile run in 1955.

**11.** If the mile had been run in the college championships in the year 2005, predict the winning time. Explain how you made your prediction.



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Using the graph to estimate distances which lie between two points on the graph is called **interpolation.** "Inter-" means between points.

Using the graph to predict distances which lie beyond the data points on the graph is called **extrapolation.** "Extra-" means beyond or outside the points on the graph.

**12. A.** Did you use interpolation or extrapolation to estimate the winning time in 1955?
**B.** Did you use interpolation or extrapolation to predict the winning time in 2005?
**C.** Which is more accurate? Explain.

The *Using Best-Fit Lines* pages in the *Student Activity Book* provide more practice with making predictions from graphs.



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***Answers and/or discussion are included in the lesson.**

Name _____ Date _____

## Using Best-Fit Lines

**1.** Each year, Mrs. Welch, a gym teacher at Bessie Coleman School, records the number of sit-ups each student can do. Nila used her data to make a graph that shows the number of sit-ups she could do each year.

**A.** Describe the graph.

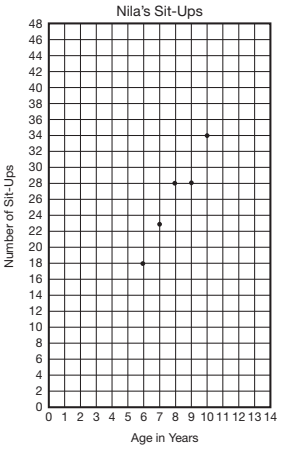
**B.** If you read the graph from left to right, do the points go uphill or downhill?

**C.** What does the graph tell you about the number of sit-ups Nila can do?

**D.** Do the points lie close to a straight line? If so, use a ruler to draw a best-fit line.

**E.** If possible, predict the number of sit-ups Nila will be able to do when she is 12. Show any work on the graph.

**F.** Does knowing Nila's age help you predict the number of sit-ups she can do?





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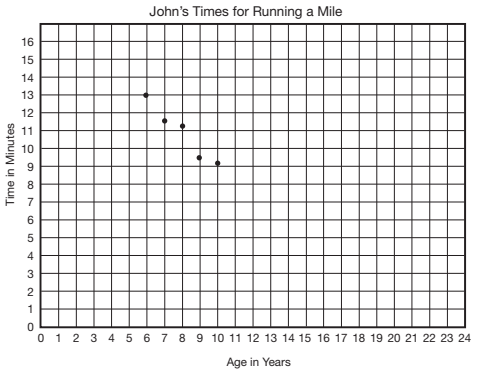
Name _____ Date _____

**2.** Mrs. Welch also records each student's best times for running a mile. John graphed his best times.




**A.** Describe the graph.

**B.** Do the points tend to go uphill or downhill?

**C.** Do the points lie close to a straight line? If so, use a ruler to draw a best-fit line.

**D.** If possible, predict how long it will take John to run a mile when he is 12.

**E.** If possible, predict how long it will take John to run a mile when he is 18.

**F.** Does knowing John's age help you predict his time for running the mile? Explain.





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## Student Activity Book

### Using Best-Fit Lines (SAB pp. 143–150)

### Questions 1–9

1. **A.*** Answers will vary. Students may state that the points tend to go uphill or that Nila can do more and more sit-ups as she gets older.

   **B.*** Uphill

   **C.*** Answers will vary. Nila can do more and more sit-ups as she gets older. She made no progress in the number of sit-ups she could do between the ages of 8 and 9.

   **D.*** Yes. See Figure 1 in the lesson for the best-fit line.

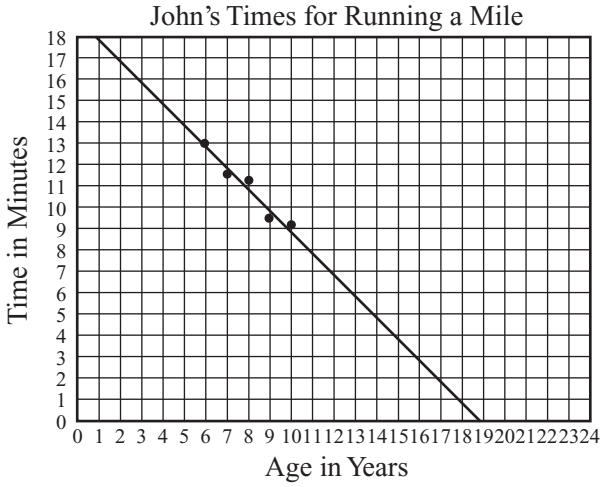
   **E.*** Predictions will vary. About 42. Accept predictions between 39 and 46 sit-ups, but answers should match the line students draw.

   **F.*** Yes

2. **A.** Answers will vary. Students might say that John is becoming a faster runner or that the graph tends to go downhill.

   **B.** Downhill

   **C.** Yes




   **D.** Predictions will vary. About 7 minutes.

   **E.*** Predictions will vary. According to our graph, John will run the mile in about one minute. This is impossible. Students should see that extrapolating this far beyond the last data point is unreliable.

   **F.*** Yes, but not for values far beyond the data points.



***Answers and/or discussion are included in the lesson.**

**3. A.*** Descriptions will vary. The points on the graph are scattered in no apparent order.

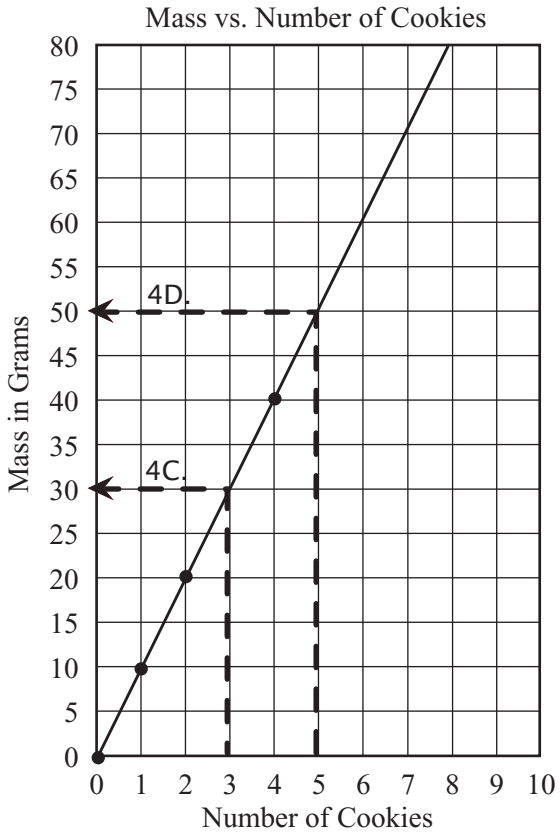
**B.*** No

**C.*** No

**D.*** Students should see that they cannot make reliable predictions on the graph since there is no pattern.

**4. A.*** Descriptions will vary. The points on the graph go uphill and the more cookies you have, the more mass there is.

**B.*** Yes, the points lie on a straight line.




**C.*** 30 grams

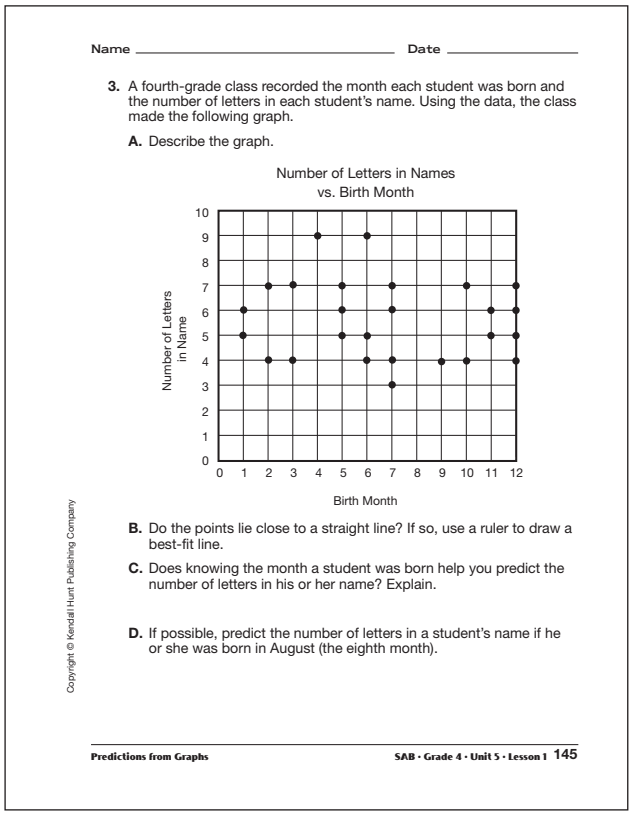
**D.*** 50 grams

**E.*** Interpolation

**F.*** (0, 0); (1, 10); (2, 20); (4, 40)

**G.*** The second number in the pair is equal to the first number multiplied by 10.

**H.*** $8 \times 10 = 80$ grams



Name _____ Date _____

**3.** A fourth-grade class recorded the month each student was born and the number of letters in each student's name. Using the data, the class made the following graph.

**A.** Describe the graph.

Number of Letters in Names vs. Birth Month

Number of Letters in Name

Birth Month

**B.** Do the points lie close to a straight line? If so, use a ruler to draw a best-fit line.

**C.** Does knowing the month a student was born help you predict the number of letters in his or her name? Explain.

**D.** If possible, predict the number of letters in a student's name if he or she was born in August (the eighth month).





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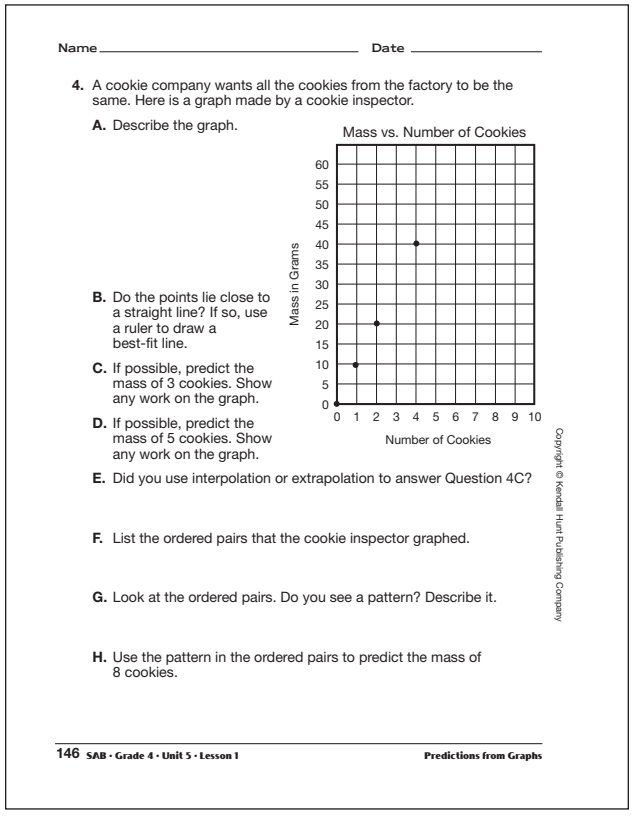

Name _____ Date _____

**4.** A cookie company wants all the cookies from the factory to be the same. Here is a graph made by a cookie inspector.

**A.** Describe the graph.

Mass vs. Number of Cookies

Mass in Grams

Number of Cookies

**B.** Do the points lie close to a straight line? If so, use a ruler to draw a best-fit line.

**C.** If possible, predict the mass of 3 cookies. Show any work on the graph.

**D.** If possible, predict the mass of 5 cookies. Show any work on the graph.

**E.** Did you use interpolation or extrapolation to answer Question 4C?

**F.** List the ordered pairs that the cookie inspector graphed.

**G.** Look at the ordered pairs. Do you see a pattern? Describe it.

**H.** Use the pattern in the ordered pairs to predict the mass of 8 cookies.





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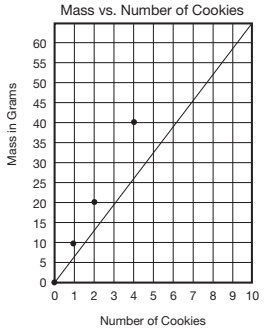
***Answers and/or discussion are included in the lesson.**

Name _____ Date _____

**5.** Ana drew a best-fit line for Question 4. Her line went from corner to corner.




**A.** How many points does Ana's line go through?

**B.** How many points are above her line?

**C.** How many points are below her line?

**D.** Ana predicted that 3 cookies would have a mass of 20 grams and 5 cookies would have a mass of 33 grams. Do you agree with her? What was Ana's mistake?

**E.** What would you tell Ana about how to draw a best-fit line?





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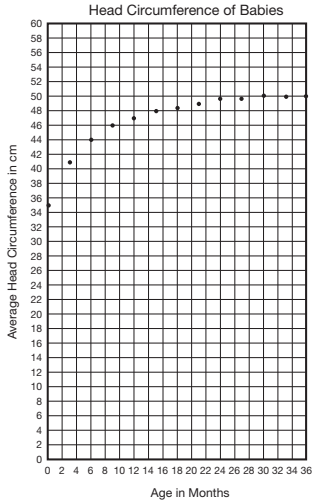
Name _____ Date _____

**6.** Doctors measure the head circumference of babies to track their growth.

**A.** Describe the graph.






**B.** If the points lie close to a line, use a ruler to draw a best-fit line.

**C.** If possible, predict the head circumference of a baby who is four months old.



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**5. A.** 1 point

**B.** 3 points

**C.** 0 points

**D.** Answers will vary. Ana's predictions make sense using her line, but her mistake is she didn't draw a line that best fits the points. Instead she drew a line from one corner of the graph to the opposite corner.

**E.** Answers will vary. Ana should draw a line that has as many points below it as above it or through the points if they follow the pattern.

**6. A.*** Descriptions will vary. The points tend to go uphill, but not in a line. They go uphill in a curve and level off.

**B.*** The points lie on a curve, so it does not make sense to draw a best-fit line.

**C.*** Predictions will vary. About 42 cm. Accept predictions between 41 and 43 cm.



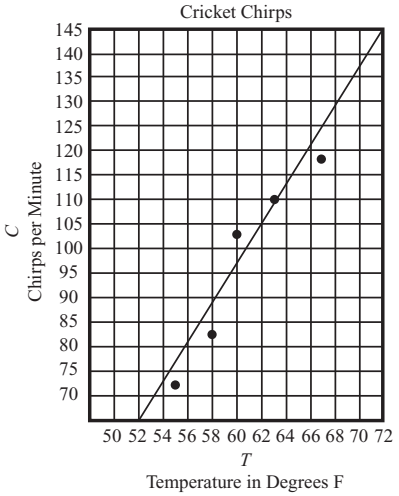
***Answers and/or discussion are included in the lesson.**

**7. A.** (67, 118); (63, 110); (58, 82); (60, 102); (55, 72)

**B.** Descriptions will vary. Students may say the points go "uphill."

**C.** The number of chirps also goes up.

**D.**




**E.** Around 135 chirps per minute. Accept predictions between 130 and 140 chirps.

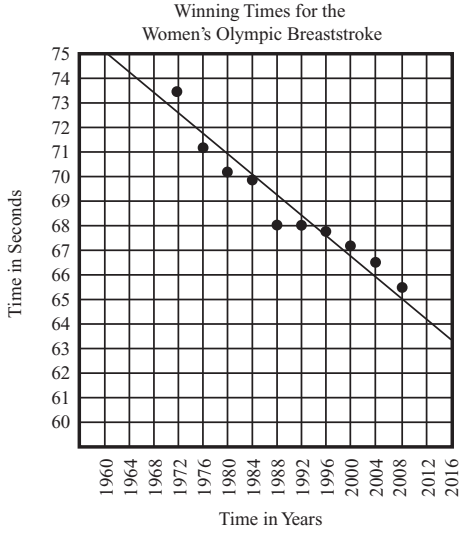
**F.** Predictions will vary. Around 80 chirps per minute. Accept predictions between 75 and 85 chirps.

**G.** Extrapolation

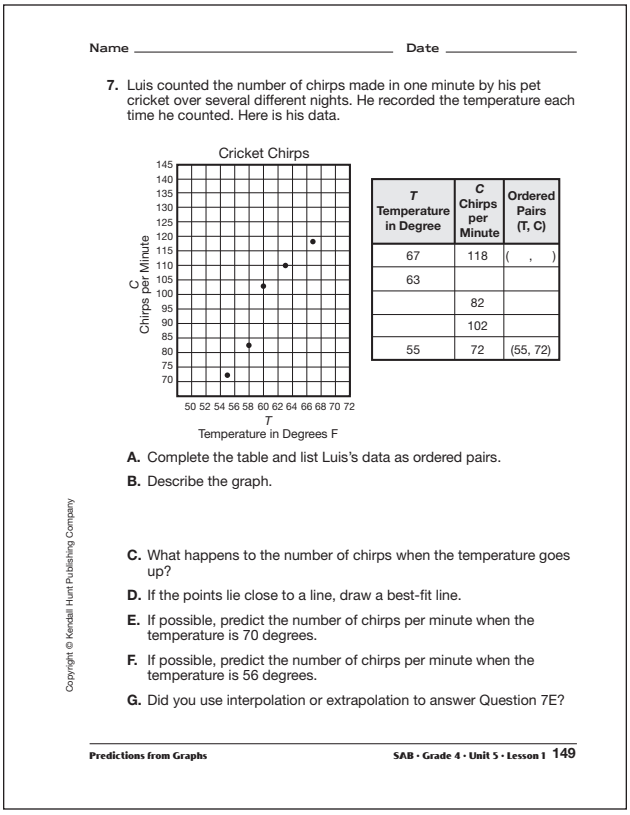
**8.*** The Mass vs. Number of Cookies graph. Its points lie on a straight line.

**9. A.** Descriptions will vary. The points tend to go downhill. As the years go by, women are becoming faster swimmers.

**B.**




**C.** Answers will vary. Between 63 and 64 sec.



Name _____ Date _____

**7.** Luis counted the number of chirps made in one minute by his pet cricket over several different nights. He recorded the temperature each time he counted. Here is his data.



| T Temperature in Degree | C Chirps per Minute | Ordered Pairs (T, C) |
|---|---|---|
| 67 | 118 | ( , ) |
| 63 | | |
| | 82 | |
| | 102 | |
| 55 | 72 | (55, 72) |

**A.** Complete the table and list Luis's data as ordered pairs.

**B.** Describe the graph.

**C.** What happens to the number of chirps when the temperature goes up?

**D.** If the points lie close to a line, draw a best-fit line.

**E.** If possible, predict the number of chirps per minute when the temperature is 70 degrees.

**F.** If possible, predict the number of chirps per minute when the temperature is 56 degrees.

**G.** Did you use interpolation or extrapolation to answer Question 7E?





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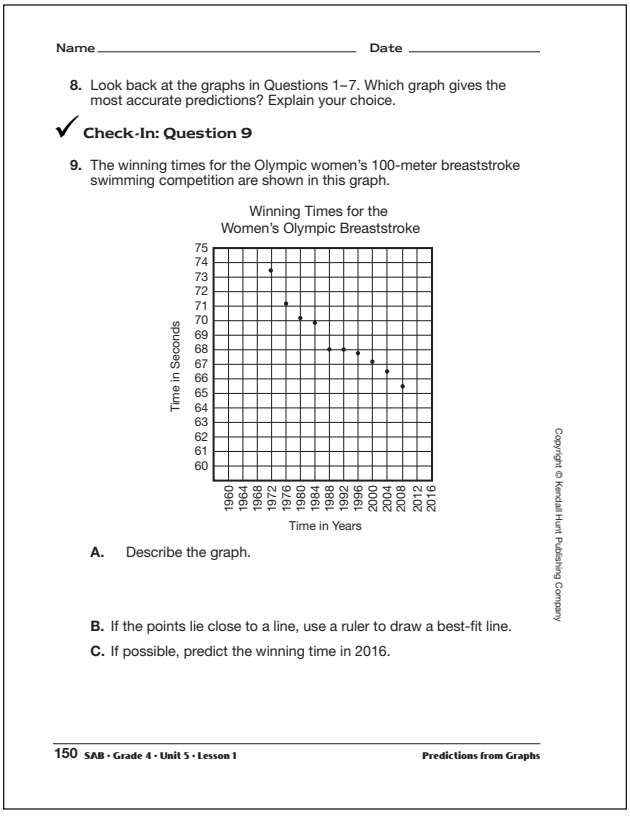

Name _____ Date _____

**8.** Look back at the graphs in Questions 1–7. Which graph gives the most accurate predictions? Explain your choice.

✓ **Check-In: Question 9**

**9.** The winning times for the Olympic women's 100-meter breaststroke swimming competition are shown in this graph.



**A.** Describe the graph.

**B.** If the points lie close to a line, use a ruler to draw a best-fit line.

**C.** If possible, predict the winning time in 2016.





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