Multiplying and Dividing Rational Expressions

11.4

Multiplying and Dividing Rational Expressions

- You can use the same rules that you used for multiplying and dividing fractions to multiply and divide rational expressions.

- Let $a, b, c,$ and d be polynomials.

- Multiplying: $\frac{a}{b} \bullet \frac{c}{d} = \frac{ac}{bd}$, where $b, d \neq 0$.

- Dividing: $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \bullet \frac{d}{c} = \frac{ad}{bc}$, where $b, c, d \neq 0$.

Multiplying Rational Expressions

Find each product and identify excluded values.

a. $\dfrac{7x^2}{3} \cdot \dfrac{9}{14x}$ *Reduce before multiplying*

b. $\dfrac{5h}{3(h+4)} \cdot \dfrac{3h+9}{h+3}$

Multiplying Rational Expressions

Find each product and identify excluded values.

a. $\dfrac{7x^2}{1\,\cancel{3}} \cdot \dfrac{\cancel{9}\;3}{14x}$ Reduce before multiplying

b. $\dfrac{5h}{3(h+4)} \cdot \dfrac{3h+9}{h+3}$

Multiplying Rational Expressions

Find each product and identify excluded values.

a. $\dfrac{7x^2}{13} \cdot \dfrac{9}{14x}$ Reduce before multiplying

$= \dfrac{3x}{2}$ Multiply

$x = 0$ Excluded Value

b. $\dfrac{5h}{3(h+4)} \cdot \dfrac{3h+9}{h+3}$ Factor and Reduce before multiplying

Multiplying Rational Expressions

Find each product and identify excluded values.

a.
$$\frac{\overset{x}{\cancel{7x^2}}}{\underset{1}{\cancel{13}}} \cdot \frac{\overset{3}{\cancel{9}}}{\underset{2}{\cancel{14x}}}$$

Reduce before multiplying

$$= \frac{3x}{2}$$

Multiply

$$x = 0$$

Excluded Value

b.
$$\frac{5h}{\underset{1}{\cancel{13}(h+4)}} \cdot \frac{\overset{1}{\cancel{3}}(\cancel{h+3})}{\cancel{h+3}\ \underset{1}{1}}\ \overset{1}{}$$

Factor and Reduce before multiplying

$$= \frac{5h}{h+4}$$

Multiply

$$x = -4, -3$$

Excluded Values

On Your Own

Find each product and identify excluded values.

1. $\dfrac{8y^2}{y-5} \cdot \dfrac{3}{4y}$ $\qquad = \dfrac{6y}{y-5}; \ y = 5, 0$

2. $\dfrac{16}{8-c} \cdot (c-8)$ $\qquad = -16; \ c = 8$

3. $\dfrac{2z-4}{6} \cdot \dfrac{3}{z^2 - 7z + 10}$ $\qquad = \dfrac{1}{z-5}; \ z = 5, 2$

Dividing Rational Expressions

- When dividing you multiply by the inverse of the second fraction.
- Reduce only when multiplying.

Example 1: Find the quotient $\dfrac{p^2 - p - 6}{p + 1} \div (p^2 - 4)$.

$$\frac{p^2 - p - 6}{p + 1} \div \frac{p^2 - 4}{1}$$

$$= \frac{p^2 - p - 6}{p + 1} \cdot \frac{1}{p^2 - 4}$$

$$= \frac{(p - 3)(p + 2)}{p + 1} \cdot \frac{1}{(p - 2)(p + 2)}$$

$$= \frac{p - 3}{(p + 1)(p - 2)}$$

The excluded values are $p = -1, 2, -2$.

On Your Own

Find each quotient and identify excluded values.

4. $\dfrac{t-2}{2t} \div \dfrac{t-2}{4t^2}$

$= 2t; \quad t = 2, 0$

5. $(g+1) \div \dfrac{g^2+g}{g-1}$

$= \dfrac{g-1}{g}; \quad g = 0, 1, -1$

6. $\dfrac{d+5}{d-1} \div (d^2+4d-5)$

$= \dfrac{1}{(d-1)(d-1)}; \quad d = 1, -5$