Two-Way Frequency Tables

Name: _____ Date: _____ Score: _____ / 26

Quick Review

A **two-way table** (contingency table) organizes data by two categorical variables. Rows represent one variable's categories; columns represent the other's. The cell at row i, column j shows how many observations fall in both categories. **Marginal totals** (row and column sums) appear in the margins. **Joint frequency**: count in one cell. **Marginal frequency**: a row or column total. **Conditional frequency**: count restricted to one category, expressed as a proportion of that category's total. Two-way tables make it easy to compare rates across groups and check for association between categorical variables.

PRACTICE

Use two-way tables to find counts and proportions.

1. Use the table. What is the Grade 9 row total?

	Bus	Car	Walk	Total
Grade 9	18	12	10	?
Grade 10	14	20	6	40
Total	32	32	16	80

2. Use the table. What is the grand total?

	Bus	Car	Walk	Total
Grade 9	18	12	10	40
Grade 10	14	20	6	40
Total	32	32	16	?

3. Use the table. Find $P(\text{Bus} \mid \text{Grade 9})$.

	Bus	Car	Walk	Total
Grade 9	18	12	10	40
Grade 10	14	20	6	40
Total	32	32	16	80

4. Use the table. What is the joint frequency for Grade 10 and Car?

	Bus	Car	Walk	Total
Grade 9	18	12	10	40
Grade 10	14	20	6	40
Total	32	32	16	80

5. Use the table. What is the marginal frequency for Walk?

	Bus	Car	Walk	Total
Grade 9	18	12	10	40
Grade 10	14	20	6	40
Total	32	32	16	80

6. Use the table. Are grade level and car transportation associated?

	Bus	Car	Walk	Total
Grade 9	18	12	10	40
Grade 10	14	20	6	40
Total	32	32	16	80

7. Use the table. Find $P(\text{Bus} \mid \text{Grade 10})$.

	Bus	Car	Walk	Total
Grade 9	18	12	10	40
Grade 10	14	20	6	40
Total	32	32	16	80

8. A two-way table like this organizes which kind of variables?

	Prefers Cats	Prefers Dogs	Total
Grade 9	16	24	40
Grade 10	20	20	40
Total	36	44	80

9. Use the table. Check whether the four inside cells add to the grand total.

	Prefers Cats	Prefers Dogs	Total
Grade 9	16	24	40
Grade 10	20	20	40
Total	36	44	80

10. Use the table. Do the row totals add to the grand total?

	Prefers Cats	Prefers Dogs	Total
Grade 9	16	24	40
Grade 10	20	20	40
Total	36	44	80

11. Use the table. Do the column totals add to the grand total?

	Prefers Cats	Prefers Dogs	Total
Grade 9	16	24	40
Grade 10	20	20	40
Total	36	44	80

12. Use the table. Find $P(\text{Grade 9 and Dogs})$.

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	Prefers Cats	Prefers Dogs	Total
Grade 9	16	24	40
Grade 10	20	20	40
Total	36	44	80

13. Use the table. Find the marginal probability $P(\text{Prefers Cats})$.

	Prefers Cats	Prefers Dogs	Total
Grade 9	16	24	40
Grade 10	20	20	40
Total	36	44	80

14. Use the table. How many students prefer cats or dogs?

	Prefers Cats	Prefers Dogs	Total
Grade 9	16	24	40
Grade 10	20	20	40
Total	36	44	80

15. Use the table. How many females like sports?

	Sports	No Sports	Total
Male	25	15	40
Female	10	10	20
Total	35	25	60

16. Use the table. What is the total number of females?

	Sports	No Sports	Total
Male	25	15	40
Female	10	10	20
Total	35	25	60

17. Use the table. Find $P(\text{Sports} \mid \text{Female})$.

	Sports	No Sports	Total
Male	25	15	40
Female	10	10	20
Total	35	25	60

18. Use the table. Find $P(\text{Male})$.

	Sports	No Sports	Total
Male	25	15	40
Female	10	10	20
Total	35	25	60

19. A two-way table has 2 row categories and 3 column categories. How many inside cells does it have?

20. Two rows in a table have very different conditional percentages. What does that suggest?

VISUAL PRACTICE

Use the graph, table, chart, or diagram to answer the question.

21. Use the two-way table to find $P(\text{Sports} \mid \text{Girl})$.

	Sports	Music	Total
Girl	5	7	12
Boy	8	4	12
Total	13	11	24

Answer:

22. Use the table to find $P(\text{Bus} \mid \text{Junior})$.

	Bus	Car	Total
Junior	6	4	10
Senior	5	9	14
Total	11	13	24

Answer:

Word Problems

23. 50 students surveyed: 30 like pizza, 25 like burgers, 20 like both. How many like neither?

24. A two-way table shows: men/yes = 30, men/no = 20, women/yes = 25, women/no = 25. Find $P(\text{yes}|\text{man})$.

25. In the same survey table (men/yes $= 30$, men/no $= 20$, women/yes $= 25$, women/no $= 25$), are gender and yes/no response associated?

26. 100 customers, 60 ordered coffee, 40 ordered tea, 15 ordered both. How many ordered only coffee?

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Answer Keys

1. $\boxed{40}$
2. $\boxed{80}$
3. $\boxed{\frac{9}{20}}$
4. $\boxed{20}$
5. $\boxed{16}$
6. $\boxed{\text{yes}}$
7. $\boxed{\frac{7}{20}}$
8. $\boxed{\text{categorical variables}}$
9. $\boxed{\text{yes}}$
10. $\boxed{\text{yes}}$
11. $\boxed{\text{yes}}$
12. $\boxed{\frac{3}{10}}$
13. $\boxed{\frac{9}{20}}$
14. $\boxed{80}$
15. $\boxed{10}$
16. $\boxed{20}$
17. $\boxed{\frac{1}{2}}$
18. $\boxed{\frac{2}{3}}$
19. $\boxed{6 \text{ cells}}$
20. $\boxed{\text{the variables are associated}}$
21. $\boxed{\frac{5}{12}}$
22. $\boxed{\frac{3}{5}}$
23. $\boxed{15}$
24. $\boxed{\frac{3}{5}}$
25. $\boxed{\text{yes (mildly)}}$
26. $\boxed{45}$

Step-by-Step Tutor Notes

1. Read the table by matching the correct row and column first, then use the count or total that fits the question. Add the Grade 9 row: $18 + 12 + 10 = 40$. This gives 40.
2. For a table question, slow down and locate the exact row, column, or cell before calculating. Add the row totals: $40 + 40 = 80$ students. This gives 80.
3. Focus on the main idea of the problem, then simplify carefully. Condition on Grade 9, so use the Grade 9 total: $\frac{18}{40} = \frac{9}{20}$. So the answer is $\frac{9}{20}$.
4. For a table question, slow down and locate the exact row, column, or cell before calculating. The joint frequency is the cell where Grade 10 and Car meet, which is 20. This gives 20.
5. For a table question, slow down and locate the exact row, column, or cell before calculating. A marginal frequency is a total in the margin. The Walk column total is 16. This gives 16.
6. Compare car rates: Grade 9 has $\frac{12}{40} = 30\%$, while Grade 10 has $\frac{20}{40} = 50\%$. The rates differ, so there is association.
7. Read the table by matching the correct row and column first, then use the count or total that fits the question. Use only the Grade 10 row: $\frac{14}{40} = \frac{7}{20}$. This gives $\frac{7}{20}$.
8. Use the labels on the display first; they tell you which count or total belongs in the answer. The rows and columns are categories, such as grade level and pet preference. This gives categorical variables.
9. Use the labels on the display first; they tell you which count or total belongs in the answer. The inside cells add to $16 + 24 + 20 + 20 = 80$, matching the grand total. This gives yes.
10. For a table question, slow down and locate the exact row, column, or cell before calculating. The row totals are 40 and 40, and $40 + 40 = 80$. This gives yes.
11. Use the labels on the display first; they tell you which count or total belongs in the answer. The column totals are 36 and 44, and $36 + 44 = 80$. This gives yes.
12. For a table question, slow down and locate the exact row, column, or cell before calculating. Use the joint cell over the grand total: $\frac{24}{80} = \frac{3}{10}$. This gives $\frac{3}{10}$.
13. Use the labels on the display first; they tell you which count or total belongs in the answer. Use the Cats column total over the grand total: $\frac{36}{80} = \frac{9}{20}$. This gives $\frac{9}{20}$.
14. The table has only two preference categories shown, so Cats plus Dogs is $36 + 44 = 80$.
15. Read the table by matching the correct row and column first, then use the count or total that fits the question. Read the cell at Female and Sports: 10. This gives 10.
16. For a table question, slow down and locate the exact row, column, or cell before calculating. The Female row total is 20. This gives 20.
17. Use the labels on the display first; they tell you which count or total belongs in the answer. Condition on females, so use the Female row: $\frac{10}{20} = \frac{1}{2}$. This gives $\frac{1}{2}$.
18. Read the table by matching the correct row and column first, then use the count or total that fits the question. Use the Male row total over the grand total: $\frac{40}{60} = \frac{2}{3}$. This gives $\frac{2}{3}$.
19. Use the labels on the display first; they tell you which count or total belongs in the answer. Multiply rows by columns: $2 \cdot 3 = 6$ inside cells. This gives 6 cells.
20. Use the labels on the display first; they tell you which count or total belongs in the answer. When conditional distributions vary a lot from row to row, the variables are probably related. This gives the variables are associated.
21. Given that the student is a girl, use the girl total 12. Of those, 5 chose sports.
22. Given Junior, use the Junior total 10. Of those, 6 ride the bus, so $6/10 = 3/5$.
23. Pizza only $= 10$, burgers only $= 5$, both $= 20$. At least one: 35. Neither: $50 - 35 = 15$.
24. Use the given numbers to build the model, then finish the calculation. Men total: 50. Yes among men: 30. $\frac{30}{50} = \frac{3}{5}$.
25. $P(\text{yes}|\text{man}) = \frac{3}{5} = 60\%$; $P(\text{yes}|\text{woman}) = \frac{25}{50} = 50\%$. Different rates suggest association, though small.
26. Set up the model from the story, then calculate carefully. Coffee total includes both: $60 - 15 = 45$ coffee-only.

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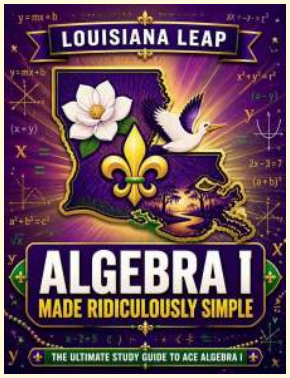

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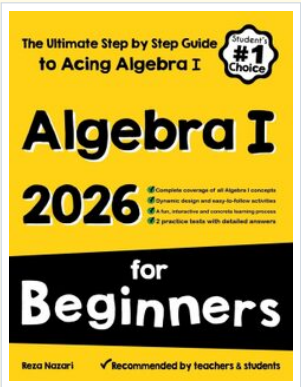

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