Denominator Detectives

Use the denominator to identify two kinds of relative frequency.

CCSS.Math.Content.HSS-ID.B.5 "Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies)..."

NAME _____ DATE _____

JOINT RELATIVE FREQUENCY

A joint relative frequency divides by the total number of all observations. It tells how often two categories occur together.

At a zoo, 14 of 175 guests were members who visited the reptile house: 14/175.

CONDITIONAL RELATIVE FREQUENCY

A conditional relative frequency divides by the total in one selected group. It tells how often something occurs within that group.

Among 60 guests who arrived by train, 21 visited the reptile house: 21/60.

Complete the survey table

Students	Engineering plan	Other plan	Total
Robotics	36	14	____
Not robotics	19	31	____
Total	____	____	____

Find the marginal relative frequency planning engineering. Then give a joint and a conditional relative frequency from this table and name each denominator. Record:

_____

1 SORT

8 items

For each item, circle TOGETHER or WITHIN, then pick two items and explain how the denominator helped you decide.

1.	A district surveys 500 students. Ninety are seniors who ride the bus: 90/500.	TOGETHER WITHIN
2.	Among 160 ninth graders, 64 prefer drama: 64/160.	TOGETHER WITHIN
3.	Of 240 customers, 30 used a coupon and paid with cash: 30/240.	TOGETHER WITHIN
4.	Among 75 student athletes, 45 play a fall sport: 45/75.	TOGETHER WITHIN
5.	Among 110 students who own a bike, 44 wear a helmet: 44/110.	TOGETHER WITHIN
6.	At a clinic, 27 of 180 patients were children who received a flu shot: 27/180.	TOGETHER WITHIN

7. Of 90 voters surveyed, 36 were independent and supported Measure A: 36/90. **TOGETHER** **WITHIN**

8. Among 50 independent voters, 20 supported Measure A: 20/50. **TOGETHER** **WITHIN**

2 PROVE IT

Explain your thinking

Pick two items from Part 1. For each one, tell how you knew where it belonged.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Write one new joint relative-frequency example and one new conditional relative-frequency example, including a numerator and denominator in each.

TOGETHER

WITHIN

CHALLENGE

Using the completed survey table, compare the proportion planning engineering within robotics and within non-robotics. Do these data suggest an association? Explain why they do not prove that robotics caused the plans.

ANSWER KEY

Denominator Detectives

HIGH SCHOOL · HSS-ID.B.5

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	A district surveys 500 students. Ninety are seniors who ride the bus: 90/500.	**TOGETHER**	The denominator is the grand total, 500, and the numerator names two categories.
2	Among 160 ninth graders, 64 prefer drama: 64/160.	**WITHIN**	The denominator is the selected group, ninth graders.
3	Of 240 customers, 30 used a coupon and paid with cash: 30/240.	**TOGETHER**	The denominator is all customers, and the numerator combines coupon use and payment type.
4	Among 75 student athletes, 45 play a fall sport: 45/75.	**WITHIN**	The denominator is the subgroup of student athletes.
5	Among 110 students who own a bike, 44 wear a helmet: 44/110.	**WITHIN**	The denominator is the subgroup of students who own a bike.
6	At a clinic, 27 of 180 patients were children who received a flu shot: 27/180.	**TOGETHER**	The denominator is all patients, and the numerator names age group and shot status.
7	Of 90 voters surveyed, 36 were independent and supported Measure A: 36/90.	**TOGETHER**	The denominator is all surveyed voters, and the numerator names party group and position.
8	Among 50 independent voters, 20 supported Measure A: 20/50.	**WITHIN**	The denominator is the subgroup of independent voters.

PART 2 · PROVE IT

Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **TOGETHER**: Joint relative frequency: In a poll of 300 residents, 45 were renters who favored a park bond, so the relative frequency is 45/300.
- **WITHIN**: Conditional relative frequency: Among 75 renters in the poll, 45 favored a park bond, so the relative frequency is 45/75.

Challenge: Row totals 50,50; column totals 55,45; grand total 100. Engineering marginal 55/100=.55; example joint 36/100=.36; conditional within robotics 36/50=.72. Non-robotics 19/50=.38. The 34-percentage-point difference suggests association; other factors or self-selection could explain it.

Accept equivalent contexts when a joint example divides a cell count by the grand total and a conditional example divides a cell count by a subgroup total. In the challenge, accept a claim that the data suggest an association with a comparison of 72% and 38%, but do not accept a causal claim. Check completed margins and marginal, joint and conditional interpretations from the actual table. Preserve all eight denominator-classification items and student-created examples.