Getting a Line on the Pattern

That is,
Least Squares Regression Line

How thick are the pages of your textbook?

- Do Pinching Pages Activity
  - Keep the data: we will use this data together for further analysis

What is the equation of a line?

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- $y = mx + b$

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What is the m?

What is the equation of a line?

- $y = mx + b$

What is "slope"?

What is the equation of a line?

- $y = mx + b$

What is "slope"?

$$\frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x}$$

What is the equation of a line?

- $y = mx + b$

What are the units on the slope?

What is the equation of a line?

- $y = mx + b$

What are the units on the slope?

$$\frac{\text{units on the rise}}{\text{units on the run}} = \frac{\text{y-units}}{\text{x-units}}$$

How thick are the pages of your textbook?

- Using the data from the Pinching Pages activity, we can determine
  - the thickness of the pages in the textbook
  - the thickness of the front cover.

Least Squares Regression Line

- Sum of the squared errors (SSE) is as small as possible
  - Sum and mean of the residuals is zero
  - Variation in the residuals is as small as possible
  - The line contains the point of averages $(\bar{x}, \bar{y})$.

Least Squares Regression Line

- For the least squares regression line y = mx + b,
  - Slope:

$$m = \frac{n\left(\sum xy\right) - \left(\sum x\right)\left(\sum y\right)}{n\left(\sum x^2\right) - \left(\sum x\right)^2}$$

  - Y-coordinate of y-intercept:

$$b = \frac{\sum y - m\left(\sum x\right)}{n}$$

Least Squares Regression Line

- For the least squares regression line y = mx + b,
  - Slope: $$m = \frac{\sum \left(x - \bar{x}\right)\left(y - \bar{y}\right)}{\sum \left(x - \bar{x}\right)^2}$$
  - Y-coordinate of y-intercept: $$b = \bar{y} - m\bar{x}$$

Pinching Pages Activity –

Measurement made using *Statistics in Action – Understanding a World of Data,* Ann E. Watkins, Richard L. Scheaffer, George W. Cobb, Key Curriculum Press, 2004 (ISBN: 1-931914-27-3)

# sheets of paper	Thickness, in	Thickness, cm
50	0.25	0.7
100	0.375	1.0
150	0.5	1.3
200	0.625	1.6
250	0.75	1.9

Pinching Pages Activity –

Measurement made using *Statistics in Action – Understanding a World of Data,* Ann E. Watkins, Richard L. Scheaffer, George W. Cobb, Key Curriculum Press, 2004 (ISBN: 1-931914-27-3)

- Using the data below, determine the least squares line that can be used to determine the thickness of one cover, the end page, and x sheets of paper in "Statistics in Action"
  - Measured in centimeters AND
  - measured in inches

x	y (in)	y (cm)
50	0.25	0.7
100	0.375	1
150	0.5	1.3
200	0.625	1.6
250	0.75	1.9

Define the variables, x and y

- X is the number of sheets of paper in "Statistics in Action".

- Y is the thickness, in centimeters, of one cover, the end page, and x sheets of paper in "Statistics in Action".

Use the Least Squares Line

- Determine the thickness of one page of the text "Statistics in Action"
  - What is "one page"?
- Can you determine the thickness of one cover of the text "Statistics in Action"?

Use the Least Squares Line

- Can you determine the thickness of one cover of the text "Statistics in Action"?
  - If you can then what is the thickness of the cover?
  - If you cannot then explain why you cannot. What, if anything, can you determine? Briefly explain.