PREPARATION READING:

Where Do We Go From Here?

The modeling process led you to first consider migration as the key feature that explained why the moose population changed over time. The model required you to make some decisions about its specific features, which you did. You then built tables and equations to describe population growth with the assumption that moose were migrating into the park. The prediction from your model was affected by those decisions, so you analyzed it in a more general way. You found that there was *no* way that a migration model could produce the predicted numbers that environmentalists had made for the moose in the year 2013. The same modeling process that had you build the migration model also forced you to reject it.

It sounds like digging a hole, only to fill it up again! But there is one thing that you *do* know now—it isn't migration! In baseball, that's called a "swing and a miss," but it only counts as one strike. Modeling rarely focuses on the key feature the first time. Much like code breaking in Chapter 1, *Secret Codes*, you learn more about the context from your efforts. You eliminate what cannot be, and narrow down what must be. You keep going! Step 4 of the modeling process said: "If the results do not make sense, reconsider the assumptions you made…and revise them to be more realistic." There is nothing more realistic than births; that's where *you* came from! Should you include deaths in the model as well? What about the moose wandering around—should you still assume that moose are migrating into the park?

Before making your model too complicated, follow the steps you took in building a migration model. Focus attention on a 20-year period, which is the average lifespan of a moose. This time, assume that reproduction is the only factor causing the population to change. That means none of the moose in the park die or wander off, and no other moose come into the park. This model may *still* be too simple, but it will allow you to concentrate on how to describe reproduction in a mathematical way. Is reproduction also an additive process? And if it is not an additive process then what is it?

Before building the reproduction model, you will want to expand your mathematical tool kit. Migration was described by an additive process and you have concluded that something else is needed. You need to explore patterns that are created by

LESSON THREE

Multiplicative Growth

Key Concepts

Mathematical modeling process

Recursive and multiplicative growth

Relative rate of growth

Growth factor

Exponential equations

Laws of exponents

Graphs of exponential functions

Exponential growth and decay

Translations

a growth that is *not* an additive process. In this lesson you will concentrate on finding those patterns, and describing them in mathematical terms. Enjoy the intermission!

DISCUSSION/REFLECTION:

1. Which of the control numbers used in the migration model are likely to be retained in a reproduction model?
2. Is there some other factor that could be used to explain the increase in population, other than migration or reproduction? Explain.
3. Perhaps you have a mathematical "intuition" about the pattern of growth you are about to investigate. Is it an additive process? Explain.