Two-Way Tables for Categorical Data

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

A two-way table counts two categorical variables. An interior cell is a joint count, while row and column totals are marginal counts. Divide by the grand total for a joint relative frequency. Divide by a row total when a question says "among this row. For 12 bus riders among 20 club members, the conditional rate is $12/20 = 60\%$.

Worked example

Example for form 1: among club members, what fraction ride the bus? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	6	4	10
No club	3	8	11
Total	9	12	21

1. Restrict to row "Club": its total is $6 + 4 = 10$. Of these, 6 are in column "Bus".
2. The conditional fraction and percentage are $6/10 = \frac{3}{5} = 60.0\%$. The percentage is rounded to the nearest tenth of a percent.
Answer: $\frac{3}{5} = 60.0\%$

Practice Problems

Show your thinking.

1. How many students are both club members and bus riders?

	Bus	Walk	Total
Club	12	8	20
No club	6	14	20
Total	18	22	40

2. How many students are in this entire survey?

	Bus	Walk	Total
Club	9	11	20
No club	13	7	20
Total	22	18	40

3. Among club members, what fraction and percentage ride the bus? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	15	5	20
No club	10	20	30
Total	25	25	50

4. Among bus riders, what fraction and percentage are club members? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	8	12	20
No club	12	8	20
Total	20	20	40

5. What fraction and percentage of all students are both club members and bus riders? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	6	9	15
No club	10	15	25
Total	16	24	40

6. Find the missing count of club members who walk.

	Bus	Walk	Total
Club	14	?	20
No club	9	11	20
Total	23	17	40

7. How many students are club members or bus riders (or both)?

	Bus	Walk	Total
Club	10	15	25
No club	5	20	25
Total	15	35	50

8. How many students are neither club members nor bus riders?

	Bus	Walk	Total
Club	7	13	20
No club	8	12	20
Total	15	25	40

9. Which row group has the higher bus-riding rate? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	18	12	30
No club	8	12	20
Total	26	24	50

10. Find the missing walking count in the club row, checking both totals.

	Bus	Walk	Total
Club	16	?	20
No club	7	13	20
Total	23	17	40

Answer Key

1. 12
2. 40
3. $\frac{3}{4} = 75.0\%$
4. $\frac{2}{5} = 40.0\%$
5. $\frac{3}{20} = 15.0\%$
6. 6
7. 30
8. 12
9. Club; 60.0% versus 40.0%.
10. 4

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The intersection of row “Club” and column “Bus” contains 12. These entries satisfy both categories.

2. This is a joint count, not the row total 20 or column total 18. Therefore the requested number is 12.

Problem 2

1. Add the first row: $9 + 11 = 20$. Add the second row: $13 + 7 = 20$.

2. The grand total is $20 + 20 = 40$. The column check, $22 + 18 = 40$, gives the same count without counting anyone twice.

Problem 3

1. Restrict to row “Club”: its total is $15 + 5 = 20$. Of these, 15 are in column “Bus”.

2. The conditional fraction and percentage are $15/20 = \frac{3}{4} = 75.0\%$. The percentage is rounded to the nearest tenth of a percent.

Problem 4

1. Restrict to column “Bus”: its total is $8 + 12 = 20$. Within it, row “Club” contributes 8.

2. The conditional fraction and percentage are $8/20 = \frac{2}{5} = 40.0\%$, to the nearest tenth of a percent. Do not divide by the grand total 40.

Problem 5

1. The requested joint category contains 6 people out of all 40. The denominator is the grand total because the selection is unrestricted.

2. The relative frequency and percentage are $6/40 = \frac{3}{20} = 15.0\%$. The percentage is rounded to the nearest tenth of a percent.

Problem 6

1. Row “Club” totals 20, and its known cell is 14. Subtract: missing count $= 20 - 14 = 6$.

2. Check the column: $6 + 11 = 17$, matching its total. Thus the missing joint count is 6, not the whole row or column total.

Problem 7

1. Row “Club” contains 25, column “Bus” contains 15, and their overlap contains 10.

2. For either category, add and subtract the overlap: $25 + 15 - 10 = 30$. Equivalently, exclude only the opposite cell: $50 - 20 = 30$.

Problem 8

1. Neither row “Club” nor column “Bus” means the opposite row and opposite column. Their intersection contains 12.

2. Check by subtracting the union: $40 - (7 + 13 + 8) = 12$. So 12 observations meet neither of the two named categories.

Problem 9

1. For “Club”, the column-“Bus” fraction and percentage are $18/30 = \frac{3}{5} = 60.0\%$.

2. For “No club”, they are $8/20 = \frac{2}{5} = 40.0\%$. Compare the exact fractions: Club has the higher rate.

Problem 10

1. Row “Club” totals 20, and its known cell is 16. Subtract: missing count $= 20 - 16 = 4$.

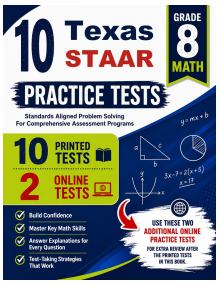
2. Check the column: $4 + 13 = 17$, matching its total. Thus the missing joint count is 4, not the whole row or column total.

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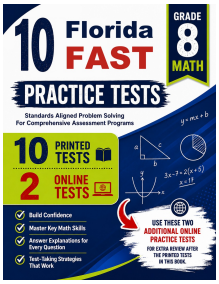
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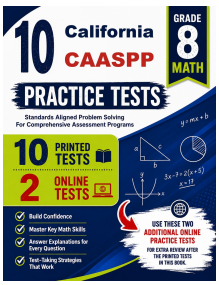
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