EXAMPLE 5 **Simplify a rational model**

CELL PHONE COSTS The average cost C (in dollars per minute) for cell phone service in the United States during the period 1991–2000 can be modeled by

$$C = \frac{46 - 2.2x}{100 - 18x + 2.2x^2}$$

where x is the number of years since 1991. Rewrite the model so that it has only whole number coefficients. Then simplify the model.

1991 cell phone

Solution

$$C = \frac{46 - 2.2x}{100 - 18x + 2.2x^2}$$ Write model.

$$= \frac{460 - 22x}{1000 - 180x + 22x^2}$$ Multiply numerator and denominator by 10.

$$= \frac{2(230 - 11x)}{2(500 - 90x + 11x^2)}$$ Factor numerator and denominator.

$$= \frac{\cancel{2}(230 - 11x)}{\cancel{2}(500 - 90x + 11x^2)}$$ Divide out common factor.

$$= \frac{230 - 11x}{500 - 90x + 11x^2}$$ Simplify.

✓ **GUIDED PRACTICE** **for Example 5**

12. In Example 5, approximate the average cost per minute in 2000.

12.4 **EXERCISES**

SKILL PRACTICE

1. **VOCABULARY** Copy and complete: A value that makes a rational expression undefined is called a(n) __?__.

2. **WRITING** Is $\dfrac{(x + 3)(x - 6)}{(x - 3)(6 - x)}$ in simplest form? *Explain.*

EXAMPLE 1
on p. 794
for Exs. 3–10

FINDING EXCLUDED VALUES Find the excluded values, if any, of the expression.

3. $\dfrac{4x}{20}$

4. $\dfrac{13}{2y}$

5. $\dfrac{5}{r + 1}$

6. $\dfrac{-s}{3s + 4}$

7. $\dfrac{-m}{4m^2 - 3m + 9}$

8. $\dfrac{n + 2}{n^2 - 64}$

9. $\dfrac{-3}{2p^2 - p}$

10. $\dfrac{5q}{q^2 - 6q + 9}$