



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Group Member: \_\_\_\_\_

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The Filly Zoo is acquiring four of each of the following animals: elephants, lions, and cheetahs. The zoo needs to build new habitats to house their new animals. Each type of animal has different qualities that require different characteristics in their habitats. Your challenge is to design the shapes of the habitats for each type of animal to make them as happy as possible using the information below.

- Elephants are big animals, and they take up a lot of room; so they want as much area as possible within their habitat.
- Lions like to corner their prey, so they want right angle corners in their habitat to help them stalk their prey but still want as much area as possible.
- Cheetahs like to run very fast, so they want at least one side of their boundary to be as long as possible. Cheetahs are not concerned about the area of their habitat.

The zoo has allotted 20 units of fence for each habitat and the zoo keeper wants to have at least 19 units of fence used for the border of each habitat. Your challenge is to use the Graphs and Geometry application of your TI-Nspire calculator to investigate different shapes and their properties to determine which shapes are best for each type of animal in the Filly Zoo. You may use any of the shapes available in the Geometry menu of your calculator as long as you consider all of the needs of each animal.

Sketch and label your elephant habitat in the space below. Explain why you think this shape works best for the elephants.

Sketch and label your lion habitat in the space below. Explain why you think this shape works best for the lions.

Sketch and label your cheetah habitat in the space below. Explain why you think this shape works best for the cheetahs.

## *Discussion Questions*

What do you notice about the relationships between the shapes and areas of the habitats?

What patterns do you notice?

Which habitat would you most like to live in? Explain your answer.

# *Sample Solutions*

## *Elephants*

The habitat for the elephants could be in the shape of the circle since a circle provides the largest area possible within a given boundary length, and area is the attribute of the habitat that is most important to the elephants. For example, given a boundary length of 20 units means that the circumference of the circle is 20 units. Then the diameter is approximately 6.37 units, with a radius of 3.18 units. Thus area of the circle is 31.77 square units.

## *Lions*

The habitat for the lion could be in the shape of a rectangle. This shape would provide the lions with four right angles to corner their prey. A more specific example could be a rectangle with a boundary length or perimeter of 20 units that will have an area of 24 square units with sides measuring 4 and 6 units. However, a square with sides measuring 5 units will yield an area of 25 square units. Thus, to maximize the area within the lions' habitat, a square shaped habitat would work best.

## *Cheetahs*

There are several possible solutions to the habitat for the cheetahs. Some students may think that a slender rectangle would be the best solution, but an obtuse triangle could allow the habitat to be very long and thin. Thus, offering a longer side for the cheetahs to run along than is possible with a slender rectangle. After finding the obtuse triangle solution, some students may create a triangle thinner than a cheetah itself. This could raise a discussion about what a reasonable solution for the cheetahs' habitat would be.