Things We Will Study

Math 101, Littlefield

Mantras

- "Mistakes happen! The important thing is to find them and fix them before they cause a problem."
- "It's OK for your eyes to glaze over when you see a complicated formula. Mine do that too!" (Just chip away at it — take one little piece at a time and work your way through it.)
- "This thing is just a number. We don't know the value yet, but it's just a number."

Thoughts on "The Language of Mathematics"

- "There is no such thing as The Language of Mathematics. There are a bunch of dialects."
- "Be sure you know what those symbols mean, in the place where they're being used."

Algebra

- PEMDAS: the standard order of operations when reading and writing formulas.
- Notations: "single-line" (like Excel) versus "visual" (superscripts, horizontal division bars, etc.)
- *Equivalent expressions* look different but give the same values. Plug in numbers to check.
- *Equivalent equations* are solved by the same numbers. Plug in numbers to check. (Find numbers that make one equation true, then be sure those same numbers make the other equation true also.)
- If you do something that might change the value of one side of an equation, you have to do the same thing to the other side also.
- One approach that solves lots of equations: kill the denominators (multiply both sides); get rid of the parentheses (expand); isolate the variable you care about (add/subtract to rearrange terms); find the coefficient on that variable (factor); divide by the coefficient. Then check your answer by plugging in numbers!
- Remember the cheat-sheets — handy techniques to manipulate symbols while preserving equivalence.
- Arithmetic, powers, logarithms, exponentials.
- Solving for one variable in one equation: linear, rational, power, exponential equations.
- Solving systems of linear equations by elimination (but better by Solver!).
- The most common errors: parentheses and minus signs.

Excel

- The basics: cells and formulas. (Parentheses again!)
- Check your algebra by plugging in numbers.
- Using Goal Seek or Solver to find numbers that solve problems. (These work even when algebra doesn't, for example to find the interest rate for a consumer loan.)
- Building tables: why you would want to, how to do it.
- "Stretching" formulas, with and without $ signs to protect cell names.
- Using the "formula auditing" tools to check your formulas by drawing arrows to related cells.
- Graphing data using the "Scatter chart".
- Trend lines: how to add them, how to interpret them.
- Logarithmic axes: how to make them; when to use them.

Applications

- Consumer Loans: simulating repayment & using Goal Seek.
- Mixture problems: build a table.
- Ratios, proportions, and unit conversions.
- The "factor-label method": carrying units through your equations.
- Exponential growth: Dr.Bartlett's video. Remember the "Rule of 70" (doubling time = 70 divided by % growth rate); more stuff consumed/produced in the last doubling period than in all previous history. (Rik's take: "You can't have continuous growth; you <u>can</u> have continuous improvement. Plan accordingly.")
- Exponential improvement: density of computer memory got 250 million times better from 1968 to 2007.
- "How To Lie With Statistics", misleading graph examples from the book.
- Curve-fitting using the Solver: the bell curve of oil production.
- The "magnetic pendulum". When uncertainty and perturbations grow exponentially, you cannot make detailed predictions very far ahead. This happens with weather, the economy, and your personal lives. If you want to meet a goal, you have to keep monitoring and nudging, or it's guaranteed you'll go off-track.
- Blood alcohol simulation: a simple "accounting" model of what happens when you drink.