Objectives: I can model an exponential relationship with a function table and graph.

Growing, Growing, Growing Investigation 3.1 and Scientific Notation

3.1 Reproducing Rabbits

1. In 1859, a small number of rabbits were introduced to Australia by English settlers. The rabbits had no natural predators in Austrailia, so they reproduced rapidly and became a serious problem, eating grasses intended for sheep and cattle.

If biologists had counted the rabbits in Australia in the years after they were introduced, they might have collected data like these:

A. The table shows the rabbit population growing exponentially.

Work: $\frac{1050}{583}$ $\frac{583}{325}$ $\frac{325}{180}$ $\frac{180}{100}$ ≈1.8 ≈1.8 ≈1.8 = 1.8

{divide population by previous years population}

Growth of Rabbit Population

Time (yr)	Population	
0	100	? ×1.8
1	180	? ×1.8
2	325	? ×1.8
3	583	? ×1.8
4	1,050	

1. What is the growth factor? 1.8 Show how you found your answer. * see work above

2. Assume the growth pattern continued. An equation for the rabbit population p for any year n after the rabbits were first introduced is $p = 1.8^n \cdot 100$. Explain what the numbers in the equation represent.

1.8 is the growth factor 100 is the starting population

3. How many rabbits will there be in 10 years? 35,705 $n=10$, $1.8^{10}(100) = 357.05(100)$

How many will there be after 25 years? 240,886,592 After 50 years? $5.8 * 10^{14}$

$n=25$, $1.8^{25}(100) = 240886.592(100)$ $n=50$, $1.8^{50}(100) \approx 5.8 * 10^{12}(10^2)$

4. After how many years will the rabbit population exceed one million? about 11.6 years

$1.8^{16} \approx 12149.95 * 100 \approx 1,214,395$

B. Suppose that during a different time period, the rabbit population could be predicted by the equation $p = 15(1.2^n)$, where p is the population in millions, and n is the number of years.

1. What is the growth factor? 1.2 2. What is the initial population? 15 rabbits

2. The table shows that the elk population in a state forest is growing exponentially.

$\frac{743}{391}$ $\frac{391}{206}$ $\frac{206}{108}$ $\frac{108}{57}$ $\frac{57}{30}$ all ratios ≈ 1.9

Growth of Elk Population

Time (yr)	Population	
0	30	×1.9
1	57	×1.9
2	108	×1.9
3	206	×1.9
4	391	×1.9
5	743	

a. What is the growth factor? 1.9

Show how you got your answer.

Explanation: Divide any year (pop) by the year before (pop)!

b. An equation you could use to predict the elk population p for any year n after the elk were first counted is $p = 30(1.9^n)$, Suppose that this growth patterns continues.

How many elk will there be in 10 years? ≈18,340 15 years? ≈455,434 | $n=10$ $30(1.9^{10})$ $30(613)$ | $n=15$ $30(1.9^{15})$ $30(15,181)$

d. After how many years will the elk population exceed one million? ≈ 16.3 years

$\frac{30(1.9^n)}{30} = \frac{1,000,000}{30}$ $1.9^n = 33,333$

$1.9^{16.5} \approx 39,759$

$1.9^{16.3} \approx 32,795$

$30(32,795) \approx 1,049,071$