

# Organizing Data

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

Statistics is mostly about **shaping raw numbers into something readable**. A pile of 30 test scores says very little; the same scores in a frequency table, a dot plot, a histogram, a pie graph, or a two-way table tell a clean story.

**Dot plots** are quick pictures for small data sets: stack a dot above each value on a number line. The shape pops out – you can see clusters, outliers, and skew at a glance.

**Pie graphs** show each category as a percent of one whole; multiply the percent by the total to get the count.

**Two-way frequency tables** cross two categorical variables. Rows are one variable, columns the other. The **marginal totals** live in the right and bottom margins; the **joint frequencies** sit in the cells.

**Conditional relative frequency.** “Given that the student used tutoring, what’s the chance they passed?” tells you to restrict to the tutoring *column* and divide. Read the condition first; it sets the denominator.

**Weighted mean.** When groups have different sizes, you can’t just average the group means. Multiply each group’s mean by its size, add, then divide by the total:  $\bar{x} = \frac{\sum n_i \bar{x}_i}{\sum n_i}$ .

**Inclusion-exclusion** for two overlapping groups:  $|A \cup B| = |A| + |B| - |A \cap B|$ . Forgetting to subtract the overlap double-counts the people who are in both.

**Common slips.** Averaging two group means without weighting. Reading the wrong total in a conditional probability ( $P(A | B)$  is over  $|B|$ , not  $|U|$ ). Adding sport-only and band counts twice when computing “at least one.” Confusing the mean with the median of a small data set.

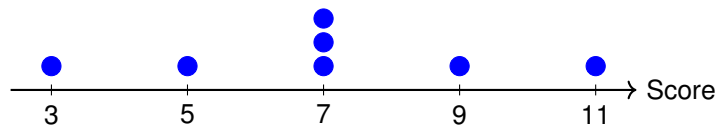
## PRACTICE

Read tables and plots; compute the requested statistic.

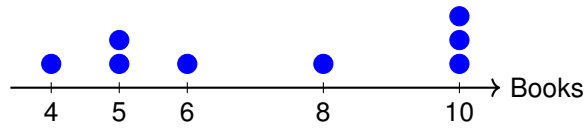
- Class A has 18 students with mean 82; Class B has 12 with mean 90. Find the combined mean. \_\_\_\_\_
- From the two-way table, find the conditional relative frequency that a student passed, given they used tutoring. \_\_\_\_\_

Outcome	Used / Did not / Total
Passed	36 / 24 / 60
Did not pass	9 / 21 / 30
Total	45 / 45 / 90

- Five scores 72, 84,  $x$ , 91, 88 have a mean of 84. Find  $x$ . \_\_\_\_\_
- Find the mean of the dot plot below. \_\_\_\_\_



5. Median of the dot plot below. \_\_\_\_\_



6. Which measure of center is most affected by an extreme outlier? \_\_\_\_\_

7. 15 students play a sport, 10 are in band, 5 do both. How many are in at least one of the two? \_\_\_\_\_

8. In a 4-row, 2-column frequency table with row sums 2,  $x$ , 6, 2 summing to  $x + 10$  and total score sum  $880 + 80x$ , if the mean score is 84 find  $x$ . \_\_\_\_\_

9. Given the same setup, what is the mode? \_\_\_\_\_

10. Median of {12, 15, 18, 18, 20, 22, 25, 30, 30, 30}. \_\_\_\_\_

11. Mean of {12, 15, 18, 18, 20, 22, 25, 30, 30, 30}. \_\_\_\_\_

12. Mode of {12, 15, 18, 18, 20, 22, 25, 30, 30, 30}. \_\_\_\_\_

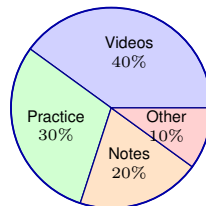
13. From the two-way table below, how many students take the bus? \_\_\_\_\_

Grade	Walk / Bus
9 <sup>th</sup>	18 / 12
10 <sup>th</sup>	14 / 16

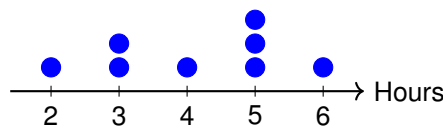
14. From that same table, what fraction of all students are 9<sup>th</sup> graders who walk? \_\_\_\_\_

15. The mean of five test scores is 80. A sixth score of 92 is added. What's the new mean? \_\_\_\_\_

16. A pie graph shows how 200 students chose review tools. How many chose videos? \_\_\_\_\_



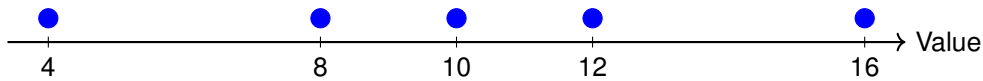
17. Median of the dot plot below. \_\_\_\_\_



18. A two-way table records gender and pet ownership. Of 50 students, 20 are male, 35 own pets, and 14 are male pet owners. How many female pet owners are there? \_\_\_\_\_



19. Mean of the dot plot below. \_\_\_\_\_



20. True or false: a data set can be bimodal (have two modes). \_\_\_\_\_

◆ Word Problems

21. A high school's two algebra classes took the same final. Class A had 25 students with a mean of 78. Class B had 20 students with a mean of 85. What is the combined mean of all 45 students (rounded to two decimal places)? \_\_\_\_\_

22. A survey of 90 students records tutoring use and pass rate. 45 used tutoring; of those, 36 passed. 45 did not use tutoring; of those, 24 passed. What's the conditional relative frequency that a student passed, given they did *not* use tutoring? \_\_\_\_\_

23. At a club fair, 150 students sign up. 80 join chess  $C$ , 90 join drama  $D$ , and 50 join both. How many join chess only? How many join neither club? \_\_\_\_\_

24. A teacher records the number of books seven students read last month as 3, 5, 7, 7, 7, 9, 11. Find the mean, median, and mode. Which best summarizes a typical reader? \_\_\_\_\_



## Answer Keys

1.  $\boxed{85.2}$

2.  $\boxed{\frac{36}{45} = 0.80}$

3.  $\boxed{85}$

4.  $\boxed{7}$

5.  $\boxed{7}$

6.  $\boxed{\text{mean}}$

7.  $\boxed{20}$

8.  $\boxed{10}$

9.  $\boxed{80}$

10.  $\boxed{21}$

11.  $\boxed{22}$

12.  $\boxed{30}$

13.  $\boxed{28}$

14.  $\boxed{\frac{18}{60} = 0.30}$

15.  $\boxed{82}$

16.  $\boxed{80}$

17.  $\boxed{4.5}$

18.  $\boxed{21}$

19.  $\boxed{10}$

20.  $\boxed{\text{True}}$

21.  $\boxed{\bar{x} \approx 81.11}$

22.  $\boxed{\frac{24}{45} \approx 0.533}$

23.  $\boxed{\text{chess only 30; neither 30}}$

24.  $\boxed{\text{mean 7, median 7, mode 7; any}}$

## Step-by-Step Explanations

1. Weighted mean: total points =  $18(82) + 12(90) = 1476 + 1080 = 2556$ . Total students = 30.  $\frac{2556}{30} = 85.2$ . Simple average of 82 and 90 would give 86 – wrong because the classes aren't the same size.

2. "Given tutoring" restricts to the 45 tutoring users. Of those, 36 passed.  $\frac{36}{45} = 0.80 = 80\%$ .

3. Total for 5 scores at mean 84:  $5 \cdot 84 = 420$ . Known scores sum to  $72 + 84 + 91 + 88 = 335$ . So  $x = 420 - 335 = 85$ .

4. Start with the key idea: Data:  $\{3, 5, 7, 7, 7, 9, 11\}$ . Sum = 49, count = 7, mean =  $\frac{49}{7} = 7$ . That gives a quick check on the answer.

5. Sorted: 4, 5, 5, 6, 8, 10, 10, 10. Eight values  $\Rightarrow$  median is the average of the 4<sup>th</sup> and 5<sup>th</sup>:  $\frac{6+8}{2} = 7$ .

6. Mean uses every value, so one extreme can yank it sharply. Median sits at the middle position and barely budges. Mode only changes if the outlier becomes the most frequent value.

7. Inclusion-exclusion:  $15 + 10 - 5 = 20$ . Add the two groups, then subtract the overlap so the 5 "both" students aren't counted twice.

8. Start with the key idea:  $\frac{880 + 80x}{x + 10} = 84$ . Multiply:  $880 + 80x = 84x + 840$ .

Subtract:  $40 = 4x$ , so  $x = 10$ . That gives a quick check on the answer.

9. With  $x = 10$ , the score 80 appears 10 times – more often than any other score (which appear at most 6 times).

10. Keep the rule visible: Ten values  $\Rightarrow$  median is the average of the 5<sup>th</sup> and 6<sup>th</sup>:  $\frac{20 + 22}{2} = 21$ . That gives a quick check on the answer.

11. Sum = 220, count = 10, mean = 22. The three 30s pull the mean a bit above the median.

12. Start with the key idea: The value 30 appears three times – more than anything else. That gives a quick check on the answer.

13. Sum down the Bus column:  $12 + 16 = 28$ . The question asks about the column total, not the row total.

14. Total students:  $18 + 12 + 14 + 16 = 60$ . Walkers in 9<sup>th</sup> grade:  $\frac{18}{60} = \frac{3}{10} = 0.30$ .

15. Old total:  $5 \cdot 80 = 400$ . New total:  $400 + 92 = 492$ . New mean:  $\frac{492}{6} = 82$ . (Adding a score above the mean pulls it up, but not all the way to 92.)

16. Start with the key idea: Videos are 40% of the whole group.  $0.40(200) = 80$  students. That gives a quick check on the answer.

17. Sorted: 2, 3, 3, 4, 5, 5, 5, 6. Eight values  $\Rightarrow$  middle two are 4 and 5. Median =  $\frac{4+5}{2} = 4.5$ .

18. Female pet owners = total pet owners – male pet owners =  $35 - 14 = 21$ . (The total of 50 and the male count of 20 give us a check but aren't needed for this answer.)

19. One steady path is: Sum = 50, count = 5, mean = 10. Notice the data is symmetric around 10. That gives a quick check on the answer.

20. If two different values tie for the highest frequency, the set is bimodal. Three or more can make it multimodal.

21. Use a weighted mean – never average two group means as if the groups were the same size. Total score points:  $25(78) + 20(85) = 1950 + 1700 = 3650$ . Total students: 45. Combined mean:  $\frac{3650}{45} \approx 81.11$ . (Sanity check: because Class A is bigger, the combined mean should be closer to 78 than to 85 – and 81.11 is.)

22. "Given they did not use tutoring" restricts the denominator to the 45 non-users.

Of those, 24 passed. Conditional relative frequency =  $\frac{24}{45} = \frac{8}{15} \approx 0.533$  (53.3%). Compare with the tutoring group's 80% pass rate – tutoring users had a much higher pass rate.

23. Chess only =  $80 - 50 = 30$  (subtract the overlap from the chess total). Drama only =  $90 - 50 = 40$ . Total in chess or drama (or both):  $30 + 50 + 40 = 120$ . Neither:  $150 - 120 = 30$ . Sanity check:  $30 + 50 + 40 + 30 = 150 \checkmark$ .

24. Sum:  $3 + 5 + 7 + 7 + 7 + 9 + 11 = 49$ . Mean:  $\frac{49}{7} = 7$ . Sorted, the middle (4<sup>th</sup> of 7) value is 7, so median = 7. Mode is the most frequent value: 7 appears three times. All three measures agree at 7 – the distribution is symmetric and nicely centered, so any of the three is a fine summary.



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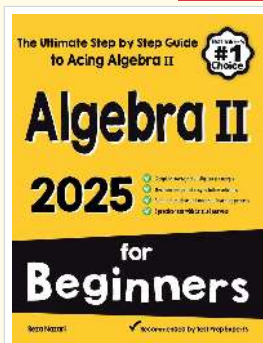
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