

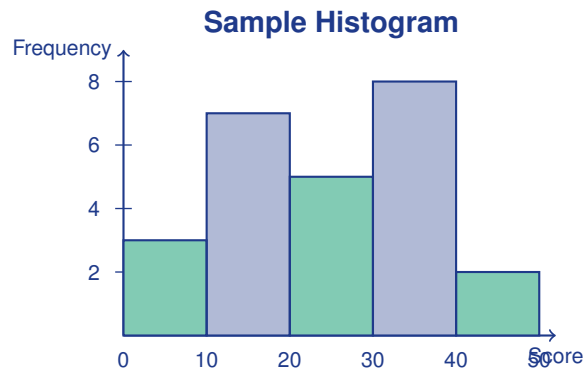
# Histograms and Stem-and-Leaf Plots

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A **histogram** uses touching bars to show how often data falls within equal-width intervals called *bins*—and unlike a regular bar graph, the bars touch because the data is continuous, picking up right where the previous bar left off. A **stem-and-leaf plot** organizes every data value into rows so you can see the shape of the distribution *and* keep all the original numbers visible. Both displays help you spot patterns, clusters, gaps, and outliers at a glance. Learning to read and build these graphs is essential for describing data and making smart comparisons!



## Key Concepts & Quick Review

### Histogram:

- Bars touch (no gaps) because the data is continuous.
- Each bar covers one interval (e.g., 0–9, 10–19, ...).
- The height of each bar shows the **frequency** (count) of data in that interval.

### Stem-and-Leaf Plot:

- The **stem** is the leading digit(s); the **leaf** is the last digit.
- Leaves are listed in order from least to greatest.
- A key tells you what the digits represent (e.g.,  $3 | 5 = 35$ ).

## Examples

① A histogram shows: 0–9 (3 students), 10–19 (7 students), 20–29 (5 students). How many students scored below 20?

**Think It Through:** The question asks how many students scored *below* 20, which means we need the bars for 0–9 and 10–19. Read the heights: the first bar is 3 students and the second bar is 7 students. Add them up:  $3 + 7 = 10$ . So 10 students scored below 20.

**Answer:** 10 students



② Make a stem-and-leaf plot for: 23, 25, 31, 34, 34, 38, 42, 47.

**Think It Through:** In a stem-and-leaf plot the *tens* digit is the stem and the *ones* digit is the leaf.

Group the data by tens:

Stem | Leaf

2 | 3 5

3 | 1 4 4 8

4 | 2 7

Key: 2 | 3 = 23. Notice that leaves in each row go from smallest to largest—that makes reading the data much easier.

**Answer:** See plot above

**Practice Problems**

Use the information given to answer each question.

1. A histogram has interval 0–9 with frequency 4, interval 10–19 with frequency 8, and interval 20–29 with frequency 6. How many data values are shown? \_\_\_\_\_
2. In problem 1, which interval has the greatest frequency? \_\_\_\_\_
3. In problem 1, how many data values are less than 20? \_\_\_\_\_
4. A histogram has frequencies 3, 7, 10, and 5 for the intervals 50–59, 60–69, 70–79, and 80–89. How many data values are shown? \_\_\_\_\_
5. Using the histogram in problem 4, how many scores are at least 70? \_\_\_\_\_
6. Using the histogram in problem 4, what fraction of the scores are in the 60–69 interval? \_\_\_\_\_
7. A stem-and-leaf plot has the row 1 | 2 5 8. List the data values in that row. \_\_\_\_\_
8. A stem-and-leaf plot has the row 3 | 0 0 4 7. Find the median of those values. \_\_\_\_\_
9. A stem-and-leaf plot has rows 2 | 1 6, 3 | 3 9, and 4 | 5. Find the range. \_\_\_\_\_
10. How many data values are shown in the stem-and-leaf plot from problem 9? \_\_\_\_\_
11. Make a stem-and-leaf plot for the data set 45, 48, 52, 55, 55, 61, 63. \_\_\_\_\_
12. Make a stem-and-leaf plot for the data set 12, 15, 18, 22, 24, 30. \_\_\_\_\_
13. A histogram uses equal-width bins from 0 to 24, and each bin has width 5. How many bars are needed? \_\_\_\_\_
14. A stem-and-leaf plot has the row 5 | 0 3 3 7 9. Find the mode of those values. \_\_\_\_\_
15. Can you find the exact median from a histogram alone? Explain why or why not. \_\_\_\_\_

**Study Tips**

**Histogram bars touch** (unlike bar graphs for categorical data). No gaps means the intervals are continuous.



- 👉 In a stem-and-leaf plot, always write leaves in **ascending order** and include a **key** so the reader knows what the digits mean.
- 👉 You **cannot** read individual data values from a histogram, only frequencies per interval. A stem-and-leaf plot preserves every value.

### 📖 Word Problems

16. A teacher records quiz scores: 72, 75, 78, 80, 82, 85, 88, 90, 93, 95. Create a stem-and-leaf plot and find the median. \_\_\_\_\_
17. A histogram of students' reading times (in minutes) shows: 0–14: 3 students, 15–29: 8, 30–44: 12, 45–59: 5. How many students read for at least 30 *min*? \_\_\_\_\_
18. Use this histogram (test scores for one class) to find: (a) the total number of students, (b) the modal interval (the bar with the most students), (c) how many students scored *at least* 80. \_\_\_\_\_



## Answer Keys

- |   |  |
|---|--|
| <p>1) 18</p> <p>2) 10–19</p> <p>3) 12</p> <p>4) 25</p> <p>5) 15</p> <p>6) <math>\frac{7}{25}</math></p> <p>7) 12, 15, 18</p> <p>8) 32</p> <p>9) 24</p> <p>10) 5</p> | <p>11) 4 5, 8; 5 2, 5, 5; 6 1, 3</p> <p>12) 1 2, 5, 8; 2 2, 4; 3 0</p> <p>13) 5</p> <p>14) 53</p> <p>15) no; only estimate</p> <p>16) Stem-and-leaf: 7 2, 5, 8; 8 0, 2, 5, 8; 9 0, 3, 5;<br/>median 83.5</p> <p>17) 17 students</p> <p>18) (a) 30 students; (b) 80–89; (c) 19 students</p> |
|---|--|

### Step-by-Step Explanations

**Strategy:** For Surface Area of Cylinders, combine the two circular bases with the rectangle that wraps around the side. The final surface-area answer should include both bases and the curved side.

**Practice 1:** Find the total surface area of a cylinder with radius  $4\text{ cm}$  and height  $6\text{ cm}$ . **Answer:** 251.2  
For the first sample, add the two circular bases and the rectangular curved surface area.

**Practice 15:** Find the total surface area of a cylinder with radius  $9\text{ m}$  and height  $5\text{ m}$ . **Answer:** 791.28  
Late in the set, add the two circular bases and the rectangular curved surface area.

**Word-problem notes:**

**16. Answer:**  $301.44\text{ cm}^2$

Since the mug is open on top, there is only *one* circular base instead of two. Base area:  $3.14 \times 4^2 = 50.24\text{ cm}^2$ . Lateral area (the curved side):  $2 \times 3.14 \times 4 \times 10 = 251.2\text{ cm}^2$ . Add them together:  $50.24 + 251.2 = 301.44\text{ cm}^2$ . Remember, if the top were closed you would add another 50.24!

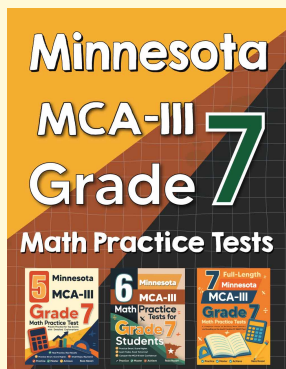
**17. Answer:**  $169.56\text{ cm}^2$

A label wraps around the curved side of the can, so we need the lateral area only. The diameter is  $6\text{ cm}$ , giving  $r = 3\text{ cm}$ . Plug into the formula:  $LA = 2\pi rh = 2 \times 3.14 \times 3 \times 9 = 169.56\text{ cm}^2$ . That is exactly how much paper one label requires.



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