"Power"ful Patterns

Math Concepts

- multiplication
- place value
- division
- whole numbers
- exponents
- decimals

Materials

- TI-15 Explorer™
- **"Power"ful Patterns** recording sheets
- pencils

Overview

Students will investigate the relationship between multiplication with repeated factors and the use of exponents. Students will connect "powers of ten" to place value positions.

Introduction

1. Have students investigate a problem that requires multiplication of a repeated factor.

   Examples:
   If you fold a piece of paper in half five times, how many layers thick would it be?

   If you didn't like baby-sitting for a particular child, you might decide to triple your hourly charge each time you baby-sit. What would you charge on the fourth time, if you charged $3.00 an hour the first time?

   After a certain kind of plant is planted, it produces ten seeds. If each of these ten seeds grows into a plant with the same seed-producing season, how many seeds will you have at the end of six seasons?

2. Have students discuss how they might use the calculator to perform the repeated multiplication actions in the problem they choose to investigate.

   Examples:
   2 [×] **2** [×] **2** [×] . . . [=] _____

   or

   [On/C] [×] **2** [On/C] **1** [On/C] [On/C] [On/C] . . .

3. Demonstrate using the exponent key [^] for multiplication of a repeated factor.

   Example:
   2 [^] **4** [=] **16**

"Power"ful Patterns *(continued)*

Introduction (continued)

4. Have students use both [^] and [0p1] to generate data about the problem. Have them record the data in the tables on the recording sheet.

   Note: In exponential notation, the repeated factor is called the "base," and the exponent is often referred to as the "power."

   Example:

Repeated Multiplication with [^] **Enter: (base) [^] (exponent) [=]**					**Repeated Multiplication with [0p1]** **Enter: [0p1] [× 3 (base)] [0p1] 1**		
(Base)		**(Exponent)**		**Product**			**Product**
3	[^]	1	=	3	[0p1]	1	3
3	[^]	2	=	9	[0p1]	2	9
3	[^]	3	=	27	[0p1]	3	27
3	[^]	4	=	81	[0p1]	4	81
3	[^]	5	=	243	[0p1]	5	243
3	[^]	6	=	729	[0p1]	6	729

5. Have students compare the data in the tables and discuss the relationships between the two lists.

Collecting and Organizing Data

While students generate data for the different bases (factors) and exponents (powers) in their problems, ask questions such as:

- What factor are you using? How is it represented in your problem?
- What does the exponent represent?
- Predict what the next entry in your table will be. How did you make your prediction?
- What happens when you change the exponent?
- What happens when you change the factor (the base of the exponent)?

How are the different ways to perform repeated multiplication on the calculator alike? How are they different?

What happens if you enter 0 instead of 1 as the starting number for the constant function? Why do you think this happens?

"Power"ful Patterns *(continued)*

Analyzing Data and Drawing Conclusions

After students have made and compared several pairs of lists using different bases (factors), have them discuss their results as a whole group. Ask questions such as:

- What problem did you make up to generate your data?
- How are everyone's problems alike? How are they different?
- How are the different data lists alike? How are they different?
- What kinds of relationships do you see between the two lists of data in each chart?
- What kinds of products occurred when you used 10 as the factor (the base)? What patterns did you see in them? Where else have you seen that pattern?

When would you most likely want to use the regular multiplication key instead of ^ or Opl? When would ^ or Opl be helpful?

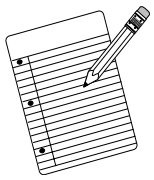
Continuing the Investigation

Have students:

- Experiment with using negative numbers for the factor (base) or for the exponent.
- Experiment with using division instead of multiplication as the repeated operation.
- Look for relationships between the data collected in these experiments.

Algebra

Name:



"Power"ful Patterns

Recording Sheet

Collecting and Organizing Data

Repeated Multiplication with [^] Enter: (base) [^] (exponent) [=]					Repeated Multiplication with [0p1] Enter: [0p1] [x] (base) [0p1] 1		
(Base)		(Exponent)		Product			Product
____	[^]	1	=	____	[0p1]	1	____
____	[^]	2	=	____	[0p1]	2	____
____	[^]	3	=	____	[0p1]	3	____
____	[^]	4	=	____	[0p1]	4	____
____	[^]	5	=	____	[0p1]	5	____
____	[^]	6	=	____	[0p1]	6	____
____	[^]	7	=	____	[0p1]	7	____
____	[^]	8	=	____	[0p1]	8	____
____	[^]	9	=	____	[0p1]	9	____

Analyzing Data and Drawing Conclusions

What is the calculator doing when you enter: _____ [^] _____ = ?
base exponent

What is the calculator doing each time you press [^]?

What pattern do you see when you use 10 as the base?