

STATISTICS AND PROBABILITY

Associations in Two-Way Tables



Grade 8 | NC.8.SP.4

Teacher-guided instruction and reusable student practice

30 multiple-choice items • 30 open/performance tasks

Seven instructional sections • Worked solutions

Models, workspaces, rubrics and evidence records

Free sample | Contents

NC.8.SP.4 | Eighth Grade mathematics

This sample contains 18 complete selected pages from the 121-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-15, 44-45, 74

Representative activities

M01: sample PDF page(s) 15; original page(s) 14

M02: sample PDF page(s) 16; original page(s) 15

O01: sample PDF page(s) 17; original page(s) 44

O02: sample PDF page(s) 18; original page(s) 45

Selected teacher prompts and keys: original page(s) 74

Using this sample

Read the preparation and access guidance before using a selected activity.

Keep teacher keys and private preparation pages separate from student copies.

Use the original resource contents to see the scope of the complete packet.

Complete paid download

The complete resource includes the full PDF task bank and teaching materials.

SCOPE

Standard and learning targets

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.

- Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.
- Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Current North Carolina Standard Course of Study, adopted June 2017. Verified against the official 2025 Grade 8 Quick Reference Guide, printed page 32. Current standards remain in use for 2026-2027 and 2027-2028; adopted revisions begin in 2028-2029.

- Find a row conditional relative frequency.
- Find a column conditional relative frequency.
- Interpret a joint relative frequency.
- Interpret a marginal relative frequency.
- Compare conditional relative frequencies.
- Describe possible categorical association.
- Construct and interpret frequency and conditional tables.

PLANNING AND NAVIGATION

Choose a purposeful sequence

Use this bank across several sessions. It is not a 60-item single-sitting test. Select a few items based on observed need, retain unused items for later evidence, and separate first independent responses from supported revisions.

Warm-up: M01-M04 and O01-O04.

I Do: M05-M08 and O05-O08.

We Do: M09-M13 and O09-O13.

Collaborative practice: M14-M18 and O14-O18.

Independent practice: M19-M23 and O19-O23.

Small-group reteach: M24-M27 and O24-O27.

Exit ticket: M28-M30 and O28-O30.

Suggested sequence: Session 1 builds meaning with the warm-up and I Do; Session 2 uses We Do and collaboration; Session 3 gathers independent evidence; Session 4 uses small-group work and exit evidence only as needed. These are flexible sessions, not quarters.

Materials: pencil, ruler, calculator for checking arithmetic, graph paper if needed.

Prerequisites: coordinate pairs and axis scales; rates and linear equations for SP.2-SP.3; fractions, totals and percentages for SP.4. All data in this packet are synthetic and nonpersonal.

INSTRUCTIONAL PREPARATION

Access without supplying answers

Read prompts aloud without emphasizing a choice. Enlarge pages, provide tactile or high-contrast axes, allow a scribe for the learner's own words, or accept oral explanations. Preserve the mathematical demand: students choose coordinates, lines, denominators and interpretations themselves.

Before scoring, check that students can access the graph or table. A student who cannot see the point locations has not yet supplied interpretable mathematical evidence. Record N/O rather than 0 when evidence is unavailable. A suggested line, denominator or answer is an answer-supplying cue; record it separately from neutral access support.

Extend: compare a second defensible representation, test a nearby prediction, or explain what extra evidence would be needed. Reteach: work with a smaller separate example, then return to a fresh item. Never invent a timed fluency threshold.

Discussion routine: What quantities or categories are recorded together? What does each coordinate or cell mean? Which evidence supports your conclusion? What does the evidence leave uncertain? Avoid turning association into a causal claim.

TEACHER REFERENCE

A complete worked model

In a synthetic collection of packages, 17 are label A and 24 are label B. Among the label A group, 10 are intact; among the label B group, 16 are intact. Every subject is either intact or dented. Construct a two-way frequency table, including totals. Then construct a row relative-frequency table and a column relative-frequency table. Label the denominator for each conditional percentage. Compare the intact percentages within the two rows and describe the evidence of possible association. Round percentages to one decimal place; explain why this table cannot establish cause.

Missing cells: $17-10=7$; $24-16=8$. Row totals 17, 24; column totals 26, 15; grand total 41. Row denominators are 17 and 24. Column denominators are 26 and 15. Within-row intact rates: 58.8% and 66.7%. The 7.8-percentage-point difference is evidence of a possible association in this sample; strength should be described in context, not by an invented cutoff. These synthetic counts do not come from a randomized causal experiment. Rounding can make totals differ slightly from 100%.

packages	intact	dented	Total
label A	10	7	17
label B	16	8	24
Total	26	15	41

REPRODUCIBLE

Reasoning organizer

Name: _____ Date: _____

Givens: quantities, categories, units and data**Representation and calculation****Justification and check****Conclusion in context and limits**

TEACHER SCRIPT

Warm-up

Core: O01; optional bank M01-M04, O01-O04. Target: Construct and interpret frequency and conditional tables.

Launch (2-3 minutes): Invite an individual first attempt, then compare representations. Say: “What is recorded together, and what must our representation preserve?”

Explore (8-15 minutes, adjust to evidence): Read the core task. Ask: “What belongs on each axis or in each table heading? Which values are observed and which are modeled? Show how you checked one entry.” Do not rush to an answer letter.

Teacher mathematics for the core item: Missing cells: $17-10=7$; $24-16=8$. Row totals 17, 24; column totals 26, 15; grand total 41. Row denominators are 17 and 24. Column denominators are 26 and 15. Within-row intact rates: 58.8% and 66.7%. The 7.8-percentage-point difference is evidence of a possible association in this sample; strength should be described in context, not by an invented cutoff. These synthetic counts do not come from a randomized causal experiment. Rounding can make totals differ slightly from 100%.

Respond to gaps: If a coordinate, unit or denominator is mismatched, ask the learner to identify the group or quantity named in the prompt. If the conclusion goes beyond the data, ask what was actually measured. After a demonstration, mark that work as supported and use another bank item for independent evidence.

Close (2-4 minutes): “Name one check that made your conclusion more trustworthy.” Record representation, reasoning, accuracy and interpretation separately; select the next item from the observed gap.

TEACHER SCRIPT

I Do

Core: O05; optional bank M05-M08, O05-O08. Target: Construct and interpret frequency and conditional tables.

Launch (2-3 minutes): Think aloud while constructing the model. Hide the worked key until the demonstration is complete. Say: “What is recorded together, and what must our representation preserve?”

Explore (8-15 minutes, adjust to evidence): Read the core task. Ask: “What belongs on each axis or in each table heading? Which values are observed and which are modeled? Show how you checked one entry.” Do not rush to an answer letter.

Teacher mathematics for the core item: Missing cells: $23-19=4$; $29-18=11$. Row totals 23, 29; column totals 37, 15; grand total 52. Row denominators are 23 and 29. Column denominators are 37 and 15. Within-row dry rates: 82.6% and 62.1%. The 20.5-percentage-point difference is evidence of a possible association in this sample; strength should be described in context, not by an invented cutoff. These synthetic counts do not come from a randomized causal experiment. Rounding can make totals differ slightly from 100%.

Respond to gaps: If a coordinate, unit or denominator is mismatched, ask the learner to identify the group or quantity named in the prompt. If the conclusion goes beyond the data, ask what was actually measured. After a demonstration, mark that work as supported and use another bank item for independent evidence.

Close (2-4 minutes): “Name one check that made your conclusion more trustworthy.” Record representation, reasoning, accuracy and interpretation separately; select the next item from the observed gap.

TEACHER SCRIPT

We Do

Core: O09; optional bank M09-M13, O09-O13. Target: Construct and interpret frequency and conditional tables.

Launch (2-3 minutes): Ask learners to supply each next step; write only what they can justify. Say: “What is recorded together, and what must our representation preserve?”

Explore (8-15 minutes, adjust to evidence): Read the core task. Ask: “What belongs on each axis or in each table heading? Which values are observed and which are modeled? Show how you checked one entry.” Do not rush to an answer letter.

Teacher mathematics for the core item: Missing cells: $25-9=16$; $34-20=14$. Row totals 25, 34; column totals 29, 30; grand total 59. Row denominators are 25 and 34. Column denominators are 29 and 30. Within-row passes rates: 36.0% and 58.8%. The 22.8-percentage-point difference is evidence of a possible association in this sample; strength should be described in context, not by an invented cutoff. These synthetic counts do not come from a randomized causal experiment. Rounding can make totals differ slightly from 100%.

Respond to gaps: If a coordinate, unit or denominator is mismatched, ask the learner to identify the group or quantity named in the prompt. If the conclusion goes beyond the data, ask what was actually measured. After a demonstration, mark that work as supported and use another bank item for independent evidence.

Close (2-4 minutes): “Name one check that made your conclusion more trustworthy.” Record representation, reasoning, accuracy and interpretation separately; select the next item from the observed gap.

TEACHER SCRIPT

Collaborative practice

Core: O14; optional bank M14-M18, O14-O18. Target: Construct and interpret frequency and conditional tables.

Launch (2-3 minutes): Assign a data reader, model builder and checker; rotate roles. Each learner writes a final explanation. Say: “What is recorded together, and what must our representation preserve?”

Explore (8-15 minutes, adjust to evidence): Read the core task. Ask: “What belongs on each axis or in each table heading? Which values are observed and which are modeled? Show how you checked one entry.” Do not rush to an answer letter.

Teacher mathematics for the core item: Missing cells: $22-6=16$; $17-12=5$. Row totals 22, 17; column totals 18, 21; grand total 39. Row denominators are 22 and 17. Column denominators are 18 and 21. Within-row smooth rates: 27.3% and 70.6%. The 43.3-percentage-point difference is evidence of a possible association in this sample; strength should be described in context, not by an invented cutoff. These synthetic counts do not come from a randomized causal experiment. Rounding can make totals differ slightly from 100%.

Respond to gaps: If a coordinate, unit or denominator is mismatched, ask the learner to identify the group or quantity named in the prompt. If the conclusion goes beyond the data, ask what was actually measured. After a demonstration, mark that work as supported and use another bank item for independent evidence.

Close (2-4 minutes): “Name one check that made your conclusion more trustworthy.” Record representation, reasoning, accuracy and interpretation separately; select the next item from the observed gap.

TEACHER SCRIPT

Independent practice

Core: O19; optional bank M19-M23, O19-O23. Target: Construct and interpret frequency and conditional tables.

Launch (2-3 minutes): Collect an uncued first response before discussion. Offer only neutral access support. Say: “What is recorded together, and what must our representation preserve?”

Explore (8-15 minutes, adjust to evidence): Read the core task. Ask: “What belongs on each axis or in each table heading? Which values are observed and which are modeled? Show how you checked one entry.” Do not rush to an answer letter.

Teacher mathematics for the core item: Missing cells: $19-3=16$; $38-25=13$. Row totals 19, 38; column totals 28, 29; grand total 57. Row denominators are 19 and 38. Column denominators are 28 and 29. Within-row intact rates: 15.8% and 65.8%. The 50.0-percentage-point difference is evidence of a possible association in this sample; strength should be described in context, not by an invented cutoff. These synthetic counts do not come from a randomized causal experiment. Rounding can make totals differ slightly from 100%.

Respond to gaps: If a coordinate, unit or denominator is mismatched, ask the learner to identify the group or quantity named in the prompt. If the conclusion goes beyond the data, ask what was actually measured. After a demonstration, mark that work as supported and use another bank item for independent evidence.

Close (2-4 minutes): “Name one check that made your conclusion more trustworthy.” Record representation, reasoning, accuracy and interpretation separately; select the next item from the observed gap.

TEACHER SCRIPT

Small-group reteach

Core: O24; optional bank M24-M27, O24-O27. Target: Construct and interpret frequency and conditional tables.

Launch (2-3 minutes): Use one representation at a time and connect each entry to its meaning. Try a fresh item afterward. Say: “What is recorded together, and what must our representation preserve?”

Explore (8-15 minutes, adjust to evidence): Read the core task. Ask: “What belongs on each axis or in each table heading? Which values are observed and which are modeled? Show how you checked one entry.” Do not rush to an answer letter.

Teacher mathematics for the core item: Missing cells: $35-19=16$; $21-17=4$. Row totals 35, 21; column totals 36, 20; grand total 56. Row denominators are 35 and 21. Column denominators are 36 and 20. Within-row complete rates: 54.3% and 81.0%. The 26.7-percentage-point difference is evidence of a possible association in this sample; strength should be described in context, not by an invented cutoff. These synthetic counts do not come from a randomized causal experiment. Rounding can make totals differ slightly from 100%.

Respond to gaps: If a coordinate, unit or denominator is mismatched, ask the learner to identify the group or quantity named in the prompt. If the conclusion goes beyond the data, ask what was actually measured. After a demonstration, mark that work as supported and use another bank item for independent evidence.

Close (2-4 minutes): “Name one check that made your conclusion more trustworthy.” Record representation, reasoning, accuracy and interpretation separately; select the next item from the observed gap.

TEACHER SCRIPT

Exit ticket

Core: O28; optional bank M28-M30, O28-O30. Target: Construct and interpret frequency and conditional tables.

Launch (2-3 minutes): Ask for a short independent explanation; use the evidence to plan the next lesson. Say: “What is recorded together, and what must our representation preserve?”

Explore (8-15 minutes, adjust to evidence): Read the core task. Ask: “What belongs on each axis or in each table heading? Which values are observed and which are modeled? Show how you checked one entry.” Do not rush to an answer letter.

Teacher mathematics for the core item: Missing cells: $22-9=13$; $26-19=7$. Row totals 22, 26; column totals 28, 20; grand total 48. Row denominators are 22 and 26. Column denominators are 28 and 20. Within-row sprouted rates: 40.9% and 73.1%. The 32.2-percentage-point difference is evidence of a possible association in this sample; strength should be described in context, not by an invented cutoff. These synthetic counts do not come from a randomized causal experiment. Rounding can make totals differ slightly from 100%.

Respond to gaps: If a coordinate, unit or denominator is mismatched, ask the learner to identify the group or quantity named in the prompt. If the conclusion goes beyond the data, ask what was actually measured. After a demonstration, mark that work as supported and use another bank item for independent evidence.

Close (2-4 minutes): “Name one check that made your conclusion more trustworthy.” Record representation, reasoning, accuracy and interpretation separately; select the next item from the observed gap.

MULTIPLE-CHOICE PRACTICE

M01 | Warm-up

Target: Find a row conditional relative frequency.

This table summarizes synthetic packages. Each object or trial is counted once by both categories. Among label A packages, what fraction are intact?

packages	intact	dented	Total
label A	10	7	17
label B	16	8	24
Total	26	15	41

- A. 10/17
- B. 10/41
- C. 7/17
- D. 10/26

Reasoning notes: show the evidence for your choice

MULTIPLE-CHOICE PRACTICE

M02 | Warm-up

Target: Find a column conditional relative frequency.

This table summarizes synthetic tiles. Each object or trial is counted once by both categories. Among smooth tiles, what fraction are unglazed?

tiles	smooth	rough	Total
glazed	17	10	27
unglazed	6	13	19
Total	23	23	46

- A. 6/23
- B. 6/46
- C. 6/19
- D. 17/23

Reasoning notes: show the evidence for your choice

OPEN / PERFORMANCE PRACTICE

001 | Warm-up

Target: Construct and interpret frequency and conditional tables.

In a synthetic collection of packages, 17 are label A and 24 are label B. Among the label A group, 10 are intact; among the label B group, 16 are intact. Every subject is either intact or dented. Construct a two-way frequency table, including totals. Then construct a row relative-frequency table and a column relative-frequency table. Label the denominator for each conditional percentage. Compare the intact percentages within the two rows and describe the evidence of possible association. Round percentages to one decimal place; explain why this table cannot establish cause.

Frequency table

packages	intact	dented	Total
label A			
label B			
Total			

Row relative frequencies (write row denominators)

packages	intact	dented	Total
label A			
label B			

Column relative frequencies (write column denominators)

packages	intact	dented
label A		
label B		
Total		

Comparison and explanation

OPEN / PERFORMANCE PRACTICE

002 | Warm-up

Target: Construct and interpret frequency and conditional tables.

In a synthetic collection of tiles, 27 are glazed and 19 are unglazed. Among the glazed group, 17 are smooth; among the unglazed group, 6 are smooth. Every subject is either smooth or rough. Construct a two-way frequency table, including totals. Then construct a row relative-frequency table and a column relative-frequency table. Label the denominator for each conditional percentage. Compare the smooth percentages within the two rows and describe the evidence of possible association. Round percentages to one decimal place; explain why this table cannot establish cause.

Frequency table

tiles	smooth	rough	Total
glazed			
unglazed			
Total			

Row relative frequencies (write row denominators)

tiles	smooth	rough	Total
glazed			
unglazed			

Column relative frequencies (write column denominators)

tiles	smooth	rough
glazed		
unglazed		
Total		

Comparison and explanation

TEACHER REFERENCE

Multiple-choice worked keys

M01 | Find a row conditional relative frequency.**Answer: A. 10/17**

The requested group contains 17 packages; 10 meet the second condition. Divide 10 by 17, giving 0.5882 (about 58.8%). Other denominators refer to different groups; selecting an alternative alone does not prove a specific misconception. Option checks: A: matches the required result. B: 10/41 does not match the calculation or evidence above. C: 7/17 does not match the calculation or evidence above. D: 10/26 does not match the calculation or evidence above.

M02 | Find a column conditional relative frequency.**Answer: A. 6/23**

The requested group contains 23 tiles; 6 meet the second condition. Divide 6 by 23, giving 0.2609 (about 26.1%). Other denominators refer to different groups; selecting an alternative alone does not prove a specific misconception. Option checks: A: matches the required result. B: 6/46 does not match the calculation or evidence above. C: 6/19 does not match the calculation or evidence above. D: 17/23 does not match the calculation or evidence above.