Where is Everybody?

NAME _____

Open the Canada Data Map and the State Data Map applets (located at illuminations.nctm.org) so that you can easily navigate between the two maps.

1. Do you notice a trend in the location of the least populated provinces or territories in Canada? Why do you think this pattern occurs?

Fewer people live in the northern provinces of Nunavat, the Yukon, and the Northwestern Territories, likely because of the cold and harsh weather.

2. What percentage of Canadians lives in Ontario?

The total population is the mean population multiplied by the number of provinces: 2,482,315.38 × 13 = 32,270,099.94. The Ontario population as represents roughly 12,541,400 ÷ 32,270,099.94 = 0.388, or 38.9%, of the Canadian population.

3. Notice the location of the three most densely populated states or districts in the United States. Why do these areas have a high population density? Use mathematical language such as numerator and denominator or dividend and divisor when writing your explanation.

The most densely populated states are the District of Columbia, New Jersey, and Rhode Island. These places have mostly urban populations, with lots of people in a small area.

4. The three cities with the greatest populations in Canada are Toronto, Montreal, and Vancouver. Use the information below to calculate the population densities of these cities.

	TORONTO	MONTREAL	VANCOUVER
Population (2001)	2,481,494	1,039,534	545,671
Land Area (km^2)	629.91	185.94	114.67
Population Density (people per km^2)	[3939.44]	[5590.7]	[4758.62]

5. How do highly populated cities affect the population density of the provinces or states in which they are located?

Highly populated cities increase total population of the state or province, which increases the numerator). This results in a higher population density.

6. What is the approximate ratio of Montreal residents to Vancouver residents?

1,039,534 ÷ 545,671=1.91, so there are roughly twice as many residents in Montreal.

7. According to the data on these maps, does Canada or the United States have a more dense population (more people per unit of land mass)? Look closely at what you are comparing.

$1\ km^2 \approx 0.386\ mi^2$ $\qquad$ $1\ mi^2 \approx 2.589\ km^2$

	People per mi^2	People per km^2
United States Population Density	[314.63]	[121.48]
Canadian Population Density	[17.28]	[6.67]

8. Describe the box-and-whisker plot for the United States' population density map. Why do you think it has this shape?

The box plot's interquartile range is compressed to the left. The median and upper quartile are well below the mean. It has this shape because the population density of the District of Columbia is extremely large, more than 8 times the next largest data point.

9. If someone asked for the "average" population density in the United States, would you use the mean, median or mode? Justify your reasoning.

The median is a better measure of central tendency because it reflects the middle value. It is therefore not distorted or skewed by the District of Columbia's high population density. Since there are no repeats of numeric values in this data set, the mode would tell us very little.

10. A data points that seems very different from other observations in a data set is known as an *outlier*. Can you identify any outliers in the U.S. data set for population density? Might there be any reason to exclude this outlier from the data map?

The outlier is the District of Columbia. It is not a state, and it has a very small land area compared to the rest of the data.

11. How would removing this outlier change the shape of the box-and-whisker plot?

The maximum would be 964.8 (NJ). The interquartile range and median would shift right.

12. Suppose you removed the outlier from the data set. Showing your work below, calculate the new mean for the data provided. Then click on the outlier data, delete it, and click "Update Map" in order to check your work.

The population density for the country is found by multiplying the average population density by the number of states, $314.63 \times 51 = 16{,}064.13$; subtracting the density for the District of Columbia, $16{,}064.13 - 8{,}370.78 = 7{,}675.35$; and then dividing by the number of remaining states, $7{,}675.35 \div 50 = 153.51$.