

Math Xa Fall 2004

Name _____

Lab: Modeling with Exponential Functions

Section Instructor _____

November 18, 2004

Collaborators _____

1. Take a sheet of newspaper 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? What stopped you from folding it in half any more times?

 - (b) A typical sheet of newspaper measures 22 inches by 27 inches. What is the area of the newspaper after one fold? What is the area after 2 folds?

 - (c) Write an expression for the area $A(n)$ of the folded sheet of 22 by 27 inch paper after n folds (so that $A(0)$ will be the area of the unfolded sheet of newspaper).

 - (d) What is the area of a folded 22 by 27 inch sheet of newspaper paper after 7 folds?

 - (e) Suppose you have super-human powers that would enable you to keep folding the paper, no matter how thick or how small the folded square got. How many folds would it take for the area of the folded paper to be less than $\frac{1}{1000}$ square inches?



Figure 1: Petronas Towers, Kuala Lumpur, Malaysia

- (f) A typical sheet of paper is 0.1 millimeters thick. Find a formula for $D(n)$, the thickness of the folded sheet of paper in millimeters after n folds, assuming an initial thickness of 0.1 millimeters.
- (g) What is the thickness of a folded sheet of paper after 7 folds, assuming an initial thickness of 0.1 millimeters?
- (h) Approximately how many folds are needed until the thickness of the paper exceeds the height of the tallest¹ buildings in the world, the Petronas Towers in Kuala Lumpur, Malaysia, at 452 meters?
- (i) Approximately how many folds are needed until the thickness of the paper exceeds the height of Mount Everest, about 8.85 kilometers²?

¹Some would say that the Taipei 101 Tower in Taiwan is the tallest building in the world. With the decorative spire at the top, it measures 508 meters. However, if you count only habitable space and measure from the sidewalk level of the main entrance to the structural top of building (excluding flagpoles and spires) the Petronas Towers are the tallest.

²How many miles is this? It's about five and a half miles. That's a tall stack of paper!