

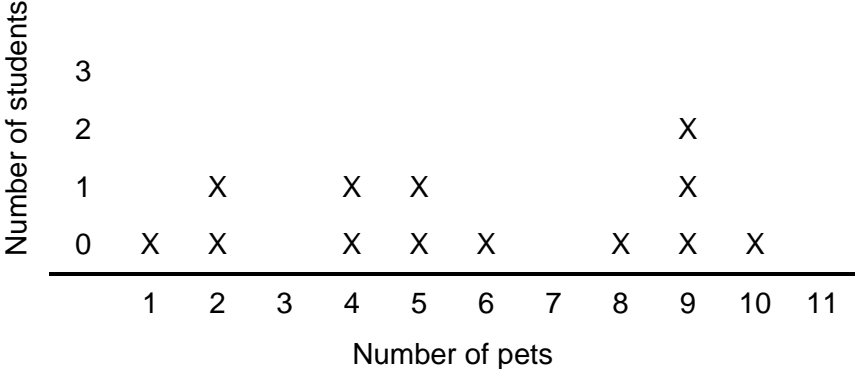
DATA AND PROBABILITY

Grade 3

BIG IDEA (1): Formulate questions that can be addressed with data and collect, organize and display data to answer them

CONCEPT	EXPECTATION	EXAMPLE
A Formulate questions	Design investigations to address a given question	<p>Problem: Which method below would be the best way for us to find out the most popular birthday month in our class?</p> <p>A. Ask the teacher. B. Call the parents of every student in our class, and ask them their child's birthday. C. Have each student in our class write his or her birthday month on a Post-it, then make a bar graph with the Post-it notes. D. Ask the school secretary to make a list of the birthdays of all third graders in the school.</p> <p>Answer: C</p> <p>Problem: Each student in a class was asked to write down the number of children in his or her family. Which question below could the students answer with the information they collect?</p> <p>A. What are the ages of all the students in the class? B. What is the most common number of children in the students' families? C. What is the most popular name of children in the students' families? D. Which student has to do the least number of chores at night?</p>

CONCEPT	EXPECTATION	EXAMPLE
		<p>Answer: B</p> <p>TEACHER NOTES: When designing investigations, students need to look carefully at the wording of the question. They need to ask themselves questions such as: Is the question clear? Is there a need to define any of the terms (e.g., Who is a sibling? Sisters and brothers only? Sisters and brothers, as well as half-brothers, half-sisters, step-sisters, step-brothers?) Students can then determine what type of data collection (e.g., surveys, interviews, measurements, observations, experiments, examination of available records, etc.) will provide the answer to the question. Next, students will need to consider sampling: Who should answer the surveys? From whom will they take measurements? Where will they stage their observations? What kind of experiments will they conduct? What records will they examine? etc. Once students have devised a process, they need to try it out on a small sample to find out if the process actually provides data that answers the original question. If not, they should revise the process accordingly.</p>

CONCEPT	EXPECTATION	EXAMPLE
C Represent and interpret data	Read and interpret information from line plots and graphs (bar, line, pictorial)	<p>Problem: Based on the line plot below, which of the following sentences is true?</p> <p style="text-align: center;">Third-Graders' Pets</p>  <p style="text-align: center;">Number of students</p> <p style="text-align: center;">Number of pets</p> <p>A. Two third graders have seven pets. B. All third graders have at least one pet. C. Most third graders have no pets. D. Four of the third graders have more than eight pets.</p>

DEFINITIONS:

bar graph—a diagram showing frequency of data on a number line.¹

line graph—a graph that uses the height or length of rectangles to compare data.²

line plot—a diagram showing frequency of data on a number line.³






































pictorial (picture) graph—a graph that uses picture or symbols to show data.⁴

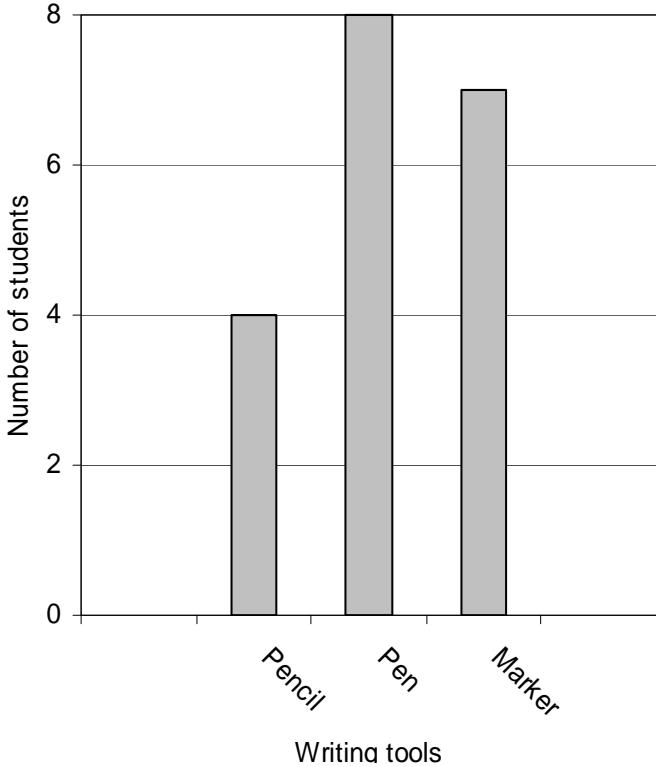
¹ Cavanah, M. (2000). *Math to know* (p. 443). Wilmington, MA: Great Source Education Group, Inc.

² Cavanah, M. (2000). *Math to know* (p. 454). Wilmington, MA: Great Source Education Group, Inc.

³ Cavanah, M. (2000). *Math to know* (p. 454). Wilmington, MA: Great Source Education Group, Inc.

⁴ Cavanah, M. (2000). *Math to know* (p. 460). Wilmington, MA: Great Source Education Group, Inc.

CONCEPT	EXPECTATION	EXAMPLE										
		<p>Answer: D</p> <p>Problem: A third-grade class made this pictograph of their favorite pie flavors.</p> <p style="text-align: center;">Favorite Pie Flavors</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td style="text-align: center;">Apple</td> <td style="text-align: center;">  </td> </tr> <tr> <td style="text-align: center;">Cherry</td> <td style="text-align: center;"> </td> </tr> <tr> <td style="text-align: center;">Lemon</td> <td style="text-align: center;"></td> </tr> <tr> <td style="text-align: center;">Blueberry</td> <td style="text-align: center;"></td> </tr> <tr> <td style="text-align: center;">Chocolate</td> <td style="text-align: center;">    </td> </tr> </tbody> </table> <p style="text-align: center;"> = 2 students</p> <ol style="list-style-type: none"> 1. Based on the information in this graph, which is the favorite flavor of the class? 2. How many students chose apple as their favorite flavor? <p>Answers:</p> <ol style="list-style-type: none"> 1. Chocolate 2. Six students 	Apple	  	Cherry	 	Lemon		Blueberry		Chocolate	    
Apple	  											
Cherry	 											
Lemon												
Blueberry												
Chocolate	    											

CONCEPT	EXPECTATION	EXAMPLE								
		<p>Problem: The bar graph below shows the writing tools students chose when the teacher gave them a choice.</p> <p style="text-align: center;">Writing Tools Used Per Student</p>  <p>The bar graph displays the number of students for three writing tools. The vertical axis is labeled 'Number of students' and ranges from 0 to 8 with grid lines every 2 units. The horizontal axis is labeled 'Writing tools' and has three categories: Pencil, Pen, and Marker. The bar for Pencil reaches the 4 mark, the bar for Pen reaches the 8 mark, and the bar for Marker reaches the 7 mark.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Writing tool</th> <th>Number of students</th> </tr> </thead> <tbody> <tr> <td>Pencil</td> <td>4</td> </tr> <tr> <td>Pen</td> <td>8</td> </tr> <tr> <td>Marker</td> <td>7</td> </tr> </tbody> </table> <p>Use the bar graph to decide which of the following sentences is <i>false</i>.</p> <ul style="list-style-type: none"> A. Most students chose markers. B. There are 19 students represented on the graph. C. Eight students chose a pen. 	Writing tool	Number of students	Pencil	4	Pen	8	Marker	7
Writing tool	Number of students									
Pencil	4									
Pen	8									
Marker	7									

		D. Most students would rather use a marker than a pencil.
CONCEPT	EXPECTATION	EXAMPLE
		<p>Answer: B is the only true statement.</p> <p>TEACHER NOTES: Students need to be able to read a graph and make statements such as “On this graph, the favorite candy of seven students is Skittles”; “Of the candies shown, peppermint is the least popular candy in our class”; or “One plant only grew 15 centimeters tall.”</p> <p>Although they do not need to know the terms, students in third grade should be exposed to graphs of categorical data (data that represent individuals or objects by one or more characteristics or traits) and quantitative data (data that represent objects or individuals by numbers assigned to certain measurable properties). The type of data affects the nature of the interpretations students can make.</p>

BIG IDEA (2): Select and use appropriate statistical methods to analyze data

CONCEPT	EXPECTATION	EXAMPLE
<p>A Describe and analyze data</p>	<p>Describe the <u>shape of data</u> and analyze it for patterns</p>	<p>Problem: After investigating the number of years their families had lived in a particular town, students in a third-/fourth-grade class compiled the following⁵:</p> <p style="text-align: center;">Years Our Families Have Lived in This Town</p> <p style="text-align: center;">Use the line plot to answer the following questions.</p> <ol style="list-style-type: none"> 1. What is the longest time a family has lived in our town? 2. How many years have most families lived in our town? How do you know? 3. How many families have lived less than 15 years in our town?

DEFINITION:

shape of data—an overview of numerical data—the highest and lowest points (range) of the data, where most of the data are clumped together, where there are no data, where there are data located far from the rest of the data (outliers), as well as what the mode and median are.⁶


⁵ Russell, S. J., Schifter, D., & Bastable, V. (2002). *Developing mathematical ideas: Working with data casebook* (pp. 65). Parsippany, NJ: Dale Seymour Publications.

⁶ Russell, S. J., Schifter, D., & Bastable, V. (2002). *Developing mathematical ideas: Working with data casebook* (pp. 65–68). Parsippany, NJ: Dale Seymour Publications.

CONCEPT	EXPECTATION	EXAMPLE
		<p>Answers:</p> <ol style="list-style-type: none"> 1. Twenty-four years 2. Three years. I know this because three years has more Xs than the other years. 3. Nineteen families <p>TEACHER NOTES:</p> <p>First, the teacher will need to ascertain whether students are able to read the graph and understand what kind of information it provides.</p> <p>Initially, students may describe the data in this way:</p> <ul style="list-style-type: none"> • The longest someone has lived in our town is 37 years. The shortest time is 0 years (one student had just moved from another town). • A lot of people have been here for 3 years. • Not a lot of people have lived here for a long time. <p>Because several students had said that the four Xs at 3 years were “a lot,” the teacher asked what the students meant. When Anna responded, “It’s the only one that has four, and all the rest have less than that,” the teacher asked, “How many Xs are in the graph?” After counting 23 Xs, Anna realized that four wasn’t “a lot” after all.</p> <p>Probing students further, with the hope that they would develop summarizing statements, the teacher asked, “So what does the data tell us about how many years the families in our class have lived in this town?” Some students focused on the clump of Xs between 0 and 6 years, because it represented 11 families, nearly half of the 23 represented on the graph. Others might also observe that a small but significant clump of families had lived in the town from 10 to 14 years. The questions that teachers should help students to develop deeper and more accurate descriptions based on the shape of the data.</p>

CONCEPT	EXPECTATION	EXAMPLE
		<p>It is natural for young students to gravitate toward the mode, so the teacher must guide them to examine other aspects of the data as well. Students should point out the “bumps” or “hills” in the data, as well as the empty spots. They should also notice where most of the data are located, along with the highest and lowest data points.</p>

BIG IDEA (3): Develop and evaluate inferences and predictions that are based on data

CONCEPT	EXPECTATION	EXAMPLE
<p>A Develop and evaluate inferences</p>	<p>Discuss events related to students' experiences as likely or unlikely</p>	<p>Problem: There is only one green tile in each of the bags shown below.</p> <ol style="list-style-type: none"> From which bag would you be most likely to pick the green tile? Explain why you chose that bag. <div style="text-align: center;">  </div> <p>Answers:</p> <ol style="list-style-type: none"> I would chose the bag with 10 tiles. Because there are less extra tiles in that bag, you would be more likely to draw the green tile from that bag. <p>Problem: The following students' names were placed in a basket for a drawing: Alex Betty Ben Sierra Rex Randy Luke Seth Dawn Darin Is the teacher more likely or less likely to draw a student's name that has an "e" in it? Explain your answer.</p> <p>Answer: The teacher is more likely to draw a student's name that has an "e" in it. There are 10 names total, and 7 have "e"s in them, and 3 do not. So the teacher is more likely to draw a name with an "e" in it.</p>

