

PROJECT

Applying Chapters
7–9

Mathematical Models of Learning

OBJECTIVE Graph data about learning time and fit a model to the data.

Materials: simple puzzle, timer



When you were first learning to read, a page in a children's book might have taken you several minutes to work through. Now when reading a book to a small child, you can read an entire page easily. How did the time needed to read a page change as you got older and better at reading?

Many scientists study learning. Some study which environments seem to promote learning and which hinder it. Some study which parts of the brain are active when people learn a new skill and which are active when they practice old ones. Others explore how learning changes over time. In this project you will measure the time it takes to do a task as it becomes more familiar to you. You will then fit a model to your data.

INVESTIGATION

1. Find or create a simple task for someone to learn. The task should not take too long to complete and should gradually get easier with practice. Note, a brainteaser puzzle that is very difficult until you realize the trick and then is very easy will not show a gradual increase in performance. A task that is too easy will show only a slight variation in performance.

Possible tasks include: assembling a small puzzle, such as a 10–30 piece jigsaw puzzle; putting 20 index cards with words on them in alphabetical order; solving 15 arithmetic problems involving order of operations where the same problems are in a different order each time; arranging shapes to match a given pattern.

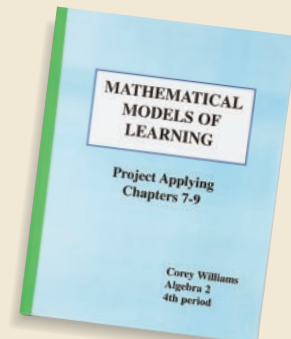
2. Choose a partner as a test subject. Explain to your partner how to do the task you chose. Administer the task to your partner and then measure the time your partner takes to complete the task. Record the data in a table like the one on the right. Repeat the process nine times.
3. Make a scatter plot of your data.
4. So far in this book you have studied linear, quadratic, polynomial, power, radical, exponential, logarithmic, and rational functions. Find a mathematical model that is one of these types of functions to fit your data.

Task number	Time
1	?
2	?
3	?
4	?
5	?
6	?
7	?
8	?
9	?
10	?

PRESENT YOUR RESULTS

Write a report to present your results.

- Begin with a description of the learning task you used and explain how you chose it.
- Include your table of data, your graph, and your mathematical model.
- Explain how you chose the type of function to model your data.
- Explain how you obtained your model.
- Write a description of your data and what they show.



Extend your results.

- Recruit a second partner and repeat the experiment.
- Find a mathematical model to describe the learning time for the new data.
- Do you get the same or different results this time? Explain why you might expect similar or different results. (For example, you might obtain similar results because both subjects are juniors in high school who like word puzzles. You might obtain different results because one subject is several years younger than the other.)

EXTENSION

You have measured the times it takes to perform an increasingly familiar task. Now you will measure the times it takes to perform an increasingly complicated task.

Possible tasks include: assembling a puzzle cut out of paper with 2 pieces, then one with 4 pieces, then one with 8 pieces, and so on; arranging index cards with words on them in alphabetical order, first doing 5 cards, then 10 cards, then 15 cards, and so on; finding the ace of spades in a deck with 4 cards, then 8 cards, and so on.

Choose a task and recruit a volunteer to help you. Measure the times it takes your volunteer to complete the task 10 times at increasing levels of difficulty. Record the data in a table, make a scatter plot of the data, and then find a mathematical model to fit your data.

