EXAMPLE 5   **Multiply a rational expression by a polynomial**

Multiply: $\dfrac{x+2}{x^3-27} \cdot (x^2+3x+9)$

$$\dfrac{x+2}{x^3-27} \cdot (x^2+3x+9) = \dfrac{x+2}{x^3-27} \cdot \dfrac{x^2+3x+9}{1}$$ Write polynomial as a rational expression.

$$= \dfrac{(x+2)(x^2+3x+9)}{(x-3)(x^2+3x+9)}$$ Factor denominator.

$$= \dfrac{(x+2)\cancel{(x^2+3x+9)}}{(x-3)\cancel{(x^2+3x+9)}}$$ Divide out common factors.

$$= \dfrac{x+2}{x-3}$$ Simplified form

✓ **GUIDED PRACTICE**   for Examples 3, 4, and 5

Multiply the expressions. Simplify the result.

8. $\dfrac{3x^5y^2}{8xy} \cdot \dfrac{6xy^2}{9x^3y}$

9. $\dfrac{2x^2-10x}{x^2-25} \cdot \dfrac{x+3}{2x^2}$

10. $\dfrac{x+5}{x^3-1} \cdot (x^2+x+1)$

KEY CONCEPT   *For Your Notebook*

Dividing Rational Expressions

To divide one rational expression by another, multiply the first rational expression by the reciprocal of the second rational expression.

Let a, b, c, and d be expressions with $b \neq 0$, $c \neq 0$ and $d \neq 0$.

Property $\dfrac{a}{b} \div \dfrac{c}{d} = \dfrac{a}{b} \cdot \dfrac{d}{c} = \dfrac{ad}{bc}$ **Simplify $\dfrac{ad}{bc}$ if possible.**

Examples $\dfrac{2}{5} \div \dfrac{7}{3} = \dfrac{2}{5} \cdot \dfrac{3}{7} = \dfrac{6}{35}$

$$\dfrac{7}{x+1} \div \dfrac{x+2}{2x-3} = \dfrac{7}{x+1} \cdot \dfrac{2x-3}{x+2} = \dfrac{7(2x-3)}{(x+1)(x+2)}$$

EXAMPLE 6   **Divide rational expressions**

Divide: $\dfrac{7x}{2x-10} \div \dfrac{x^2-6x}{x^2-11x+30}$

$$\dfrac{7x}{2x-10} \div \dfrac{x^2-6x}{x^2-11x+30} = \dfrac{7x}{2x-10} \cdot \dfrac{x^2-11x+30}{x^2-6x}$$ Multiply by reciprocal.

$$= \dfrac{7x}{2(x-5)} \cdot \dfrac{(x-5)(x-6)}{x(x-6)}$$ Factor.

$$= \dfrac{7x\cancel{(x-5)}\cancel{(x-6)}}{2\cancel{(x-5)}\cancel{(x)}\cancel{(x-6)}}$$ Divide out common factors.

$$= \dfrac{7}{2}$$ Simplified form