EXAMPLE 6   **TAKS REASONING: Multi-Step Problem**

ADVERTISING The amount A (in millions of dollars) spent on all advertising and the amount T (in millions of dollars) spent on television advertising in the United States during the period 1970–2003 can be modeled by

$$A = \frac{13{,}000 + 3700x}{1 - 0.015x} \qquad \text{and} \qquad T = \frac{1800 + 860x}{1 - 0.016x}$$

where x is the number of years since 1970. Write a model that gives the percent p (in decimal form) of the amount spent on all advertising that was spent on television advertising. Then approximate the percent spent on television advertising in 2003.

Solution

STEP 1 **Write** a verbal model. Then write an equation.

Percent spent on television advertising	=	Amount spent on television advertising	÷	Amount spent on all advertising
p	=	T	÷	A

STEP 2 **Find** the quotient.

$p = T \div A$ **Write equation.**

$$= \frac{1800 + 860x}{1 - 0.016x} \div \frac{13{,}000 + 3700x}{1 - 0.015x}$$ **Substitute for T and for A.**

$$= \frac{1800 + 860x}{1 - 0.016x} \cdot \frac{1 - 0.015x}{13{,}000 + 3700x}$$ **Multiply by multiplicative inverse.**

$$= \frac{(1800 + 860x)(1 - 0.015x)}{(1 - 0.016x)(13{,}000 + 3700x)}$$ **Multiply numerators and denominators.**

$$= \frac{\cancel{20}(90 + 43x)(1 - 0.015x)}{(1 - 0.016x)\cancel{(20)}(650 + 185x)}$$ **Factor and divide out common factor.**

$$= \frac{(90 + 43x)(1 - 0.015x)}{(1 - 0.016x)(650 + 185x)}$$ **Simplify.**

STEP 3 **Approximate** the percent spent on television advertising in 2003. Because $2003 - 1970 = 33$, $x = 33$. Substitute 33 for x in the model and use a calculator to evaluate.

$$p = \frac{(90 + 43 \cdot 33)(1 - 0.015 \cdot 33)}{(1 - 0.016 \cdot 33)(650 + 185 \cdot 33)} \approx 0.239$$

▶ About 24% of the amount spent on all advertising was spent on television advertising in 2003.

✓ **GUIDED PRACTICE**   **for Example 6**

7. In Example 6, find the values of T and of A separately when $x = 33$. Then divide the value of T by the value of A. *Compare* your answer with the answer in Step 3 above.