

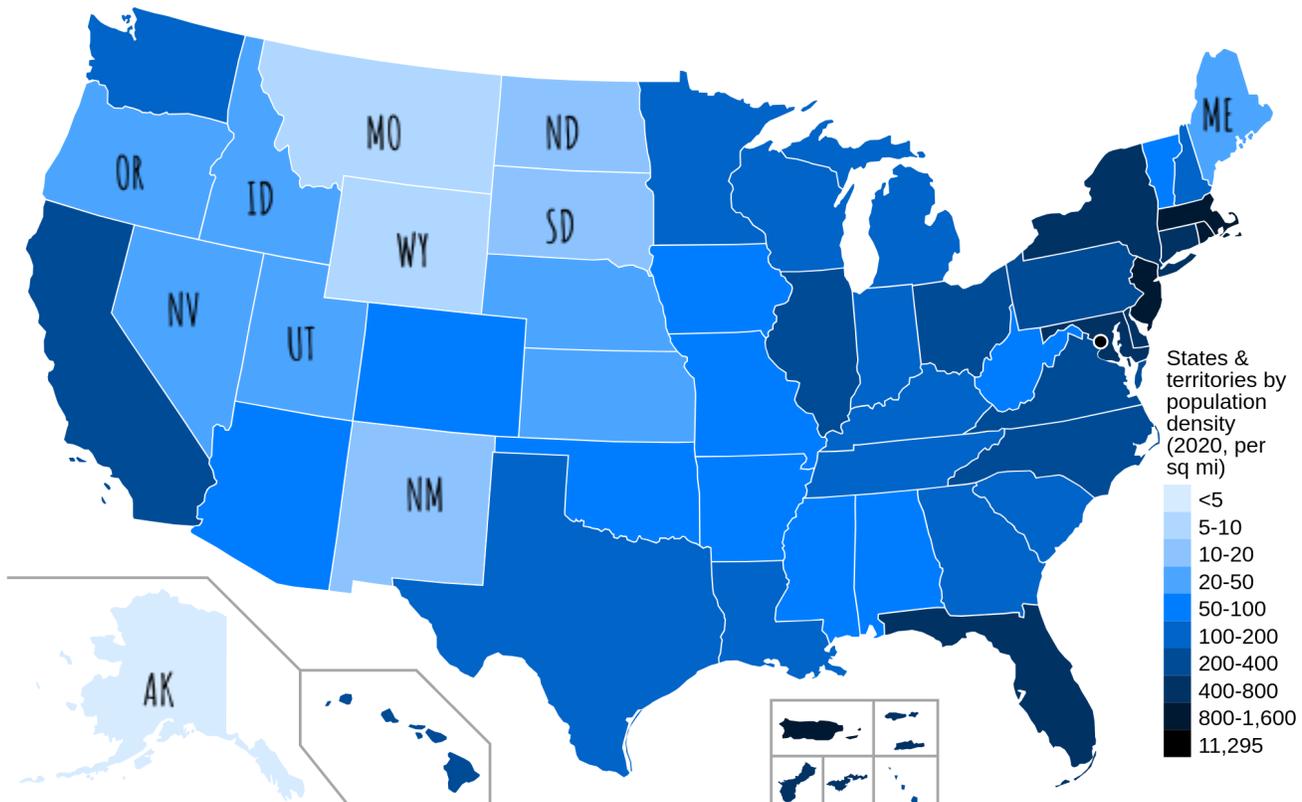
M100: Quantitative Reasoning Post-Badge Task

Reflecting on Badge Learning

Now that you have learned more about reasoning quantitatively, respond to the questions that follow. These are the same questions you responded to before the start of this badge.

The Task

One definition of a “rural” county is one that has a population density of fewer than 500 people per square mile. Use the population density data below to answer the questions in this task.



QUESTION 1

If you were going to classify *states* as rural using the county definition, which states would meet the definition of “fewer than 500 people per square mile”? Label 10 state names (abbreviations) on the map that would meet this definition.

Answers will vary. Sample response shown on map above.

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QUESTION 2 The data on the map are from 2020. The 2023 population of Montana is 1,132,812 and the state has an area of 147,040 square miles.

Based on the 2023 data, would Montana still be classified the same way (be the same color)? Explain your reasoning.



The 2023 population density for Montana would be $1132182/147070$, or 7.704 people per square mile. The color of MN would be the same in 2023 as it was in 2020.

Note: Because the colors are a bit tricky to detect a student may think that the original graph shows MN in the <5 category. This response may still receive full credit if the explanation is sufficient to show full mathematical understanding of the question posed.

QUESTION 3

Look up some information on your own state to help you answer the questions below.



State Name: *Answers will vary.*

Current Population: *Answers will vary.*

By what percent do you think your state will grow each year for the next 5 years? Explain.

Answers will vary. A solid response should take into account recent historical increase/decrease data for the particular state.

Based on the growth/decay rate you predicted, what will the population be in your state each year for the next 5 years? Complete the table.

Year	Predicted Population
<i>Answers will vary.</i>	<i>Answers will vary.</i>
<i>Answers will vary.</i>	<i>Answers will vary.</i>
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QUESTION 4 According to data, Massachusetts (MA) has the worst drivers in the country with 61.1 incidents per 1,000 drivers from Nov. 5, 2023 through Nov. 4, 2024. Conversely, Arkansas (AR) has the best drivers in the U.S. with 14.7 incidents per 1,000 drivers during the same time period.

- What do you think an “incident” is in this context?
- Complete the table to show the expected number of incidents in each state for the given number of drivers.
- Create a double line graph (on paper or using technology) to show the data in the table.
- Write an equation for each graph. Explain what your variables represent.

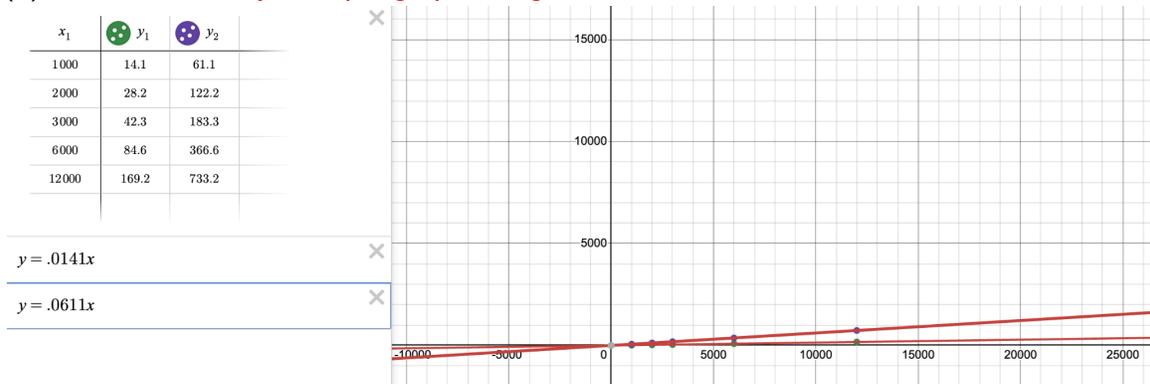


(a) *Answers will vary. Some responses may include things like ticket citations, accidents or other driving infractions.*

(b)

Number of Drivers	Expected Number of Driving Incidents in AR	Expected Number of Driving Incidents in MA
1,000	14.7	61.1
10,000	147	611
50,000	735	3,055

(c) *Answers will vary. Sample graph using Desmos shown.*



(d) $y = (14.7/1000)x$, or equivalent
 $y = (61.1/1000)x$, or equivalent

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QUESTION 5

- (a) What do you notice about the population density of Massachusetts vs. Arkansas? Do you think that population density is related to the rate of driving incidents per state? Why or why not?
- (b) The state of Massachusetts has approximately 2.4 million licensed drivers. Based on this number, how many total driving incidents do Massachusetts drivers likely have during a one year period?
- (c) The state of Arkansas has approximately 2.3 million licensed drivers. Based on this number, how many total driving incidents do Arkansas drivers likely have during a one year period?



- (a) *Answers will vary. Sample responses may signal that a lower population density reduces the chances of driving incidents because there are fewer cars on the road in a small area.*
- (b) *Answers will vary. A full credit response should use the rate of 61.1 incidents per 1000 drivers and proportional reasoning (or other mathematically sound method) to determine a number of incidents close to 146,640 incidents for MA.*
- (c) *Answers will vary. A full credit response should use the rate of 14.7 incidents per 1000 drivers and proportional reasoning (or other mathematically sound method) to determine a number of incidents close to 33,810 incidents for AR.*

QUESTION 6 Look up some additional data about the “best” and “worst” drivers. Do these additional data support or refute your thinking about the relationship between population density and driving quality?



Answers will vary. Students may find that Michigan and Vermont also have good drivers, while states like Rhode Island and California are known for having worse drivers. While Michigan falls more toward the middle in terms of its classification as rural or not, the other states seem to support the idea that more densely populated states are prone to more traffic incidents.

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QUESTION 7 What else did you learn that was not reflected in Questions 1-5?



Answers will vary.

QUESTION 8 Compare your answers to these questions now to your answers from the earlier attempt. What do you notice about your progress?



Answers will vary. Look for students to explain what they know now compared to what they knew when responding to the pre-test.