What is Density?

Beans and Density

Now that we've explored area, let's consider density. When we calculate the density of a population, we need to divide the population over a certain area. For this activity, you will need about 100 beans (rice grains or other items about the same size are fine as well) and the grid paper on the next page.

1) On grid paper, color or fill in an area of 18 square inches.

2) Count out 54 beans and pour them on to your 18 square-inch area.

3) Spread the beans out equally so that there is the same number of beans in each of the 18 squares.

4) You should be able to put an equal amount of beans on each square. Once you divide up all 54 beans equally, how many are there in each square? _____

5) This grid has a density of _____ beans per square inch. (In other words: *How many beans are in each square?*)

How we write measurements of density:

If you had 18 beans to spread out on the rectangular grid, the density is *1 bean per square inch*, since you can put 1 bean on each of the 18 squares in the grid. Try it on your grid.

If you had 36 beans, you could put 2 beans on each of the 18 squares. So, if the population is 36 beans and the area is 18 square inches, then the density is *2 beans per square inch*. This means there will be 2 beans for every square inch. Try it.

Density measurements can be written in different ways. Each of the following means the same thing and should be read as "*2 beans per square inch:*"

2 beans/square inch *2 beans/sq. in.* *2 beans/in^2*

Density of Foxes in a State Park

In the last exercise, you filled in an area of 18 square inches. Imagine that this grid now represents a state park with an area of 18 square miles. There is a population of 54 foxes living in the park (represented by the beans). The population density of foxes is 3 foxes per square mile.

In the life sciences, the word **population** refers to all the organisms of a species living in a specific area. A **species** is a group of similar living things which interbreed among themselves.

In the spring, the fox population increased when 36 baby foxes were born.

6) Count out beans to represent the additional foxes and add them to the grid.

7) What is the total population of foxes now? _____

8) Can you put the same number of beans in each square? _____

   If so, how many beans are there in each square? _____

9) The density after the population increase is _____ foxes per _____ .

The next winter was really cold and, unfortunately, 27 foxes died.

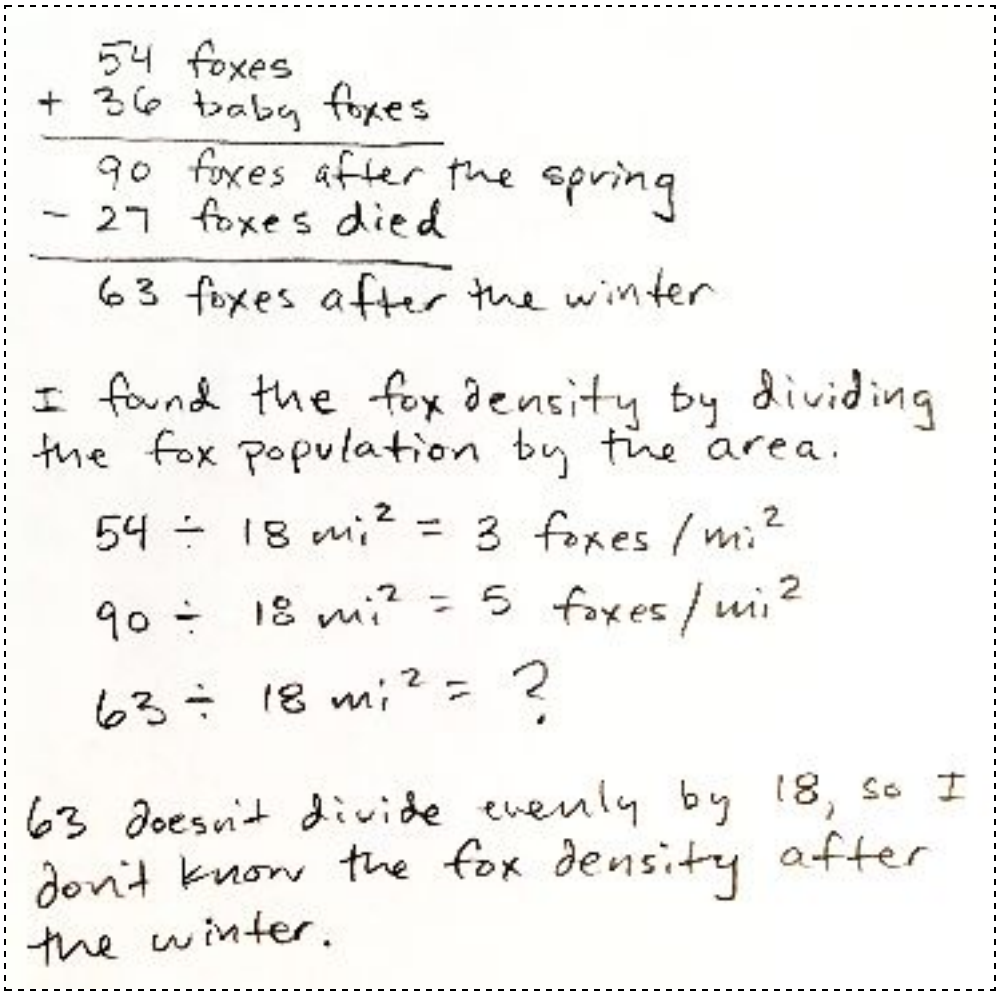
10) Remove 27 beans. What is the total population of foxes now? _____

11) You won't be able to divide an equal amount of whole beans into each square, but what if you could cut some beans in half?

    _____

12) The fox population density after the winter is _____ foxes/sq. _____ .

13) Take a look at Tayshawn's work on the fox population problem. Can you help him find the fox population density after the winter?



Finding Density from Area and Population

In order to find the density, you can *distribute* (spread out evenly) the population to each square in the area. Once you have distributed the population, the density is the number of things left in each square.

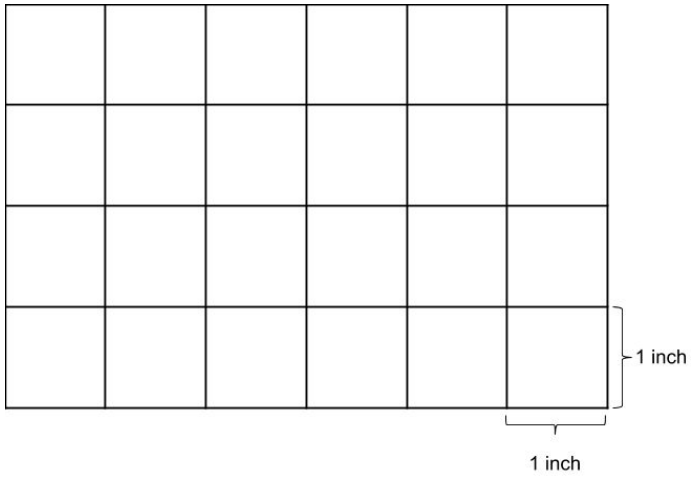
Try these practice exercises. Fill in the missing information.

1) Population = 144 beans

Area = _24_ square _inches_

Density = _____ per sq. _in._

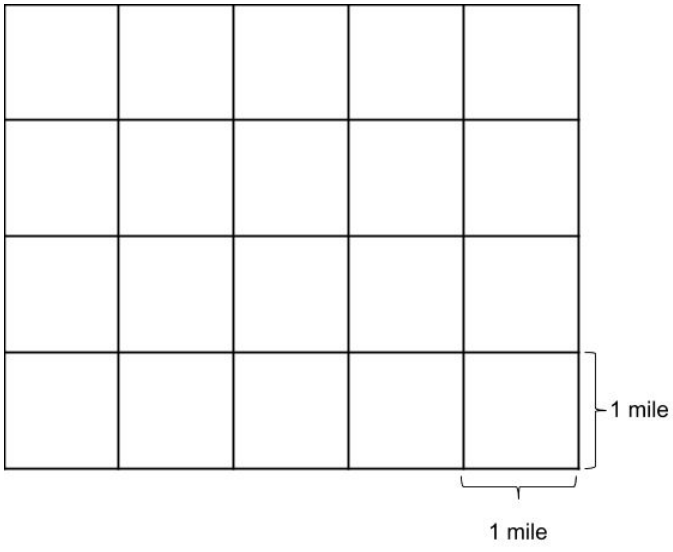
** Remember that you can find the density by dividing the number of beans by the number of squares.*



2) Population = 180 foxes

Area = _____ sq. _____

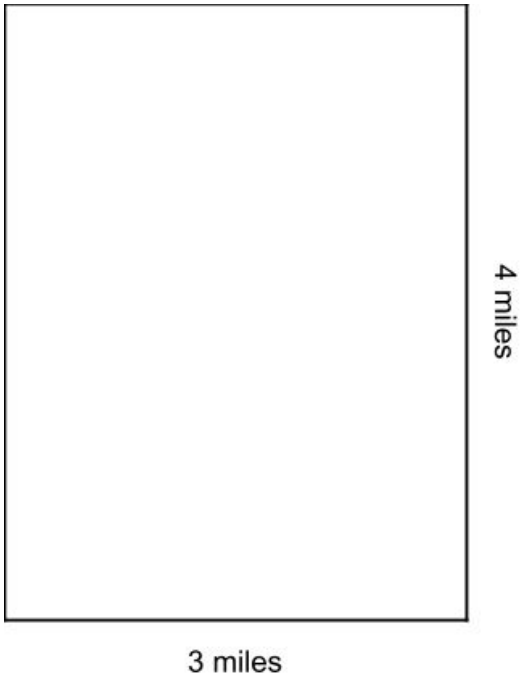
Density = _____ / sq. _____



3) Population = 132 squirrels

Area = _____ square _____

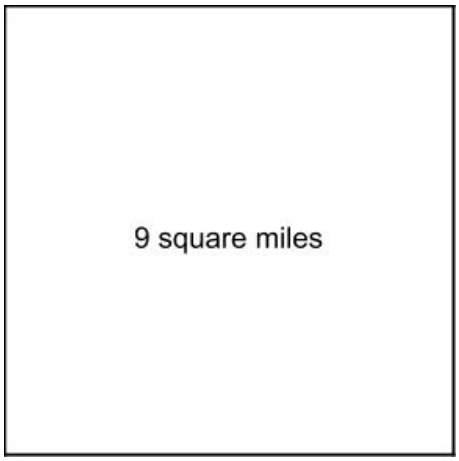
Density = _____ squirrels/sq. mi.



4) Population = 27,000 pigeons

Area = _____

Density = _____



Fill in the missing blanks.

5)

Population = 350 people

Area = 14 square miles

Density = _____ people/_____

6)

Population = 100 rabbits

Area = 40 sq. mi.

Density = _____ _____ /_____

7)

Population = 1,035 pigeons

Area = 60 mi^2

Density = _____ pigeons/_____

8)

Population = 5,000 chickens

Area = 10,000 square _____

Density = _____ chickens/ft^2

9)

Population = 2000 people

Area = _____ mi^2

Density = 200 people/mi^2

10)

Population = _____ people

Area = 7 mi^2

Density = 5,000 people/mi^2

Answer the questions below.

11) If a population of 200 cows lives on 5 square miles of land, what does it mean that there is a density of 40 cows/mile^2?

12) Imagine a population of deer in a forest. In the winter, animals compete for fewer and fewer resources. Many deer don't survive and the population decreases while the area of the forest stays the same. What happens to the population density of deer?

13) If parts of the forest are cut down to make room for houses, but the population stays the same, what happens to the population density of deer?

Challenge Question: There are about 2 million rats in New York City, which has a land area of about 300 square miles. What is the population density of rats in New York City?