

Multiplying Rational Expressions

The rule for multiplying rational expressions is the same as the rule for multiplying numerical fractions: multiply numerators, multiply denominators, and write the new fraction in simplified form.

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

Property $\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$ **Simplify $\frac{ac}{bd}$ if possible.**

Example $\frac{5x^2}{2xy^2} \cdot \frac{6xy^3}{10y} = \frac{30x^3y^3}{20xy^3} = \frac{\cancel{10} \cdot 3 \cdot \cancel{x} \cdot x^2 \cdot y^3}{\cancel{10} \cdot 2 \cdot \cancel{x} \cdot y^3} = \frac{3x^2}{2}$

**EXAMPLE 3 TAKS PRACTICE: Multiple Choice**

What is a simplified form of $\frac{12x^4y}{2xy^3} \cdot \frac{5x^2y^5}{6y}$?

- (A) $\frac{7}{2}x^5y^2$ (B) $5x^5y^2$ (C) $5x^7y^2$ (D) $15x^6y^{3/2}$

Solution

$$\frac{12x^4y}{2xy^3} \cdot \frac{5x^2y^5}{6y} = \frac{60x^6y^6}{12xy^4}$$

Multiply numerators and denominators.

$$= \frac{\cancel{12} \cdot 5 \cdot \cancel{x} \cdot x^5 \cdot y^4 \cdot y^2}{\cancel{12} \cdot \cancel{x} \cdot y^4}$$

Factor and divide out common factors.

$$= 5x^5y^2$$

Simplified form

▶ The correct answer is B. (A) (B) (C) (D)

ANOTHER WAY

In Example 3, you can also first simplify each fraction, then multiply, and finally simplify the result:

$$\begin{aligned} \frac{12x^4y}{2xy^3} \cdot \frac{5x^2y^5}{6y} &= \frac{6x^3}{y^2} \cdot \frac{5x^2y^4}{6} \\ &= \frac{\cancel{6} \cdot 5 \cdot x^5 \cdot y^2 \cdot y^2}{\cancel{6} \cdot y^2} \\ &= 5x^5y^2 \end{aligned}$$

EXAMPLE 4 Multiply rational expressions

Multiply: $\frac{3x - 3x^2}{x^2 + 4x - 5} \cdot \frac{x^2 + x - 20}{3x}$

$$\frac{3x - 3x^2}{x^2 + 4x - 5} \cdot \frac{x^2 + x - 20}{3x} = \frac{3x(1 - x)}{(x - 1)(x + 5)} \cdot \frac{(x + 5)(x - 4)}{3x}$$

Factor numerators and denominators.

$$= \frac{3x(\mathbf{1 - x})(x + 5)(x - 4)}{(x - 1)(x + 5)(3x)}$$

Multiply numerators and denominators.

$$= \frac{3x(\mathbf{-1})(x - 1)(x + 5)(x - 4)}{(x - 1)(x + 5)(3x)}$$

Rewrite $1 - x$ as $(-1)(x - 1)$.

$$= \frac{3x(\mathbf{-1})(\cancel{x - 1})(\cancel{x + 5})(x - 4)}{(\cancel{x - 1})(\cancel{x + 5})(3x)}$$

Divide out common factors.

$$= (-1)(x - 4)$$

Simplify.

$$= -x + 4$$

Multiply.