

# Reading Two-Way Tables and Scatter Plots

**Grade 9 – Algebra 1 math · Worksheet · Standards: S-ID.B.5, S-ID.B.6, S-ID.C.7, S-ID.C.8, S-ID.C.9**

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

These 20 problems train standards S-ID.B.5, S-ID.B.6, S-ID.C.7, S-ID.C.8 and S-ID.C.9. The first problems find joint, marginal and conditional relative frequencies and describe scatter plots. Later problems use lines of best fit, residuals and the correlation coefficient.

The last six problems build models, judge them and separate correlation from causation.

**Standards:** S-ID.B.5, S-ID.B.6, S-ID.C.7, S-ID.C.8, S-ID.C.9 · **Level:** Grade 9 Algebra 1

## Problem 1 Complete the Totals (easy)

In a pet survey of 7th and 8th graders, the counts are shown. Fill in the row totals, the column totals and the number of students surveyed.

|           | Dog | Cat | Total |
|-----------|-----|-----|-------|
| 7th grade | 24  | 16  |       |
| 8th grade | 18  | 22  |       |
| Total     |     |     |       |

## Problem 2 Joint Relative Frequency (easy)

Use the pet survey (24 seventh graders prefer dogs, out of 80 students in all). What is the joint relative frequency of 7th graders who prefer dogs?

## Problem 3 Marginal Relative Frequency (easy)

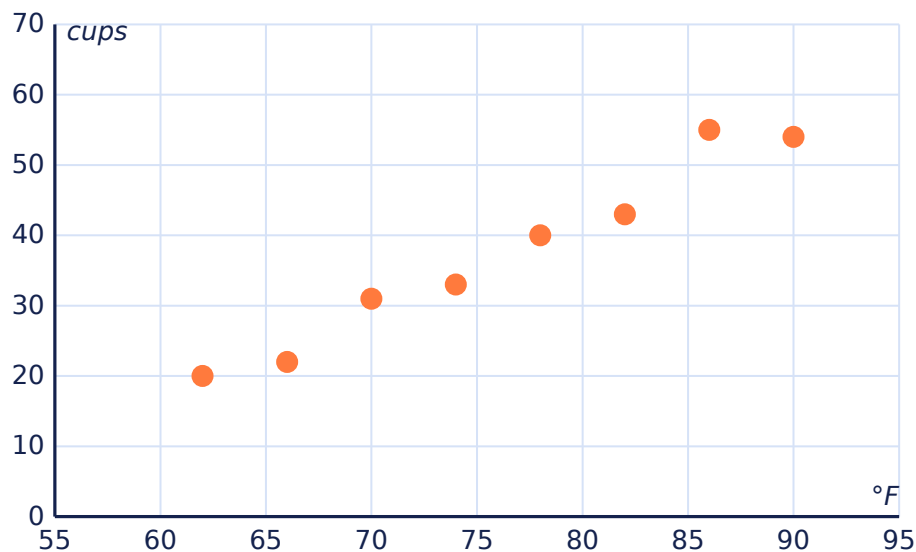
In the pet survey, 38 of the 80 students prefer cats. Find the marginal relative frequency of preferring cats.

## Problem 4 Conditional Relative Frequency (easy)

In the pet survey, what fraction of the 8th graders prefer dogs? What fraction of the cat lovers are 8th graders (to the nearest tenth of a percent)?

### Problem 5 Describe a Scatter Plot (easy)

The scatter plot shows lemonade cups sold at a stand and the afternoon temperature. Describe the direction, the strength and the form of the association.



*Cups sold at different temperatures.*

### Problem 6 Predict with a Line (easy)

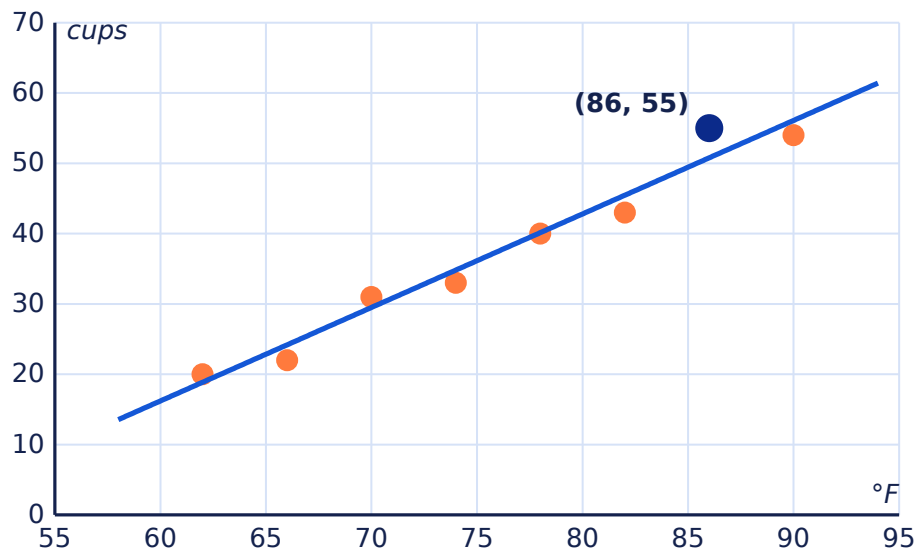
The line of best fit for the lemonade data is  $\hat{y} = 1.33x - 63.6$ , where  $x$  is the temperature in °F. Predict the cups sold at 80°F and at 66°F, rounded to the nearest cup.

### Problem 7 Interpret Slope and Intercept (medium)

For  $\hat{y} = 1.33x - 63.6$ , explain the meaning of the slope and of the intercept in the lemonade context. Does the intercept make sense?

### Problem 8 Find a Residual (medium)

On the graph the point (86, 55) is plotted with the line  $\hat{y} = 1.33x - 63.6$ . Find the predicted value at 86°F and the residual.



The line of best fit and the point (86, 55).

### Problem 9 Residual Table (medium)

Use  $\hat{y} = 1.33x - 63.6$  to complete a table of residuals for the points (62, 20), (70, 31), (82, 43) and (90, 54). Do the signs look random?

### Problem 10 Match the Correlation (medium)

Match each correlation coefficient to the best description:  $r = 0.95$ ,  $r = -0.80$ ,  $r = 0.05$ ,  $r = -0.30$ .

- Strong negative linear relationship
- Almost no linear relationship
- Weak negative linear relationship
- Strong positive linear relationship

### Problem 11 Ice Cream and Sunburn (medium)

A town records that months with higher ice cream sales also have more sunburn cases, with  $r = 0.88$ . A friend says ice cream causes sunburn. Explain what is wrong with this claim and name a lurking variable.

### Problem 12 Conditional Frequency, Three Columns (medium)

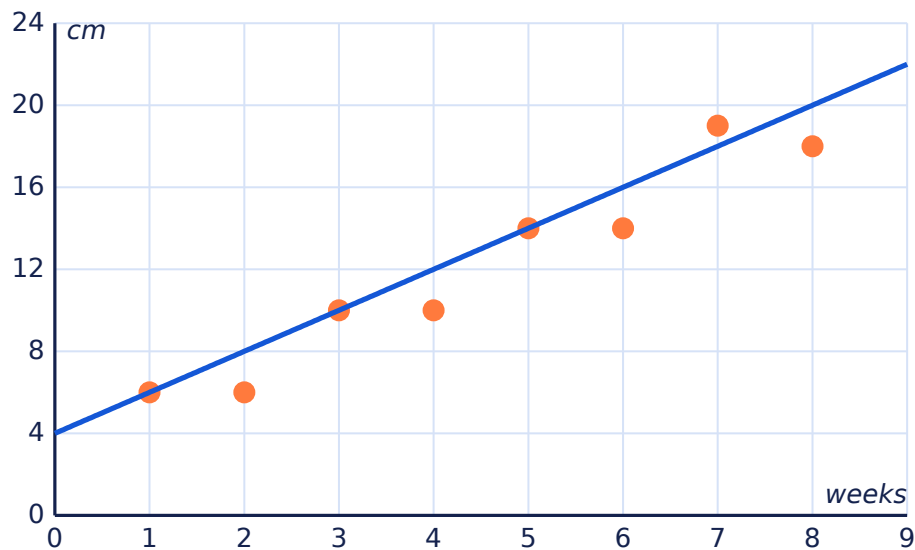
The table shows how 140 students get to school. Find the conditional relative frequency of walking among girls, and of boys among the students who come by car.

|  |     |      |     |
|--|-----|------|-----|
|  | Bus | Walk | Car |
|--|-----|------|-----|

|       | Bus | Walk | Car |
|-------|-----|------|-----|
| Boys  | 30  | 18   | 12  |
| Girls | 35  | 25   | 20  |

### Problem 13 Read a Line from a Graph (medium)

A class tracks the height of a bean plant. The line is drawn through (0, 4) and (8, 20). Find its equation, interpret the slope and the intercept, and predict the height at week 11.



Plant height with a drawn line.

### Problem 14 Is the Prediction Safe? (medium)

Use  $\hat{y} = 1.33x - 63.6$  to predict the lemonade sales at 30°F and at 100°F. Which prediction is unreliable, and why?

### Problem 15 Regression by Calculator (hard)

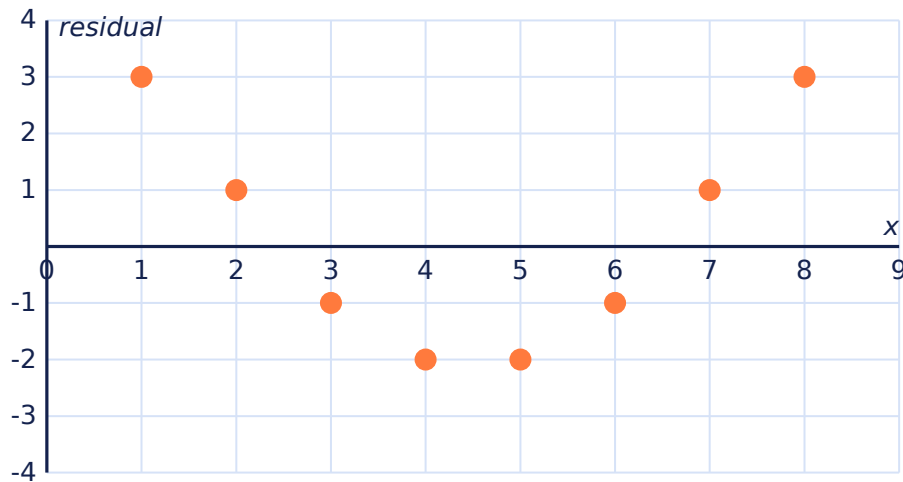
Hours of sleep  $x$  and reaction time  $y$  (in milliseconds) were measured for six students: (5, 310), (6, 295), (7, 280), (8, 262), (9, 251) and (6.5, 292). Use a calculator to find the line of best fit and  $r$ , rounded as shown in the answer key, and interpret both.

### Problem 16 Build a Table from Percentages (hard)

Of 200 customers, 120 ordered online and 80 shopped in the store. Among the online customers 45% used a coupon, and among the in-store customers 25% did. Build a two-way table, then find the probability that a customer who used a coupon ordered online.

### Problem 17 Residual Plot Pattern (hard)

A linear model was fitted to eight data points, and its residual plot is shown. Is a linear model appropriate? Explain what type of model might fit better.



*Residuals of a linear model.*

### Problem 18 Line from Two Data Points (hard)

A used bike store lists a bike at \$420 when it is 1 year old, \$300 at 3 years and \$180 at 5 years. Write a linear model for the value  $V$  after  $t$  years, interpret the slope, predict the value at 6 years and find when the value reaches \$0.

### Problem 19 Which Model Fits Better? (hard)

Two lines were fitted to the same four points. The residuals are Model A: 4,  $-1$ , 2,  $-3$ , and Model B: 1, 2,  $-1$ ,  $-2$ . Compute the sum of the squared residuals for each model and decide which fits better.

### Problem 20 Firefighters and Damage (hard)

A city study finds  $r = 0.78$  between the number of firefighters sent to a fire and the dollar damage. A reporter writes, "Sending more firefighters causes more damage." Explain the flaw in this conclusion and identify the lurking variable.