**The Mathematics of Santa**

1. Let's assume that Santa only visits those who are children in the eyes of the law, that is, those under the age of 18. There are roughly 2,520,000,000 such individuals in the world. However, Santa started his annual activities long before diversity and equal opportunity became issues, and as a result he doesn't handle Muslim, Hindu, Jewish and Buddhist children. That reduces his workload significantly to a mere 15% of the total, namely \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2. However, the crucial figure is not the number of children but the number of homes Santa has to visit. According to the most recent census data, the average size of a family in the world is 3.5 children per household. Thus, Santa has to visit \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_individual homes. Of course, we are assuming that there is at least one good child in each home.

3. Santa has about 31 hours of Christmas to work with, thanks to the different time zones and the rotation of the earth, assuming east to west, which seems logical. Santa can complete the job if he averages \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ household visits per second. In other words, for each Christian household with at least one good child, Santa has \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a second to do the following: park his sleigh, dismount, grab his bag of goodies, slide down the chimney, fill the stockings, put gifts under the tree, eat cookies, drink milk, get back up the chimney, back into the sleigh, and move on.

4. To keep the math simple, let's assume that these 108 million stops are evenly distributed around the earth. That means Santa is faced with a mean distance between households of around 0.75 miles, and the total distance Santa must travel is just over 75 million miles. Hence Santa's sleigh must be moving at \_\_\_\_\_\_\_\_\_\_miles per second. Sound travels at 1125 ft/sec. So Santa is moving at \_\_\_\_\_\_\_\_\_\_\_ times the speed of sound. A typical reindeer can run at most 15 miles per hour

5. What happens when we take into account the payload on the sleigh? Assuming that the average weight of presents Santa delivers to each child is 2 pounds, the sleigh is carrying \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tons -- and that's not counting Santa himself, who, judging by all those familiar pictures, is no lightweight. On land, a reindeer can pull no more than 300 pounds. Of course, Santa's reindeer can fly. (True, no known species of reindeer can fly. However, biologists estimate that there are some 300,000 species of living organisms yet to be classified, and while most of these are insects and germs, we cannot rule out flying reindeer.) Now, there is a dearth of reliable data on flying reindeer, but let's assume that a good specimen can pull ten times as much as a normal reindeer. This means that Santa needs \_\_\_\_\_\_\_\_\_\_\_\_\_\_ reindeer. (We have not even considered the weight or size of a sleigh required to pull such an amount.

6. Now, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ tons traveling at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ miles per second creates enormous air resistance, and this will heat the reindeer up in the same fashion as a spacecraft re-entering the earth's atmosphere. The two reindeer in the lead pair will each absorb some 14.3 quintillion joules of energy per second. In the absence of a NASA-designed heat shield, this will cause them to burst into flames spontaneously, exposing the pair behind them. The result will be a rapid series of deafening sonic booms, as the entire reindeer team is vaporized within 4.26 thousandths of a second., or right about the time they reach the \_\_\_\_\_\_\_\_\_\_\_ house.

7. Now consider poor Santa. As a result of accelerating from a dead stop to \_\_\_\_\_\_\_\_\_\_ mps in \_\_\_\_\_\_\_\_\_\_\_\_\_\_ seconds, would be subject to acceleration forces of 17000g’s. A 250 pound Santa (which seems ludicrously slim) would be pinned back by the sleigh by over 4 million pounds of force, instantly crushing his bones and organs and reducing him to a quivering blob of red goo.