Two-Way Tables for Categorical Data

Spot mistakes, reason, and work backward

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

QUICK REVIEW

A conditional percentage needs the correct reference group. If 15 of 25 club members walk, the walking rate among members is $15/25 = 60\%$, not $15/N$ for the whole survey. To repair a missing cell, subtract the known cell from its row total, then verify the column. Compare proportions, not raw counts, when group sizes differ.

Worked example

Example for form 2: among club members, what fraction ride the bus? Give percentages to the nearest tenth of a percent.

1. Restrict to row "Club": its total is $7 + 4 = 11$. Of these, 7 are in column "Bus".

2. The conditional fraction and percentage are $7/11 = \frac{7}{11} \approx 63.6\%$. The percentage is rounded to the nearest tenth of a percent.

Answer: $\frac{7}{11} \approx 63.6\%$

	Bus	Walk	Total
Club	7	4	11
No club	3	8	11
Total	10	12	22

Practice Problems

Show your thinking.

1. A learner divides by all students to find bus riding among club members. Correct the denominator.

	Bus	Walk	Total
Club	12	18	30
No club	6	24	30
Total	18	42	60

2. A learner compares bus counts 20 and 15 only. Compare the actual row rates. Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	20	30	50
No club	15	5	20
Total	35	35	70

3. Check whether adding row total and column total double-counts anyone. Find club or bus.

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

4. A learner uses the row total to find membership among bus riders. Find the correct fraction. Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	9	21	30
No club	6	14	20
Total	15	35	50

5. Recover a missing cell rather than copying the column total.

	Bus	Walk	Total
Club	13	?	20
No club	17	3	20
Total	30	10	40

6. Distinguish a joint percentage from a conditional one: what fraction of everyone is in club and rides bus? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	8	12	20
No club	4	16	20
Total	12	28	40

7. Two groups have different sizes. Check whether their bus rates are equal. 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

8. A learner says neither club nor bus means adding two margins. Find the correct count.

	Bus	Walk	Total
Club	5	15	20
No club	12	8	20
Total	17	23	40

9. Correct an all-student denominator for the bus rate among club members.

	Bus	Walk	Total
Club	14	21	35
No club	9	6	15
Total	23	27	50

10. Use both margins to verify the missing club-walking cell.

	Bus	Walk	Total
Club	17	?	30
No club	8	12	20
Total	25	25	50

Answer Key

1. Use $12/30 = \frac{2}{5}$, not $12/60$.
2. No club; 40.0% versus 75.0%.
3. 27
4. $\frac{3}{5} = 60.0\%$
5. 7
6. $\frac{1}{5} = 20.0\%$
7. Neither; 40.0% versus 40.0%.
8. 8
9. Use $14/35 = \frac{2}{5}$, not $14/50$.
10. 13

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The condition limits the group to row “Club”, with $12 + 18 = 30$ members. The favorable intersection has 12 members.

2. Divide by this restricted total: $12/30 = \frac{2}{5}$. Using denominator 60 would answer a different question about the entire sample.

Problem 2

1. For “Club”, the column-“Bus” fraction and percentage are $20/50 = \frac{2}{5} = 40.0\%$.

2. For “No club”, they are $15/20 = \frac{3}{4} = 75.0\%$. Compare the exact fractions: No club has the higher rate.

Problem 3

1. Row “Club” contains 20, column “Bus” contains 18, and their overlap contains 11.

2. For either category, add and subtract the overlap: $20 + 18 - 11 = 27$. Equivalently, exclude only the opposite cell: $40 - 13 = 27$.

Problem 4

1. Restrict to column “Bus”: its total is $9 + 6 = 15$. Within it, row “Club” contributes 9.

2. The conditional fraction and percentage are $9/15 = \frac{3}{5} = 60.0\%$, to the nearest tenth of a percent. Do not divide by the grand total 50.

Problem 5

1. Row “Club” totals 20, and its known cell is 13. Subtract: missing count $= 20 - 13 = 7$.

2. Check the column: $7 + 3 = 10$, matching its total. Thus the missing joint count is 7, not the whole row or column total.

Problem 6

1. The requested joint category contains 8 people out of all 40. The denominator is the grand total because the selection is unrestricted.

2. The relative frequency and percentage are $8/40 = \frac{1}{5} = 20.0\%$. The percentage is rounded to the nearest tenth of a percent.

Problem 7

1. For “Club”, the column-“Bus” fraction and percentage are $6/15 = \frac{2}{5} = 40.0\%$.

2. For “No club”, they are $10/25 = \frac{2}{5} = 40.0\%$. Compare the exact fractions: the rates are equal.

Problem 8

1. Neither row “Club” nor column “Bus” means the opposite row and opposite column. Their intersection contains 8.

2. Check by subtracting the union: $40 - (5 + 15 + 12) = 8$. So 8 observations meet neither of the two named categories.

Problem 9

1. The condition limits the group to row “Club”, with $14 + 21 = 35$ members. The favorable intersection has 14 members.

2. Divide by this restricted total: $14/35 = \frac{2}{5}$. Using denominator 50 would answer a different question about the entire sample.

Problem 10

1. Row “Club” totals 30, and its known cell is 17. Subtract: missing count $= 30 - 17 = 13$.

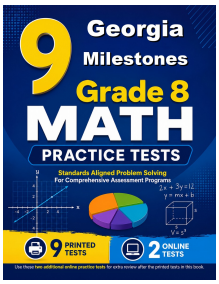
2. Check the column: $13 + 12 = 25$, matching its total. Thus the missing joint count is 13, not the whole row or column total.

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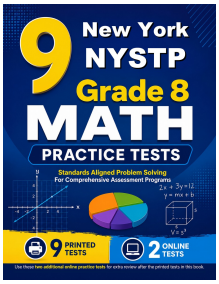
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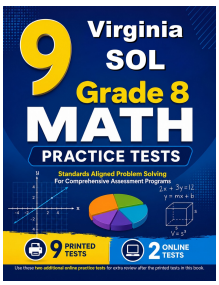
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