

It makes sense that the larger the area of a region, the larger the number of species that inhabit the region. Many ecologists have modeled the species-area relation with a power function and, in particular, the number of species S of bats living in caves in central Mexico has been related to the surface area of the caves by the equation $S = 0.7A^{0.3}$.¹

- a. *The cave called Misión Imposible near Puebla, Mexico, has a surface area of $A = 60 \text{ m}^2$. How many species of bats would you expect to find in that cave?*

Here we are given the area and asked to find the number of species. We substitute into the given relation

$$\begin{aligned} S &= 0.7A^{0.3} \\ &= 0.7 \cdot 60^{0.3} \\ &\approx 2.39 \end{aligned}$$

Thus we should expect to find 2 or 3 species in the cave.

- b. *If you discover that 4 species of bats live in a cave, estimate the area of the cave.*

We are given the number of species and tasked to find the area of the cave. We substitute into the given relation

$$\begin{aligned} S &= 0.7A^{0.3} \\ 4 &= 0.7A^{0.3} \\ \frac{4}{0.7} &= A^{0.3} \\ \frac{4}{0.7} &= A^{3/10} \\ \left(\frac{4}{0.7}\right)^{10/3} &= \left(A^{3/10}\right)^{10/3} \\ 333.58 &\approx A \end{aligned}$$

Thus the surface area of the cave is about 333.58 m^2 .

¹Stewart, *Calculus, Early Transcendentals*, p. 36, #30.