Math Xa Fall 2003

Lab 7: Modeling with Exponential Functions

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1. Let $L(t)$, $M(t)$, and $C(t)$ represent the annual salaries (in dollars) of Larry, Moe, and Curly, and suppose that these functions are given by the following formulas, where t is in years, $t = 0$ corresponds to this year's salary, $t = 1$ to the salary one year from now, and so on. The domain of each function is $t = 0, 1, 2, \ldots$ up to retirement.

$$L(t) = 40000 + 2500t$$
$$M(t) = 50000(0.97)^t$$
$$C(t) = 40000(1.05)^t$$

   (a) Describe in words how each employee's salary is changing.

   (b) Suppose you are just four years away from retirement. You'll collect salary for four years, including the present year. Which person's situation would you prefer to be your own? Show how you determined your answer.

   (c) If you are in your early twenties and looking forward to a long future with the company, which would you prefer? Explain your answer.

2. Take a blank sheet of paper and fold it in half. Then fold it in half a second time and a third time. Keep folding it in half until you cannot do so any longer.

   (a) How many times did you fold your sheet of paper in half? (If you did better than 7, either you or your paper is rather exceptional.)

   (b) A typical sheet of paper is 0.1 millimeters thick. Find a formula for $D(t)$, the thickness of the folded sheet of paper in millimeters after t folds, assuming an initial thickness of 0.1 millimeters.

   (c) What is the thickness of the folded sheet of paper after 7 folds?

   (d) What would the thickness be after 14 folds? What percent of your height is this quantity? (Note that 1 inch equals 25.4 millimeters.)

   (e) Approximately how many folds are needed until the thickness of the paper exceeds the height of the tallest buildings in the world, the Petronas Towers in Kuala Lumpur, Malaysia, at 452 meters?

Figure 1: Petronas Towers, Kuala Lumpur, Malaysia