Least Squares Regression Line (LSRL)

Statistics Worksheet · Grades 10–12

Name: _____ Date: _____

Learning Objectives

- Identify and interpret the slope and y-intercept of a least squares regression line in context
- Use the LSRL equation to predict values of the response variable given an explanatory variable
- Determine and explain the appropriateness of using a linear model for prediction

Problems

1. A linear model for predicting a man's height (in inches) from his shoe size is given below. Identify the slope and the y-intercept of the model.

$$\hat{y} = 53.24 + 1.65x$$

2. Using the linear model for men's height and shoe size, predict the height of a man whose shoe size is 10.

$$\hat{y} = 53.24 + 1.65x$$

3. A linear model predicts the number of wins for a college football team based on average points scored per game. Interpret the slope in context.

$$\hat{y} = -3.7506 + 0.4372x$$

4. Using the football wins linear model, interpret the y-intercept in context. Does the y-intercept make practical sense here?

$$\hat{y} = -3.7506 + 0.4372x$$

5. A team averages 30 points per game. Use the football wins linear model to predict their number of wins for a season.

$$\hat{y} = -3.7506 + 0.4372x$$

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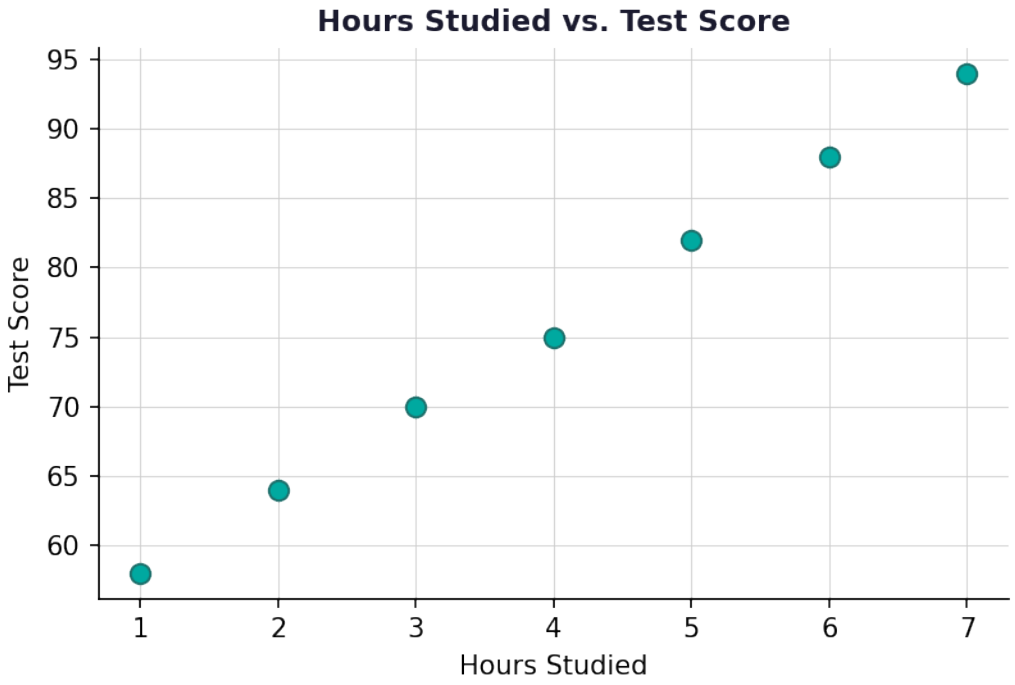
6. The data below shows the number of hours studied and the corresponding test scores for 7 students. Plot the scatter plot and describe the association between hours studied and test score.



7. Using the data for hours studied and test scores, a calculator produces the LSRL shown below. Predict the test score for a student who studies 4.5 hours.

$$\hat{y} = 51.43 + 6.07x$$

8. The table below shows shoe sizes and heights (in inches) for 5 men. Use a calculator to find the LSRL equation, rounding a and b to two decimal places.

Shoe Size (x)	Height in Inches (y)
8	66
9	68
10	70
11	72
12	74

9. A student uses the football wins LSRL to predict wins for a team that scores 80 points per game. A classmate says this prediction is unreliable. Explain why the classmate may be correct.

$$\hat{y} = -3.7506 + 0.4372x$$

10. A researcher collects data on the number of absences (x) and final exam scores (y) for 8 students. The data produces the LSRL below. A student had 6 absences but scored 78 on the exam. Calculate the residual for this student and explain what it means in context.

$$\hat{y} = 95.2 - 3.4x$$

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Least Squares Regression Line (LSRL) — Answer Key

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Answer Key

1. Answer: Slope = 1.65; y-intercept = 53.24

- The equation is in the form ■ = a + bx, where a is the y-intercept and b is the slope.
- a = 53.24 (y-intercept) and b = 1.65 (slope).

2. Answer: ■ = 69.74 inches

- Substitute x = 10 into the equation: ■ = 53.24 + 1.65(10).
- ■ = 53.24 + 16.50 = 69.74 inches.

3. Answer: For every 1-point increase in average points scored per game, the predicted number of wins increases by 0.4372.

- The slope b = 0.4372 represents the rate of change of ■ with respect to x.
- In context: for each additional point scored per game on average, the team is predicted to win 0.4372 more games.

4. Answer: The y-intercept of -3.7506 means that if a team scores 0 points per game on average, they are predicted to have about -3.75 wins. This does not make practical sense.

- The y-intercept a = -3.7506 is the predicted value of y when x = 0.
- A negative number of wins is not possible, so the y-intercept has no practical meaning in this context.

5. Answer: ■ ≈ 9.37 wins

- Substitute x = 30: ■ = -3.7506 + 0.4372(30).
- ■ = -3.7506 + 13.116 = 9.3654 ≈ 9.37 wins.

6. Answer: Strong positive linear association: as hours studied increase, test scores increase.

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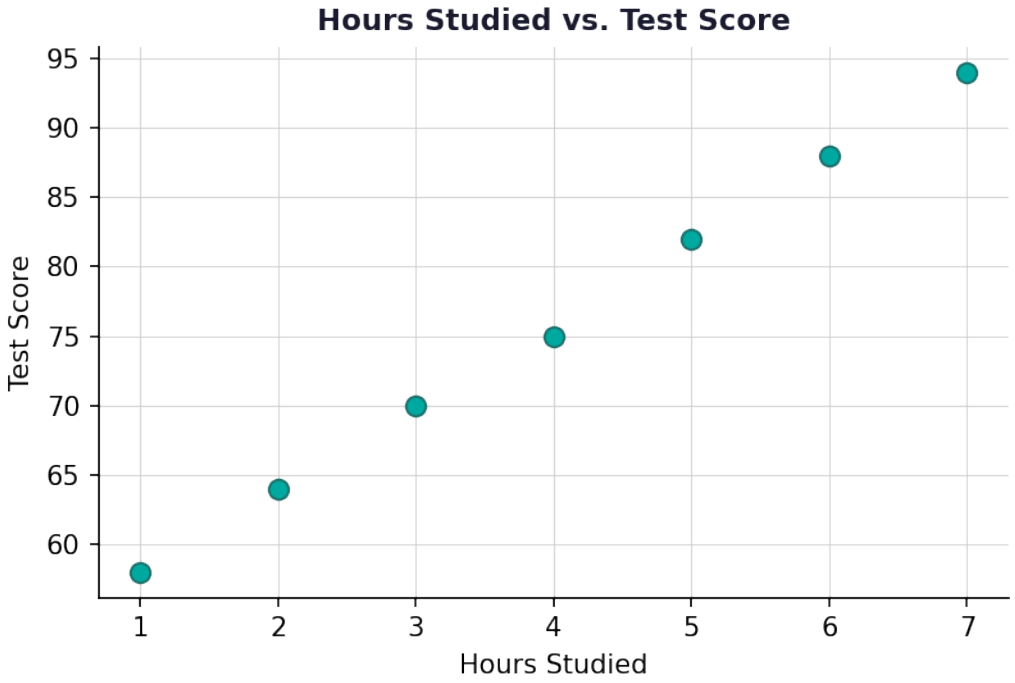

- Plot each point (hours, score) on the scatter plot.
- Observe that as x increases, y increases consistently — this indicates a positive linear association.

7. Answer: ■ ≈ 78.75

- Substitute x = 4.5 into the equation: ■ = 51.43 + 6.07(4.5).
- ■ = 51.43 + 27.315 = 78.745 ≈ 78.75.

8. Answer: ■ = 50.00 + 2.00x

- Enter shoe sizes in L1 and heights in L2 on a TI-84.
- Press STAT → CALC → 8: LinReg(a+bx), then input L1, L2 and press ENTER.
- The calculator gives a = 50.00 and b = 2.00, so ■ = 50.00 + 2.00x.

9. Answer: Predicting for x = 80 is extrapolation — it is far outside the range of the original data. Predictions made outside the data range are unreliable.

- The LSRL was built using data from 12 teams whose average scores were likely in a typical range (e.g., 20–45 points).
- Using x = 80 goes far beyond the observed data range, making the prediction an extrapolation.
- Extrapolation can produce inaccurate or meaningless predictions, so the classmate is correct to be cautious.

10. Answer: Residual = 3.2. The student scored 3.2 points higher than the model predicted.

- First find the predicted value: ■ = 95.2 - 3.4(6) = 95.2 - 20.4 = 74.8.
- Residual = Actual - Predicted = 78 - 74.8 = 3.2.
- A positive residual means the student performed 3.2 points better than the model predicted based on their absences.

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