

Regression Analysis: Lines, Residuals and r

Grade 12 – AP Statistics math · Test · Standards: AP Statistics Unit 5 (2026-27)

Name: _____ Date: _____ Class: _____

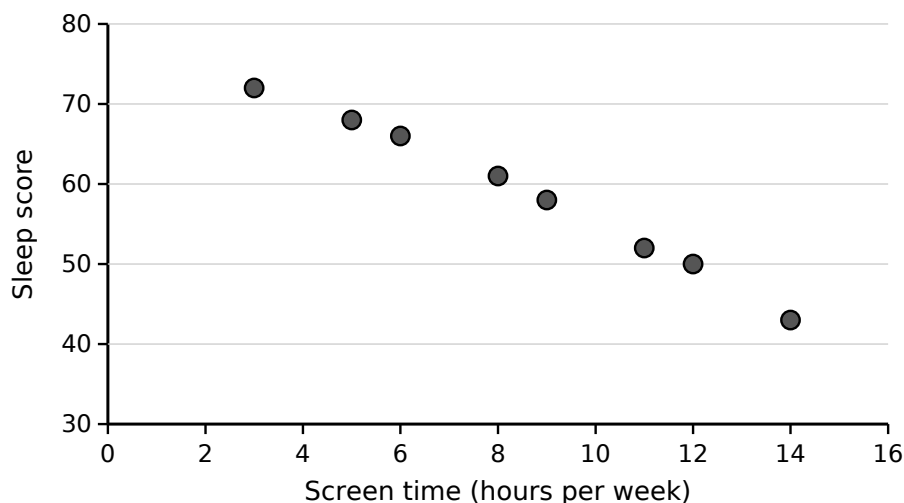
This 45-minute test has eight AP-style questions worth 20 points. Show the formulas with numbers, interpret every slope, intercept and r-squared in context, and justify conclusions from graphs and residual plots.

Standards: AP Statistics Unit 5 (2026-27) · **Level:** Grade 12 AP Statistics

Time: 45 minutes · 8 questions · Total: 20 points · Calculator: as allowed by your teacher

Question 1 Describing Association (2 points)

The scatterplot shows the number of hours of screen time per week (x) and a sleep-quality score (y) for 8 teenagers.



Screen time and sleep score.

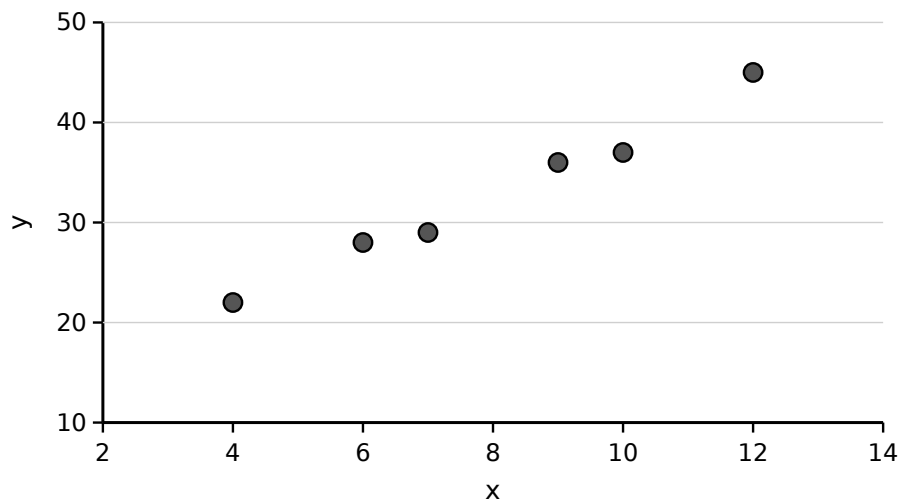
Describe the association in terms of direction, form and strength. Is it reasonable to conclude that screen time lowers sleep quality? Explain.

Question 2 Least-Squares Line (3 points)

For 40 students, hours studied per week has mean 10.5 and standard deviation 2.0, and test score has mean 71 and standard deviation 6.2; the correlation is 0.85. (a) Find the least-squares line for predicting score from hours. (b) Interpret the slope. (c) Interpret the y-intercept, or explain why it is not meaningful.

Question 3 Prediction and Residual (2 points)

A least-squares line for the six points $((4, 22), (6, 28), (7, 29), (9, 36), (10, 37), (12, 45))$ is $\hat{y} = 10.548 + 2.786x$. (a) Predict y for $x = 9$. (b) Find and interpret the residual of the point $(9, 36)$.



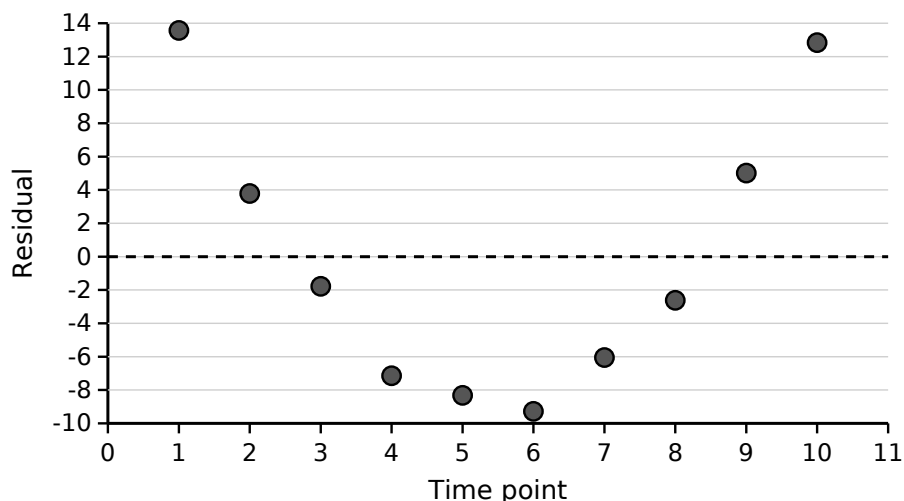
Six points.

Question 4 Interpreting r (2 points)

A study finds a correlation of $r = -0.72$ between the number of hours of TV watched per week and a fitness score. (a) Interpret r^2 in context. (b) Explain why the relationship is negative.

Question 5 Residual Plot (3 points)

A linear model is fitted for a reaction measured at 10 time points. The residual plot is shown.



Residuals for a linear fit.

(a) What does the residual plot show about the linear model? (b) Describe what a residual plot

would look like if the model were appropriate. (c) Could the value of r^2 be large even though the model is inappropriate? Explain.

Question 6 Influential Point (2 points)

A scatterplot of the heights and weights of 30 adults shows a strong positive linear pattern. A new adult 7 feet 4 inches tall and weighing only 150 pounds is added. (a) Is the new point an outlier, an influential point, or both? (b) Describe the likely effect on the slope and on r .

Question 7 Computer Output (3 points)

A regression of the price (in dollars) of used tablets on their age (in years) gives the output below.

Predictor	Coef
Constant	412.5
Age	-58.2

$S = 31.4$, $R\text{-sq} = 88.4\%$.

- Write the regression equation. (1 point)
- Interpret the slope and the S value. (1 point)
- Find the correlation r . (1 point)

Question 8 Extrapolation and Causation (3 points)

A study of 12 cities finds the line $\hat{y} = 8.1 + 0.62x$, where x is the number of parks per 100,000 people (from 2 to 14) and $\hat{y}$ is the mean life satisfaction score. (a) Predict the score for a city with 30 parks per 100,000 and comment. (b) A mayor says building parks will raise life satisfaction. Is this conclusion justified? Explain.