

# A Broken Calculator?

## Powers of 10

Rafael and Alesia were using their calculators to complete a math assignment. After Rafael tried to use the  $10^x$  key to enter the numbers shown below, he told Alesia that the calculator must be broken because the display showed strange numbers. Alesia said that the calculator was not broken and that she knew what the numbers shown on the display meant. Enter each of the following numbers in your calculator and record the displays. Then help Alesia explain to Rafael what each display means. (Hint: To use the  $10^x$  key, enter the exponent first and then press the  $10^x$  key.)

Enter	Display	Meaning
$10^8$		
$3 \times 10^8$		
$10^9$		
$5 \times 10^9$		
$10^{10}$		
$8 \times 10^{10}$		
$10^{11}$		
$6 \times 10^{11}$		
$10^{12}$		
$7 \times 10^{12}$		
$10^{13}$		
$9 \times 10^{13}$		

### Thinking Cap



What happens when you try to use the  $10^x$  key to enter  $15 \times 10^{15}$ ? Explain the result.

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## Powers of 10

**Topic:** Powers of 10

**Objective:** To explore how the calculator evaluates powers of 10.

**NCTM Standards:** Communication, Reasoning, Number and Number Relationships

### Using the Activity

Students use the calculator in this activity to explore evaluating powers of 10.

- The  $10^x$  key can be used to evaluate powers of 10.

**Examples** To enter  $10^8$  into the calculator, press 8  $10^x$ . The display shows 1. 08. The meaning of this is  $1 \times 10^8$ , which is equal to  $10^8$ . To enter  $3 \times 10^8$  into the calculator, press 3  $\times$  8  $10^x$   $=$ . The display shows 3. 08 which means  $3 \times 10^8$ .

**Assessment** Students should check their entries in the DISPLAY and MEANING columns of the chart to be sure the powers of 10 are the same as those in the first column.

### Answers

$10^8$ : See example above.

$3 \times 10^8$ : See example above.

$10^9$ : 9  $10^x$  1. 09, which means  $1 \times 10^9$ .

$5 \times 10^9$ : 5  $\times$  9  $10^x$   $=$  5. 09, which means  $5 \times 10^9$ .

$10^{10}$ : 10  $10^x$  1. 10, which means  $1 \times 10^{10}$ .

$8 \times 10^{10}$ : 8  $\times$  10  $10^x$   $=$  8. 10, which means  $8 \times 10^{10}$ .

$10^{11}$ : 11  $10^x$  1. 11, which means  $1 \times 10^{11}$ .

$6 \times 10^{11}$ : 6  $\times$  11  $10^x$   $=$  6. 11, which means  $6 \times 10^{11}$ .

$10^{12}$ : 12  $10^x$  1. 12, which means  $1 \times 10^{12}$ .

$7 \times 10^{12}$ : 7  $\times$  12  $10^x$   $=$  7. 12, which means  $7 \times 10^{12}$ .

$10^{13}$ : 13  $10^x$  1. 13, which means  $1 \times 10^{13}$ .

$9 \times 10^{13}$ : 9  $\times$  13  $10^x$   $=$  9. 13, which means  $9 \times 10^{13}$ .

### Thinking Cap

The display shows 1.5 16. This means  $1.5 \times 10^{16}$ , which is the same as  $15 \times 10^{15}$ .