What are my chances…really?

Topics: Quantitative Literacy, Probability
NCTM Standards: Measurement; Data Analysis and Probability; Number and Operation; Problem Solving; Connections
NH GLE's: Number and Operations; Geometry and Measurement; Data, Statistics, and Probability; Problem Solving, Reasoning, and Proof; and Communication, Connections, and Representations

Introduction: The Powerball® Lottery is a game that costs $1.00 to play. For one dollar, you get five numbers (from a group of 59 numbers) and another number (called the "Powerball") from a separate group of 39 numbers. To win the jackpot, you must match all five numbers and the Powerball.

The probability that this actually occurs is $\frac{1}{195{,}249{,}054}$.

That is, one out of one hundred ninety-five million, two hundred forty-nine thousand, fifty four.

This probability is a very small number. The denominator of the fraction, 195,249,054, is a very large number! It is difficult to get a feel for exactly how small (or large) the numbers are. So, let us try a few demonstrations to help us understand.

I. **An example using time**:

1. To begin the activity, please fill in the blanks below:

a. There are _____ seconds in one minute.

b. There are _____ seconds in one **hour**. (How do you know?)

c. There are _____ seconds in one **day**. (How do you know?)

d. We know that there are _____ different "ways" you can choose numbers for the Powerball® ticket (hint: it is the denominator of the fraction above).

2. Suppose that you were able to buy one (unique) Powerball® ticket for every second of a day.

a. How much money would you be spending each day?

b. How many total **days** would it take before you bought every possible Powerball® ticket? Show your work below.

c. Suppose you start buying tickets on January 1st, 2010 at 12:00 sharp at midnight. What **date (year, month, day)** would it be by the time you had each possible Powerball® ticket?

d. Suppose you decide to only by a ticket every 10 seconds instead of every second. So, now you are spending "only" _____ dollars per day.

e. How many days (and years) will it take before you purchase all possible Powerball® tickets?

f. In this last example, how old would you be before you purchased even half the tickets?

II. An example using Distance

1. Suppose you were in Boston and decided to travel south and west across the USA. You decided that you would travel exactly 195,249,054 inches.

a. How many miles is that?

b. So, approximately where do you think you would end up? (List a few possibilities)

c. And in that entire travelled distance, what "distance" represents the winning Powerball® ticket?

III. Wrap-up

Do these two illustrations help you understand "how small" the actual numerical probability, $\frac{1}{195,249,054}$, is? Explain your thoughts below.