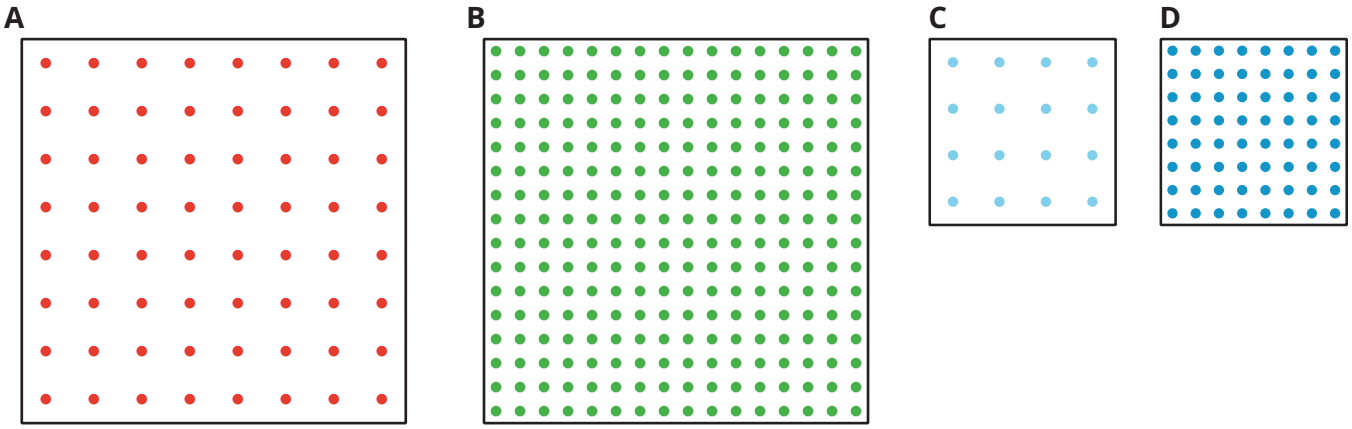
Unit 9, Lesson 4

How Crowded Is This Neighborhood?

Let's see how proportional relationships apply to where people live.

4.1 Dot Density

The figure shows four squares. Each square encloses an array of dots. Squares A and B have side length 2 inches. Squares C and D have side length 1 inch.



1. Complete the table with information about each square.

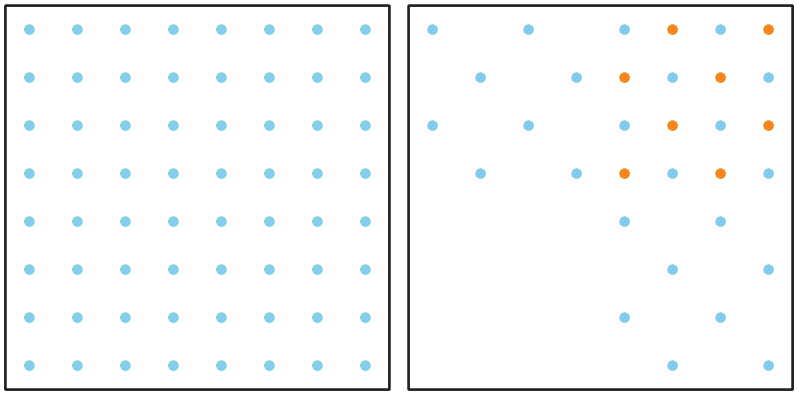
square	area of the square in square inches	number of dots	number of dots per square inch
A			
B			
C			
D			

2. Compare each square to the others. What is the same and what is different?

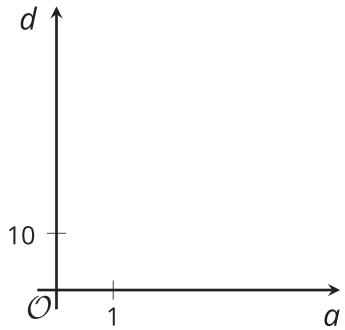
CC BY NC Illustrative Mathematics, based on IM 6–8 Math, CC BY Open Up Resources.

4.2 Dot Density with a Twist

The figure shows two arrays, each enclosed by a square that is 2 inches wide.



1. On this coordinate plane, a represents the area of the square and d represents the number of dots enclosed by the square. For each square, plot a point that represents its values of a and d.



2. Draw lines from $(0, 0)$ to each point. For each line, write an equation that represents the proportional relationship.

3. What is the constant of proportionality for each relationship? What do the constants of proportionality mean in terms of the dots and squares?

CC BY NC Illustrative Mathematics, based on IM 6–8 Math, CC BY Open Up Resources.

4.3 Housing Density

Here are pictures of two different neighborhoods.

This image depicts an area that is 0.3 kilometers long and 0.2 kilometers wide.

This image depicts an area that is 0.4 kilometers long and 0.2 kilometers wide.

For each neighborhood, find the number of houses per square kilometer.

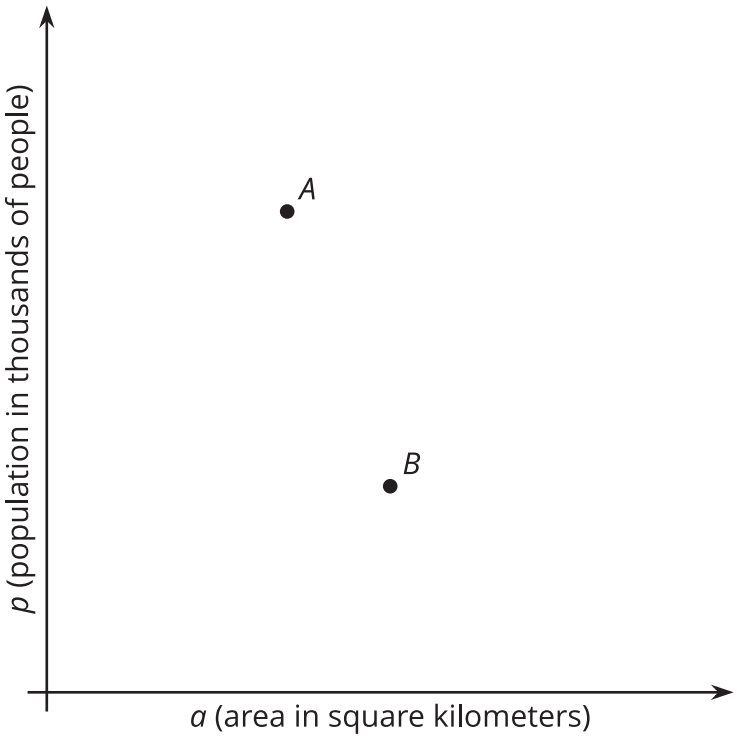
CC BY NC Illustrative Mathematics, based on IM 6–8 Math, CC BY Open Up Resources.

4.4 Population Density

At the time that data was collected in 2023:

- New York City had a population of 8,468 thousand people and covered an area of 1,214 square kilometers.
- Los Angeles had a population of 3,849 thousand people and covered an area of 1,302 square kilometers.

1. Each point, labeled A or B, corresponds to one of the two cities. Which is which? Label them on the graph.



2. Write an equation for the line that passes through $(0, 0)$ and A. What is the constant of proportionality?

3. Write an equation for the line that passes through $(0, 0)$ and B. What is the constant of proportionality?

4. What do the constants of proportionality tell about the crowdedness of these two cities?

CC BY NC Illustrative Mathematics, based on IM 6–8 Math, CC BY Open Up Resources.

Are you ready for more?

1. Predict where these types of regions would be shown on the graph:
   a. A suburban region where houses are far apart, with big yards

   b. A neighborhood in an urban area with many high-rise apartment buildings

   c. A rural state with lots of open land and not many people

2. Next, use this data to check your predictions:

place	description	population	area (km^2)
Chalco	a suburb of Omaha, Nebraska	10,092	7.5
Anoka County	a county in Minnesota, near Minneapolis/ St. Paul	367,018	1,155
Guttenberg	a city in New Jersey	11,502	0.49
New York	a state	19,840,000	141,300
Rhode Island	a state	1,096,000	3,140
Alaska	a state	732,673	1,717,856
Tok	a community in Alaska	1,214	342.7

CC BY NC Illustrative Mathematics, based on IM 6–8 Math, CC BY Open Up Resources.