# Frequency and Histograms

| Name: _____ | Date: _____ | Score: _____ / 48 |
|---|---|---|

## Quick Review

A **frequency** is just a tally count – how many times a value (or a value inside a particular range) shows up in the data. A **frequency table** groups the data into **bins** (also called intervals or classes) and lists how many data points land in each bin.

**Relative frequency** is the proportion, not the raw count: divide each bin's frequency by the total sample size. Relative frequencies always sum to $1$ (or $100\%$) because every data point is in exactly one bin.

**A histogram** is the picture of a frequency table. Bars sit side by side – *no gaps* – because the $x$-axis is a continuous number line. That's the big visual difference between a histogram and a bar chart: bar charts show categories and have gaps; histograms show numerical intervals and the bars touch.

**Bin width matters.** Skinny bins (more bars) show fine detail but can look jagged from random noise. Wide bins (fewer bars) smooth things out but can hide real patterns. There's no single "right" width – it's a judgment call.

**Reading shape.** A histogram with most data piled on the left and a thin tail stretching right is *right-skewed* (positive skew). Tail to the left means *left-skewed*. Roughly mirror-image bars mean *symmetric*. The distribution is named for the direction the tail points – a classic trap is to name it for where the bulk sits instead.

**Common slips.** Confusing a histogram with a bar chart (categorical vs. numerical). Forgetting that changing bin width does not change the data count – it only changes how the bars look. Reporting a relative frequency as a count instead of a proportion.

## PRACTICE

*Read or build frequency tables; describe the histogram shape when asked.*

1. What does the frequency of a data value tell you? _____
2. State one key visual difference between a histogram and a bar chart. _____
3. Find the relative frequency of a bin with count $9$ in a sample of $30$ students. _____
4. True or false: the sum of all relative frequencies in any frequency table equals $1$. _____
5. In a survey of $30$ students about books read last month, the bins are $0$–$1$, $2$–$3$, $4$–$5$, $6$–$7$ with frequencies $6, 11, 9, 4$. How many students read $4$ or more books? _____

| Books | Frequency |
|---|---|
| $0$–$1$ | 6 |
| $2$–$3$ | 11 |
| $4$–$5$ | 9 |
| $6$–$7$ | 4 |

6. From the same table, what fraction of the $30$ students read $4$ or more books? _____
7. In a class of $40$ students, the $3$–$5$ hours of study bin has frequency $14$. Find its relative frequency. _____

| Hours | Frequency |
|---|---|
| $0$–$2$ | 8 |
| $3$–$5$ | 14 |
| $6$–$8$ | 12 |
| $9$–$11$ | 6 |

8. Using the same table, what is the relative frequency of the $6$–$8$ hour bin? _____
9. A histogram has most bars piled on the right side and a thin tail trailing to the left. Name the shape. _____

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**10.** In a frequency table of $25$ volunteers' ages with bins $15$–$24$ (freq $7$), $25$–$34$ (freq $10$), $35$–$44$ (freq $5$), $45$–$54$ (freq $3$), which bar would be tallest in a histogram? _____

| Age | Frequency |
|---|---|
| 15–24 | 7 |
| 25–34 | 10 |
| 35–44 | 5 |
| 45–54 | 3 |

**11.** If a data set has $50$ total points and the relative frequency of a bin is $0.24$, what is the bin's frequency? _____

**12.** A student narrows the bin width from $10$ to $5$ on the same data set. How does the number of bars change? _____

**13.** True or false: changing the bin width changes the total number of data values. _____

**14.** Is a histogram appropriate for displaying favorite ice-cream flavors? _____

**15.** Bins of size $3$ are $0$–$2$, $3$–$5$, $6$–$8$, $9$–$11$. Which bin holds the value $5$? _____

**16.** A frequency table has bin counts $4, 11, 9, 6$. What is the total sample size? _____

**17.** True or false: a histogram with all bars roughly equal height is called uniform. _____

**18.** A histogram is roughly symmetric. What can you say about its tail directions? _____

**19.** Out of $20$ students, $7$ landed in the $85$–$94$ bin. Find the relative frequency of that bin as a percent. _____

**20.** Two bins have frequencies $8$ and $12$ out of a total of $40$. What fraction of the data lies in either bin? _____

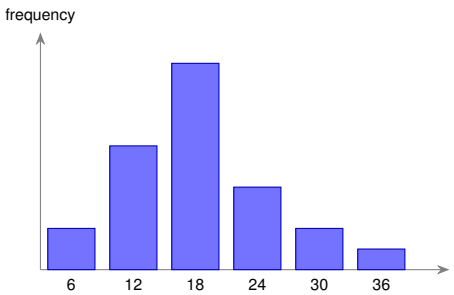
## Word Problems

**21.** A teacher records the quiz scores of $20$ students: $65, 72, 88, 91, 78, 85, 69, 74, 82, 95, 77, 83, 70, 86, 90, 68, 81, 76, 89, 93$. Using bins $65$–$74$, $75$–$84$, $85$–$94$, $95$–$104$, which bin has the highest frequency? ____

**22.** A coach asks her runners how many minutes they trained each day last week. She bins the answers and gets the table below. What is the relative frequency of the $30$–$44$ minute bin, as a percent? _____

| Minutes | Frequency |
|---|---|
| 0–14 | 5 |
| 15–29 | 9 |
| 30–44 | 14 |
| 45–59 | 7 |
| 60–74 | 5 |

**23.** A pediatrician records the ages (in months) of $25$ toddlers visiting her clinic. The histogram is below. Describe the shape and which measure of center – mean or median – would be the better summary. ____

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**24.** A statistics teacher hands out a survey: "how many hours did you sleep last night?" The $30$ responses are binned and shown in the frequency table below. What fraction of students slept $8$ or more hours? Give your answer as a reduced fraction. _____

| Hours | Frequency |
|---|---|
| 4–5 | 3 |
| 6–7 | 12 |
| 8–9 | 10 |
| 10–11 | 5 |

## Additional Practice

**25.** Find the mean of $4, 6, 8, 10$. _____

**26.** Find the median of $3, 9, 4, 10, 7$. _____

**27.** Find the range of $12, 5, 9, 20$. _____

**28.** Find the mode of $2, 3, 3, 5, 8$. _____

**29.** Find $z$ for $x = 72$, mean $60$, standard deviation $6$. _____

**30.** Interpret $z = -1.5$. _____

**31.** Predicted $y$ for $\hat{y} = 2x + 5$ at $x = 6$. _____

**32.** Residual if actual $= 20$ and predicted $= 17$. _____

**33.** Positive association: slope sign? _____

**34.** Margin of error $= 3\%$ around $58\%$. _____

**35.** Sample or census: survey every student. _____

**36.** Random assignment belongs to which study type? _____

**37.** Find Q1 for $2, 4, 6, 8, 10$. _____

**38.** Find Q3 for $2, 4, 6, 8, 10$. _____

**39.** IQR if $Q1 = 12$ and $Q3 = 27$. _____

**40.** Normal data: about what percent within $1$ SD? _____

**41.** Mean of $5, 5, 8, 10$. _____

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**42.** Median of $1, 4, 9, 12, 18, 20$. _____

**43.** Range of $-3, 4, 11, 15$. _____

**44.** Mode of $6, 7, 7, 8, 8, 8$. _____

**45.** $z$ for $x = 45$, mean $50$, standard deviation $5$. _____

**46.** Residual if actual $= 31$ and predicted $= 28$. _____

**47.** IQR if $Q1 = 6$ and $Q3 = 14$. _____

**48.** About what percent is within $2$ SD in a normal model? _____

# Answer Keys

1. how many times it appears
2. histogram bars touch; bar-chart bars have gaps
3. $0.30$
4. True
5. $13$
6. $\frac{13}{30}$
7. $0.35$
8. $0.30$
9. left-skewed
10. $25$–$34$
11. $12$
12. the number of bars roughly doubles
13. False
14. No – use a bar chart
15. $3$–$5$
16. $30$
17. True
18. both tails are similar in length
19. $35\%$
20. $\frac{1}{2}$
21. $85$–$94$
22. $35\%$
23. right-skewed; the median is a better summary
24. $\frac{1}{2}$

### Additional Practice Answers

25. $7$
26. $7$
27. $15$
28. $3$
29. $2$
30. $1.5$ SD below mean
31. $17$
32. $3$
33. positive
34. $55\%$ to $61\%$
35. census
36. experiment
37. $3$
38. $9$
39. $15$
40. $68\%$
41. $7$
42. $10.5$
43. $18$
44. $8$
45. $-1$
46. $3$
47. $8$
48. $95\%$

**Additional Practice:** Answers for all numbered items, including the added practice, are shown in the grid above.

## Step-by-Step Explanations

**1.** Frequency is a raw tally count – nothing more. If $7$ shows up three times in the data, its frequency is $3$.
**2.** Histograms display numerical intervals on a continuous number line, so consecutive bars share an edge. Bar charts display categories (no natural order between them), so the bars are separated.
**3.** Relative frequency $= \frac{9}{30} = 0.30$ $(30\%)$. That's the share of the sample sitting in that bin.
**4.** Every data point falls into exactly one bin, so the proportions add up to the whole – $1$, or $100\%$.
**5.** Add the last two bins: $9 + 4 = 13$. The first two bins are *below* the cutoff of $4$, so leave them out.
**6.** Keep the rule visible: $13$ students out of $30$ – write the count over the total. (That's about $0.433$, or $43\%$.) That gives a quick check on the answer.
**7.** One steady path is: $\frac{14}{40} = 0.35$. About $35\%$ of the class falls in the $3$–$5$ hour bin. That gives a quick check on the answer.
**8.** Start with the key idea: $\frac{12}{40} = 0.30$. Roughly a third of the class. This is the part to check before moving on, because it keeps the answer tied to the original question.
**9.** Name the shape by where the tail *points*, not where the bulk sits. Tail to the left $\Rightarrow$ left-skewed (also called negatively skewed).
**10.** The tallest bar matches the largest frequency. Here, the $25$–$34$ bin has the biggest count at $10$.
**11.** One steady path is: Reverse the formula: count $=$ relative frequency $\times$ total $= 0.24 \times 50 = 12$. That gives a quick check on the answer.
**12.** Smaller bins partition the same range into more pieces, so the histogram gets more bars. The data count itself doesn't change – only the picture.
**13.** Bin width is a display choice. The data set is the data set – binning rearranges how counts are grouped, never adds or removes points.
**14.** Favorite-flavor data is categorical, not numerical. Histograms are for numerical data grouped into intervals; categories need a bar chart.
**15.** Bins use closed intervals on whole numbers here, so $5$ sits in the $3$–$5$ bin (it's the upper endpoint).
**16.** Add all the frequencies: $4 + 11 + 9 + 6 = 30$. The bin counts always sum to the total $n$.
**17.** Uniform shape means the frequency is spread evenly across the range – no clear peak or tail.
**18.** Symmetric means the left half is approximately a mirror image of the right half – the two tails balance each other out.
**19.** One steady path is: $\frac{7}{20} = 0.35 = 35\%$. Multiply by $100$ to convert proportion to percent. That gives a quick check on the answer.
**20.** Start with the key idea: $8 + 12 = 20$ points out of $40$ total $= \frac{20}{40} = \frac{1}{2}$ $(50\%)$. This is the part to check before moving on, because it keeps the answer tied to the original question.
**21.** Sort each score into its bin. $65$–$74$: $\{65, 68, 69, 70, 72, 74\} = 6$ scores. $75$–$84$: $\{76, 77, 78, 81, 82, 83\} = 6$. $85$–$94$: $\{85, 86, 88, 89, 90, 91, 93\} = 7$.

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$95$–$104$: $\{95\} = 1$. The $85$–$94$ bin holds the most at $7$. (Sanity check: $6 + 6 + 7 + 1 = 20$, matches the total.)

**22.** Total runners: $5 + 9 + 14 + 7 + 5 = 40$. The $30$–$44$ minute bin holds $14$ of them. Relative frequency $= \frac{14}{40} = 0.35 = 35\%$. So $35\%$ of runners trained between $30$ and $44$ minutes – the most popular interval.

**23.** The bulk of the data piles up near $18$ months and the long thin tail stretches to the right toward $36$. That's a right-skewed shape. The few high values pull the *mean* upward, but the *median* stays anchored at the middle position. For skewed data, the median gives a more honest sense of a typical value.

**24.** "$8$ or more" covers the last two bins: $10 + 5 = 15$ students. The total is $3 + 12 + 10 + 5 = 30$. So the fraction is $\frac{15}{30} = \frac{1}{2}$. Half the class slept at least eight hours – the other half is the chunk that probably needs to fix their sleep schedule before the next quiz.



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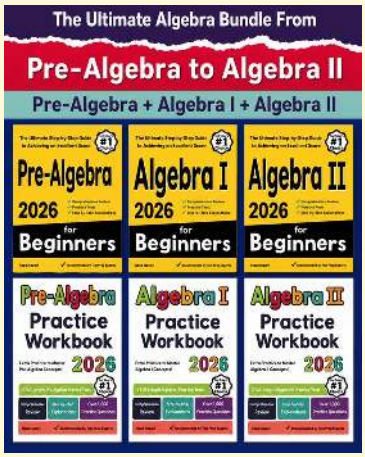


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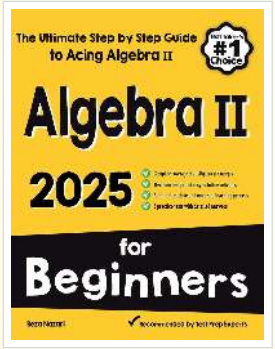


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