Name: __________________

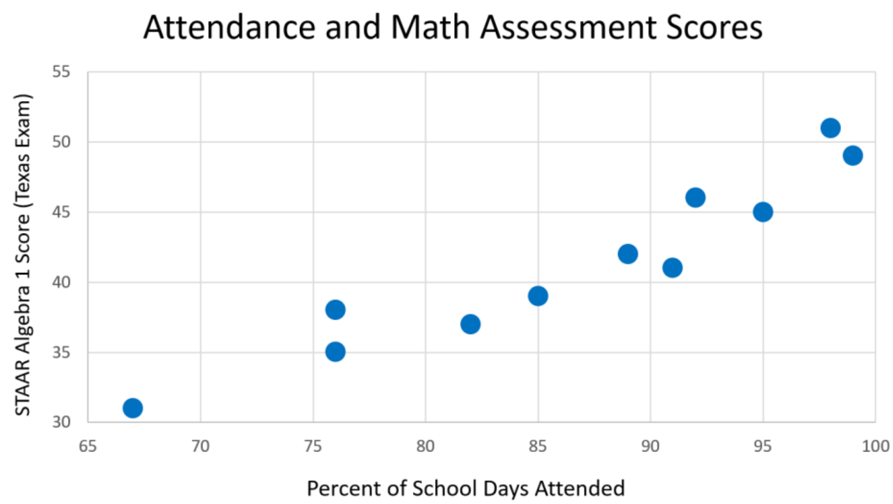
AP Statistics Handout: Lesson 3.2

Topics: least squares regression line, slope, y-intercept, predictions using LSRL, extrapolation

Lesson 3.2 Guided Notes

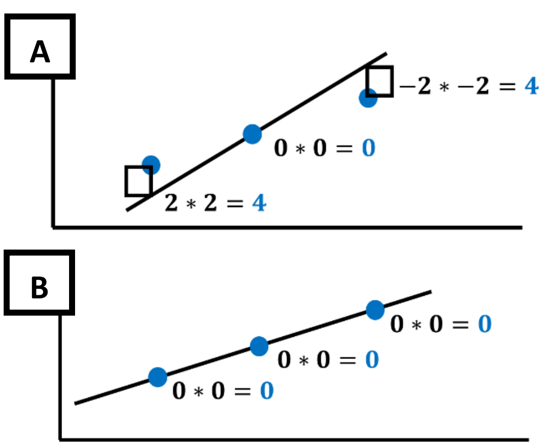
Closing the school achievement gap with attendance: Low-income students tend to have lower attendance rates and lower math test scores than their middle/upper income peers. Would raising their attendance close the achievement gap? To explore this possibility, a random sample was collected of students in Texas. For each student, data was collected on their attendance rate (percent of school days attended) and raw test scores on the Algebra 1 state exam.

Percent Attendance (x)	Algebra 1 Raw Score (y)
95	45
89	42
67	31
98	51
99	49
76	38
92	46
91	41
76	35
85	39
82	37

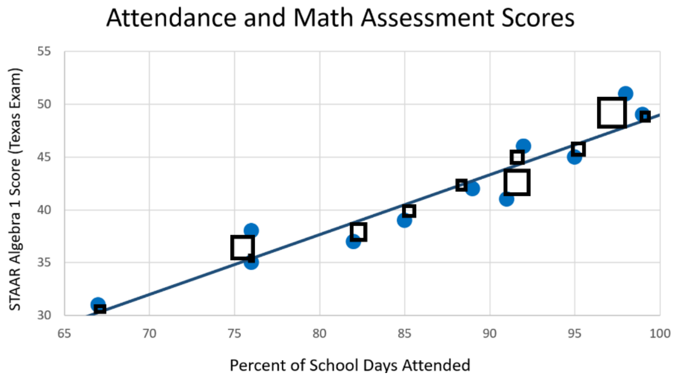


Least Squares Regression Line (LSRL)

a) For the above, what is the explanatory variable? What is the response variable? How can you tell?



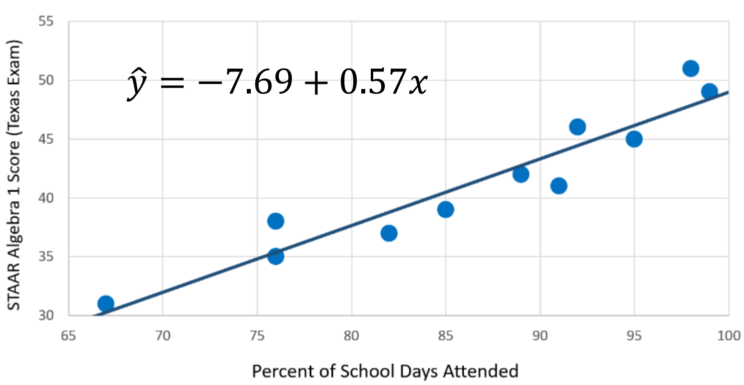
b) How can we use the information provided by the squared residuals to determine which model (A or B) better fits the data?

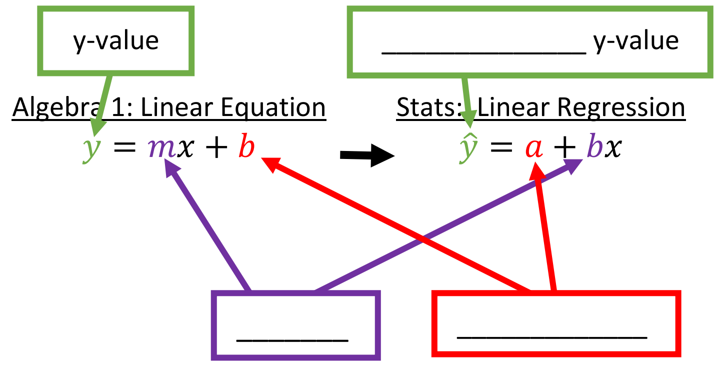


<u>Least Squares Regression Line (LSRL):</u> a linear model that minimizes the sum of the _________________ between the data and the model.

- Also called “line of best fit”

Slope and y-intercept





$$\boldsymbol{\hat{y} = -7.69 + 0.57x}$$

$\hat{y}$: Predicted test score
x: Percent attendance

1) Interpret the slope value:

Stem: For every 1 <u>unit</u> increase in <u>explanatory variable</u>, our model predicts an average **increase/decrease** of <u>slope</u> in <u>response variable</u>.

Your answer:

2) Interpret the y-intercept:

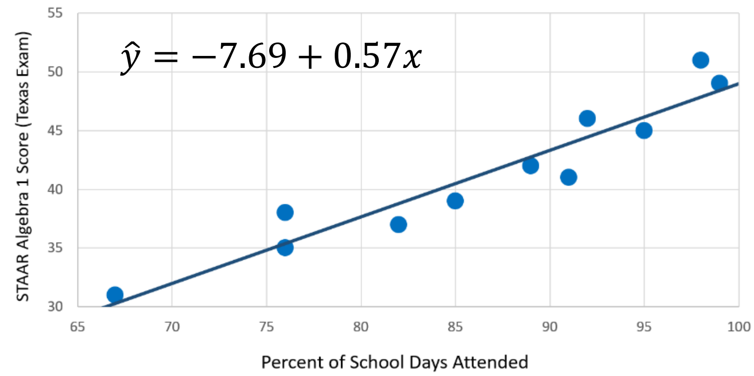
Stem: When the <u>explanatory variable</u> is zero <u>units</u>, our model predicts that the <u>response variable</u> would be <u>y-intercept</u>.

Your answer:

3) Is the y-intercept meaningful in this context? Explain…

Predictions using the LSRL

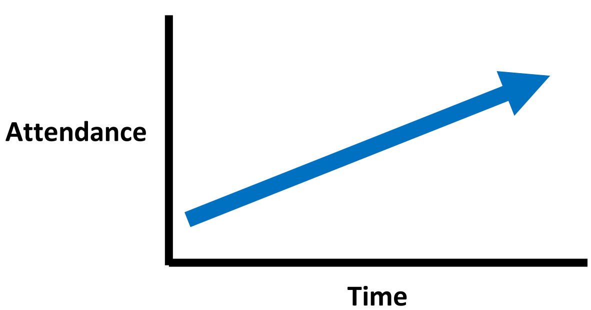
4) The superintendent of the district asks: "If a student meets our minimum attendance goal (87%), what would their predicted test score be?" Answer his question and show your work (including drawing your process on the scatterplot):

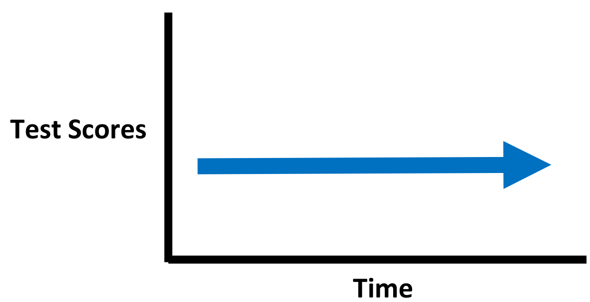


Lesson 3.2 Discussion

In the past several years, schools have piloted large-scale (and expensive) initiatives to improve student attendance.[1] These included call programs for chronically absent students, hiring attendance case managers and coordinators, and using Uber/Lyft for students with transportation issues.

The result:





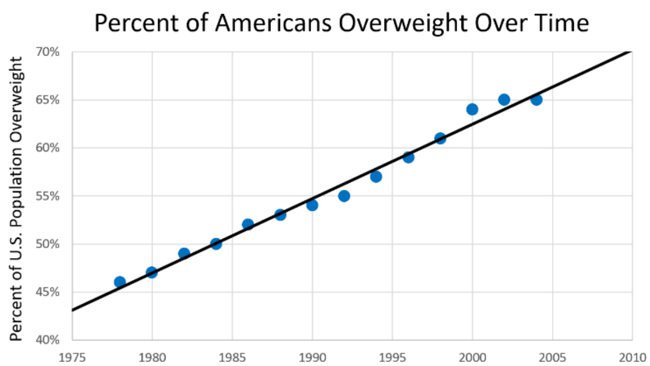
Discussion Question: Why didn't test scores grow when attendance rose?

[1] See attendance research: Pyne, Grodsky, et al., (2018). *What Happens When Children Miss School? Unpacking Elementary School Absences in MMSD*. Madison, WI: Madison Education Partnership.

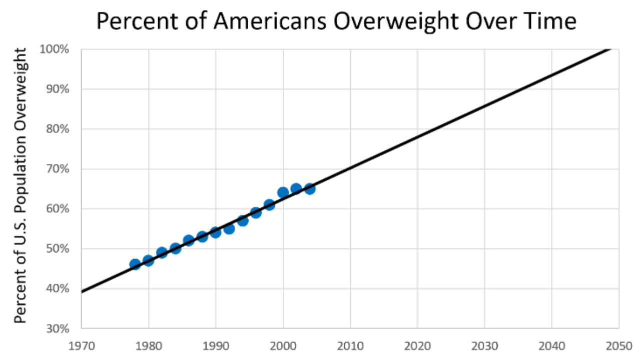
Lesson 3.2 Practice

1) Dr. Youfa Wang at University of North Carolina published a study[2] on obesity in America. Using linear regression, the study concluded that by 2048, if trends continue, **100% of Americans would be overweight**. Using the graphs[3] below, do you believe this conclusion is correct? Why or why not?

Example inspired by Ellenberg, J. *How Not to be Wrong,* pg. 50-61.



Data and Model



Model Projection

2) Teachers: We recommend providing additional practice exercises from your AP Stats textbook or from prior AP Stats exams. The following textbook sections and AP exam questions are aligned to the content covered in this lesson.

- *The Practice of Statistics (AP Edition)*, 4th-6th editions: section 3.2
- *Stats: Modeling the World (AP Edition)*, 4th & 5th editions: chapter 7, 3rd edition: chapter 8
- *Statistics: Learning from Data (AP Edition)*, 2nd edition: sections 4.2-4.3
- *Advanced High School Statistics*, section 8.2
- AP Exam Free Response Questions (FRQs): 2017 Q1 (parts a&b), 2015 Q5

2 Wang, Beydoun, et al., "Will all Americans become overweight or obese? estimating the progression and cost of the US obesity epidemic." *Obesity* (Silver Spring). 2008;16(10):2323-2330. doi:10.1038/oby.2008.351

3 Graphs provided are representative approximations of analyses from the paper