

UM PRINTABLES

Two-Way Frequency Tables & Scatter Plots

Printable Statistics Activity Bundle with ELL Vocabulary Anchors

Common Core Standards:
HSS.ID.B.5 • HSS.ID.B.6 • HSS.ID.C.7 • HSS.ID.C.8

- ✓ 5 Comprehensive Statistics Activities
- ✓ Clear ELL-Friendly Vocabulary Anchors (English)
- ✓ Color-Coded Two-Way Tables & Visual Scaffolds
- ✓ Sentence Frames for Data Description
- ✓ Printable Matching & Sorting Activities
- ✓ Complete Answer Keys with Detailed Solutions
- ✓ Printable Visual Glossary
- ✓ Aligned to Common Core High School Statistics Standards

Grade Level: 9-12 (High School Statistics & Probability)

Table of Contents

1. ELL Vocabulary Glossary (Printable)	3
2. Activity 1: Reading Two-Way Frequency Tables	5
1.1 Vocabulary Anchors	5
1.2 Guided Practice	7
1.3 Independent Practice	9
1.4 Answer Key	11
3. Activity 2: Constructing Two-Way Tables	13
2.1 Vocabulary & Concepts	13
2.2 Guided Construction	15
2.3 Practice Problems	17
2.4 Answer Key	18
4. Activity 3: Conditional Probability from Two-Way Tables	20
3.1 Understanding Conditional Probability	20
3.2 Calculation Practice	22
3.3 Real-World Applications	24
3.4 Answer Key	26
5. Activity 4: Constructing & Interpreting Scatter Plots	28
4.1 Correlation Vocabulary	28
4.2 Plotting Practice	30
4.3 Interpretation Exercises	33
4.4 Answer Key	35
6. Activity 5: Lines of Best Fit & Residuals	37
5.1 Introduction to Lines of Best Fit	37
5.2 Calculating & Interpreting Residuals	39
5.3 Practice & Application	41
5.4 Answer Key	43
7. Review Request & Feedback	45

Activity 1: Reading Two-Way Frequency Tables

Standard: HSS.ID.B.5 — Summarize categorical data for two categories in two-way frequency tables

1.1 Vocabulary Anchors

Instructions: Read each vocabulary term carefully. Use the color-coded table below to identify joint frequencies (teal cells) and marginal frequencies (purple cells).

Example: Student Survey — Pet Preference by Grade Level

Grade Level	Dogs	Cats	Other	Total
9th Grade	45	30	15	90
10th Grade	52	28	20	100
11th Grade	38	35	17	90
12th Grade	41	32	17	90
Total	176	125	69	370

Teal Cells = Joint Frequencies

Purple Cells = Marginal Frequencies (Totals)

Key Terms:

Joint Frequency

A count in the interior of the table representing observations in a specific combination of two categories. Example: 45 9th graders prefer dogs.

Marginal Frequency

A total in the last row or last column. Example: 176 total students prefer dogs across all grades.

Conditional Relative Frequency

The ratio of a joint frequency to its row or column total. Example: $45/90 = 0.50$, meaning 50% of 9th graders prefer dogs.

2.2 Guided Construction Practice

Instructions: Use the raw data below to construct a two-way frequency table. Follow the 6-step process.

Raw Data: Transportation Method by Grade Level (150 students surveyed)

- 9th Grade (50 students): 20 Bus, 15 Car, 10 Walk, 5 Bike
- 10th Grade (50 students): 18 Bus, 20 Car, 7 Walk, 5 Bike
- 11th Grade (50 students): 12 Bus, 25 Car, 8 Walk, 5 Bike

Your Table Template:

Grade	Bus	Car	Walk	Bike	Total
9th					50
10th					50
11th					50
Total					150

Sentence Frame: The joint frequency of _____ and _____ is _____.

Sentence Frame: The total number of students who _____ is _____.

Guided Problem 2: Music Preference by Gender

120 students were surveyed. Here are the results:

- Males (60 students): 22 prefer Pop, 18 prefer Rock, 12 prefer Hip-Hop, 8 prefer Other
- Females (60 students): 28 prefer Pop, 14 prefer Rock, 10 prefer Hip-Hop, 8 prefer Other

Gender	Pop	Rock	Hip-Hop	Other	Total
Male					60
Female					60

3.2 Conditional Probability Calculation Practice

Instructions: Use the table below to calculate each conditional probability. Show your work using the formula.

Practice Table: College Plans by Gender (400 students)

Gender	4-Year College	2-Year College	No College	Total
Male	95	55	50	200
Female	110	50	40	200
Total	205	105	90	400

Question 1: $P(4\text{-Year College} \mid \text{Male}) = ?$

Work: _____

Answer: _____

Question 2: $P(4\text{-Year College} \mid \text{Female}) = ?$

Work: _____

Answer: _____

Question 3: $P(\text{Male} \mid 4\text{-Year College}) = ?$

Work: _____

Answer: _____

Question 4: $P(\text{Female} \mid 2\text{-Year College}) = ?$

Work: _____

Answer: _____

Question 5: $P(\text{No College} \mid \text{Male}) = ?$

Work: _____

Answer: _____

Question 6: $P(\text{No College} \mid \text{Female}) = ?$

Work: _____

Answer: _____

3.3 Real-World Applications

Instructions: Apply conditional probability to real-world scenarios. These problems require you to construct tables from word problems and then calculate probabilities.

Application 1: Medical Testing

A study of 500 patients tested for a condition found:

- 200 patients have the condition; 300 do not
- Of those with the condition: 180 tested positive, 20 tested negative
- Of those without the condition: 45 tested positive, 255 tested negative

- Construct the two-way table.
- $P(\text{Positive} \mid \text{Has Condition}) = ?$ (This is called 'sensitivity')
- $P(\text{Negative} \mid \text{No Condition}) = ?$ (This is called 'specificity')
- $P(\text{Has Condition} \mid \text{Positive}) = ?$ (This is called 'positive predictive value')

Application 2: Sports Participation

A survey of 300 high school students:

- 150 students play a sport; 150 do not
- Of sport players: 120 have $\text{GPA} \geq 3.0$, 30 have $\text{GPA} < 3.0$
- Of non-players: 75 have $\text{GPA} \geq 3.0$, 75 have $\text{GPA} < 3.0$

Questions:

- Construct the two-way table.
- $P(\text{GPA} \geq 3.0 \mid \text{Plays Sport}) = ?$
- $P(\text{GPA} \geq 3.0 \mid \text{Does Not Play Sport}) = ?$
- Is there an association between sports participation and GPA? Explain.

Application 3: Technology Usage

A survey of 600 adults about social media usage:

- 350 use social media daily; 250 do not
- Of daily users: 200 are under 40, 150 are 40+
- Of non-daily users: 80 are under 40, 170 are 40+

Questions:

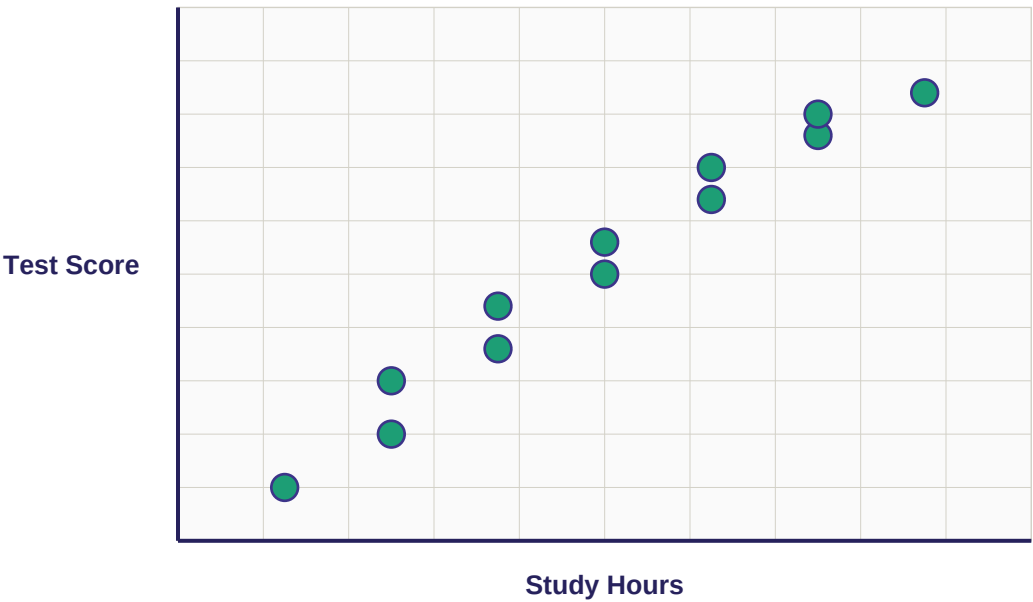
- Construct the two-way table.

4.2 Plotting Practice

Instructions: Plot the following data points on the coordinate grid. Then describe the correlation you observe.

Dataset 1: Study Hours vs. Test Score

Study Hours vs. Test Score



Questions:

1. What type of correlation do you observe?

Sentence Frame: There is a ____ correlation between study hours and test score.

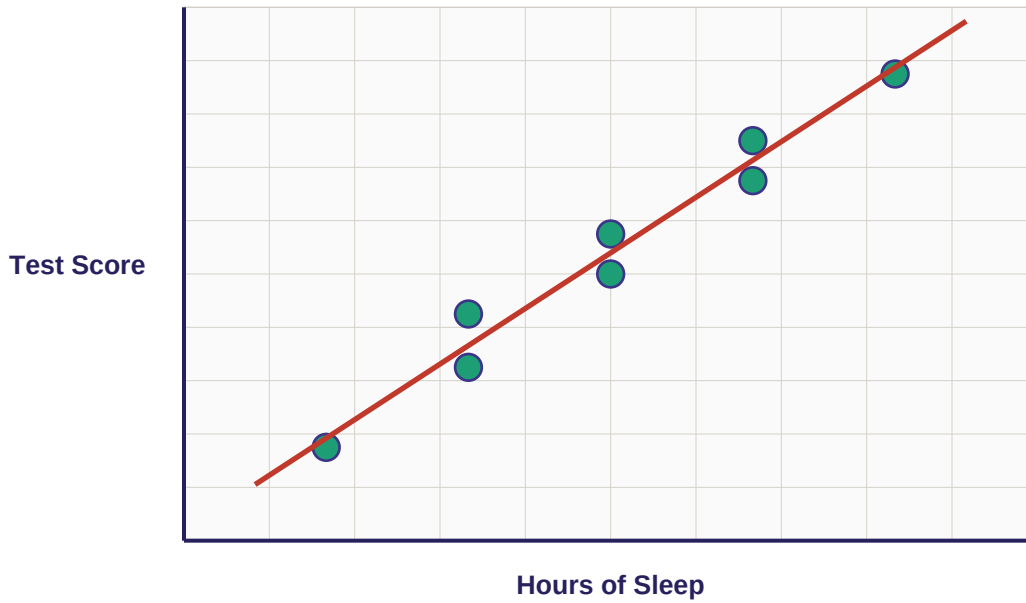
2. How would you describe the strength?

Sentence Frame: The correlation is ____ because ____.

3. If a student studies for 4.5 hours, predict their test score.

Dataset 2: Temperature vs. Hot Beverage Sales

Sleep Hours vs. Test Score with Line of Best Fit



Least-squares regression line (rounded): $\hat{y} = 6.92x + 28.08$

Solution to Question Example: Predict score for 7.5 hours of sleep:

Step 1: The least-squares regression equation, rounded to two decimals, is $\hat{y} = 6.92x + 28.08$.

Step 2: Substitute $x = 7.5$: $\hat{y} = 6.92(7.5) + 28.08$.

Step 3: Calculate: $\hat{y} \approx 79.98$, so the predicted score is about 80.

Step 4: Interpretation: A student who sleeps 7.5 hours is predicted to score about 80 on the test.

Step 5: Slope interpretation: Each additional hour of sleep is associated with an increase of about 6.92 points in predicted test score.

Step 6: Y-intercept interpretation: At 0 hours of sleep, the model predicts about 28.08 points; this is an extrapolation outside the observed range and is not practically meaningful.

Sentence Frames:

Sentence Frame: The line of best fit is $y = \quad x + \quad$.

Sentence Frame: For each additional unit of $\quad$, $\quad$ increases/decreases by $\quad$.

Sentence Frame: When $\quad = 0$, the predicted $\quad$ is $\quad$.

Sentence Frame: For $\quad = \quad$, the predicted $\quad$ is $\quad$.

5.4 Answer Key — Activity 5

Practice 1 — Temperature vs. Lemonade Sales:

- a) Slope = 3: For each 1°F increase in temperature, lemonade sales increase by 3 cups. This makes sense — hotter weather leads to more thirst and more lemonade purchases.
- b) Y-intercept = −20: When temperature is 0°F, predicted sales = −20 cups. This does NOT make practical sense (can't sell negative cups). The y-intercept is outside the range of observed data, so it's not meaningful in context. This is common with linear models.
- c) At 95°F: $y = 3(95) - 20 = 285 - 20 = 265$ cups predicted.
- d) Friday has the largest residual (+10). This means actual sales (260) were 10 cups higher than predicted (250). Friday might have had a special event or promotion that boosted sales beyond what temperature alone would predict.
- e) The residuals are: −5, +5, +5, +5, +10. They are mostly positive with one negative. Because four of the five residuals are positive, the model shows a slight systematic underprediction. The residuals are small, so the model is reasonable over this range, but the pattern is not perfectly random around zero.

Practice 2 — Age vs. Height:

Age (x)	Height (y)	Predicted ($\hat{y} = 2.43x + 30.46$)	Residual ($y - \hat{y}$)
3	38	37.75	+0.25
4	40	40.18	−0.18
5	43	42.61	+0.39
6	44	45.04	−1.04
7	48	47.46	+0.54
8	50	49.89	+0.11
9	52	52.32	−0.32
10	55	54.75	+0.25

- a) Slope ≈ 2.43 : For each additional year of age, the model predicts an increase of about 2.43 inches in height.
- b) At age 12: $\hat{y} = 2.43(12) + 30.46 = 59.62$ inches, or about 5 ft 0 in.

WHAT'S INSIDE THE FULL RESOURCE

Two-Way Frequency Tables & Scatter Plots • Grades 9–12

45-PAGE PDF

5 ACTIVITIES

ELL SCAFFOLDS

DETAILED KEYS

CORE LEARNING SEQUENCE

01

Read Two-Way Frequency Tables

1.1 Vocabulary Anchors • 1.2 Guided Practice • 1.3 Independent Practice • 1.4 Answer Key
Joint frequency • marginal frequency • conditional relative frequency • sentence frames • table interpretation.

02

Construct Two-Way Tables

2.1 Vocabulary & Concepts • 2.2 Guided Construction • 2.3 Independent Practice • 2.4 Answer Key
Six-step construction process • transportation • music • snacks • devices • reading preferences.

03

Conditional Probability

3.1 Understanding • 3.2 Calculation Practice • 3.3 Real-World Applications • 3.4 Answer Key
 $P(A|B)$ • correct denominators • college plans • medical testing • sports/GPA • technology usage.

04

Scatter Plots & Correlation

4.1 Correlation Vocabulary • 4.2 Plotting Practice • 4.3 Interpretation • Matching Activity • 4.4 Answer Key
Positive/negative/no correlation • strength • predictions • explanatory/response variables • outliers.

05

Lines of Best Fit & Residuals

5.1 Introduction • 5.2 Residuals • 5.3 Practice & Application • 5.4 Answer Key
Least-squares line • slope • y-intercept • prediction • residual = actual – predicted • residual plots • model fit.

TEACHER & STUDENT SUPPORT

ELL Vocabulary Glossary

Printable English-only reference covering two-way tables, joint/marginal frequency, conditional relative frequency, scatter plots, correlation, line of best fit, residuals, categorical data, and conditional probability.

Sentence Frames & ELL Scaffolds

Student-friendly frames support mathematical language, contextual descriptions, and explanations throughout the bundle.

Color-Coded Tables & Visual Supports

Consistent table cues, formula panels, worked examples, and structured visual scaffolds reinforce key statistical ideas.

Guided, Independent & Applied Practice

Students progress from explicit examples to construction, calculation, interpretation, prediction, association, and model-fit analysis.

Real-World Contexts

Medical testing, sports/GPA, social media, transportation, devices, reading, snack preference, sales, temperature, and age/height.

Complete Answer Keys

Detailed calculations, completed tables, percentages, probability interpretations, correlation conclusions, residual tables, and model-fit analysis.

FULL RESOURCE SECTION MAP

Cover + TOC + 2-page glossary • Activity 1 begins p.5 • Activity 2 p.12 • Activity 3 p.19

Activity 4 p.27 • Activity 5 p.36 • Thank-you / review page p.44 • Final copyright page p.45

Selected preview pages are full-size pages from the resource; the complete PDF contains the full instructional sequence and keys.

COMMON CORE ALIGNMENT

HSS.ID.B.5 • HSS.ID.B.6 • HSS.ID.C.7 • HSS.ID.C.8 • Grades 9–12