Notes 1.1 – Models and Equation Solving

I. Mathematical Models

Any mathematical structure used for prediction and study of data

- *Numerical*
  - where numbers are organized to gain insight into data. Examples 1 and 2 on pages 64 and 65 of your text.
- *Algebraic* Exploration 1 p.66
  - Uses formulas to relate variable quantities with data being studied. These are used for prediction. Ex.: $d = rt$
- *Graphic*
  - A visual representation of numerical data. Ex. 4 from text-

0	1	2	3	4	5	6	7
0	.75	3	6.75	12	18.75	27	36.75

I. Mathematical Models

- Fitting a Model:
  - Graph the data
  - Choose a general form to represent
  - STAT-CALC-type of regression
  - Check the correlation!

0	1	2	3	4	5	6	7
0	.75	3	6.75	12	18.75	27	36.75

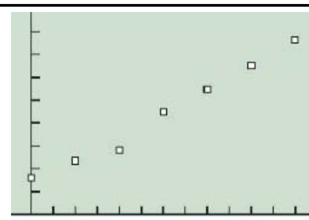
Table 1.4 Years of Life Expected at Birth in the United States, 1950–2010

Years After 1950	0	10	20	30	40	50	60
Life Expectancy	68.2	69.7	70.8	73.7	75.4	76.8	78.7

Source: National Center for Health Statistics, U.S. Department of Health and Human Services.

I. Mathematical Models

Male Life Expectancy in US 1950-2010



[–5, 65] by [63, 80]

EXPLORATION 2 Interpreting the Model

The parabola in Example 4 arose from a law of physics that governs falling objects, which should inspire more confidence than the linear model in Example 5. We can repeat Galileo's experiment many times with differently sloped ramps, with different units of measurement, and even on different planets, and a quadratic model will fit it every time. The purpose of this Exploration is to think more deeply about the linear model for the life expectancy data.

1. The linear model we found will not continue to predict life expectancy indefinitely. Why must it eventually fail?
2. Do you think that our linear model will give an accurate estimate for the life expectancy of a person born in the United States in 2015? Why or why not?
3. The linear model is such a good fit that it actually calls our attention to the unusually low point in 1970. Statisticians might look for some unusual circumstance in 1970 that might explain the temporary dip in life expectancy. Can you think of one? As a hint, consider the scatter plot in Figure 1.3, which shows the life expectancy for *males* in the United States for the same time period.

II. The Zero Factor Property

- A product of real numbers is zero if and only if at least one of the factors in the product is zero.
  - i.e. – ALWAYS set one side of your polynomial equation equal to zero before you solve the equation.

- Fundamental Connection- If *a* is a number that satisfies the equation $f(x) = 0$, then
  1) *a* is a **root** or **solution** of the equation $f(x) = 0$.
  2) *a* is a **zero** of the equation $y = f(x)$.
  3) *a* is an **x-intercept** of the graph of the equation $y = f(x)$.

III. Problem Solving Steps

A.) Understand the problem:

B.) Develop a mathematical model:

C.) Solve the problem and support/confirm:

D.) Interpret the solution:

IV. Grapher Failure/Hidden Behavior

A.) Graph and discuss $\dfrac{x^2 - 1}{x - 1}$

B.) Graph and discuss $\dfrac{x + 4}{x - 1}$

C.) Graph and discuss $y = x^3 - 1.1x^2 - 65.4x + 229.5$

Remember the Fundamental Theorem of Algebra –

Any polynomial function of degree *n* will have at most *n* solutions!

Homework: p.74 #1-18, 25-28