

## Day 12 (July 20, 2011)

Want Bowen's CME Textbooks?

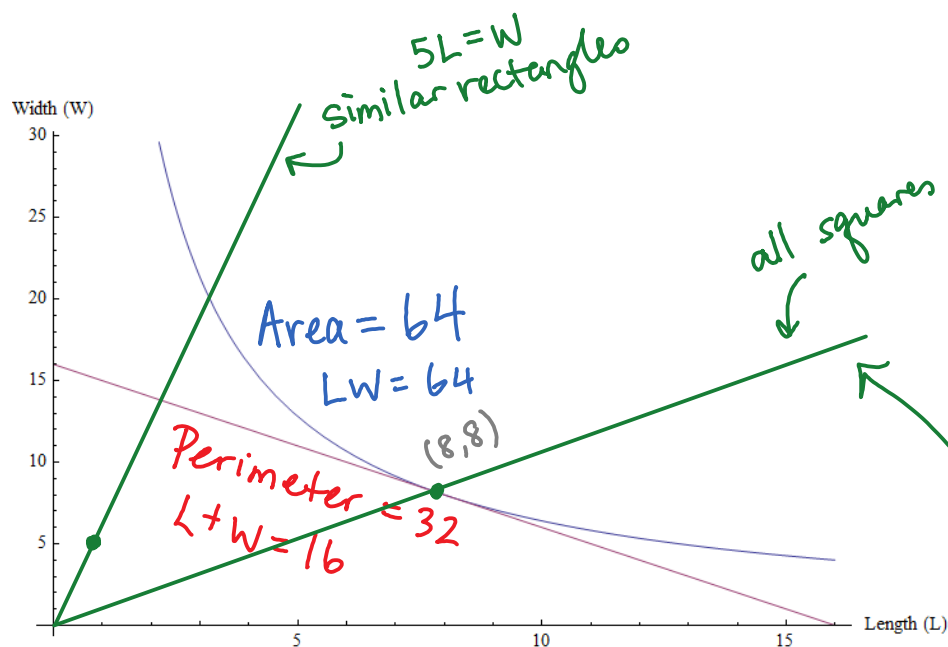
Go to <http://www.tinyurl.com/getcme>

### **Common Core Math Practices:**

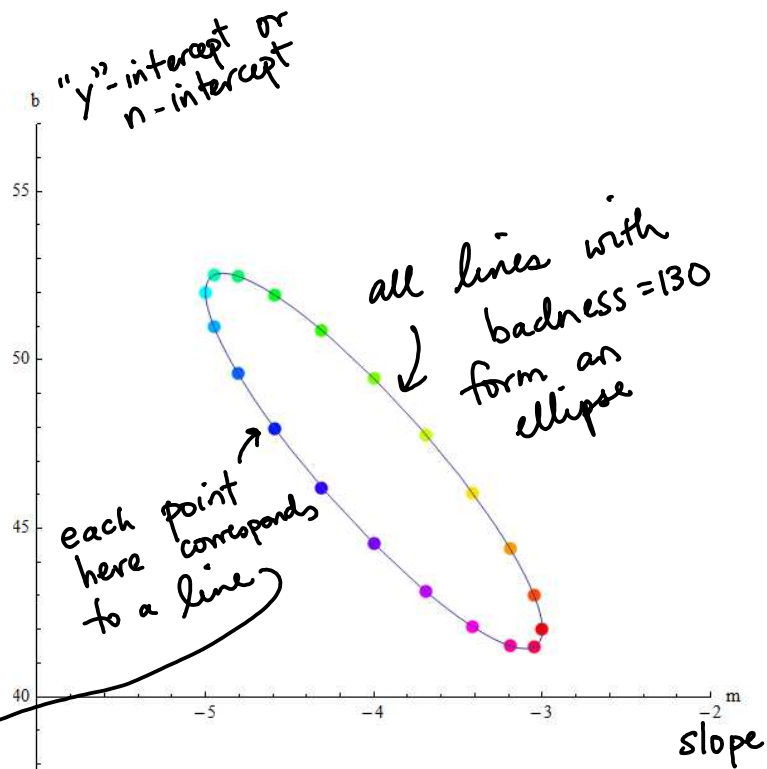
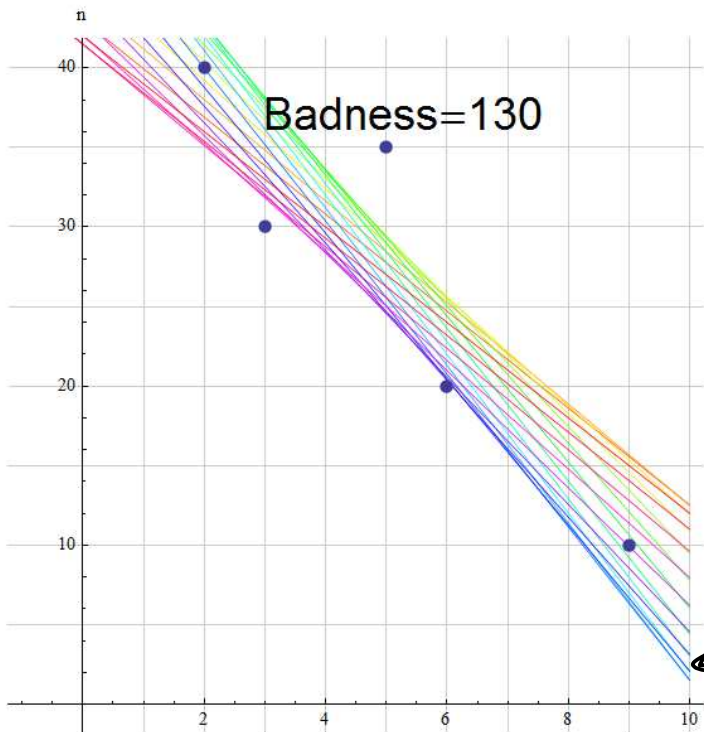
5. Use appropriate tools strategically
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

*Moduli spaces* are created to classify and organize geometric objects. Each coordinate point in a moduli space represents a collection of geometric objects that are classified as being alike in some way. Moduli spaces allow us to easily go back and forth between algebraic and geometric representations.

This kind of flexible and strategic use of algebraic and geometric representations gives us a neat way to prove that for a given perimeter the rectangle with the largest area must be a square.



A fundamental moduli space: *projective space*. The  $P^1$  projective space is the set of all lines in the plane that pass through the origin. We've been looking at a subset of this space by focusing on similar rectangles.



This kind of flexible and strategic use of algebraic and geometric representations gives us a way to prove that there is always a unique least squares line. Here's how:

- The "badness" function is always a sum of squared linear functions, so  $m^2$  and  $b^2$  appear with a positive signs when the whole thing is expanded.
- Therefore, in the  $m$ - $b$  plane, the curve of constant "badness" is an ellipse. The smaller the badness, the smaller the ellipse.
- Lowest badness = best fit line
- This happens when the ellipse collapse into one point.