

2.2 Multiplying and Dividing Rational Expressions

In order to Multiply and Divide Rational Expressions, we need to remember the rules for multiplying and dividing fractions from grade 7:

Multiplying: Multiply across - numerators multiply by numerators and denominators multiply by denominators. Then simplify.

Dividing: "Multiply and flip the second guy" (the reciprocal). You now use multiplication rules and simplify.

Ex.)

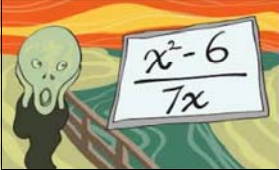

$$\frac{12}{10} \cdot \frac{5}{4} = \frac{60}{40} = \frac{3}{2}$$

Math $\frac{3}{2}$ Frac

$$\frac{-3}{5} \div \frac{3}{20} = -\frac{3}{5} \times \frac{20}{3} = -\frac{60}{15} = -4$$

$$\frac{-1}{6} \div \frac{-8}{24} = -\frac{1}{6} \times \frac{24}{-8} = \frac{-24}{-48} = \frac{1}{2}$$

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Now we combine the steps for simplifying rational expressions with the steps for multiplying and dividing fractions:

Ex.) Simplify each expression.


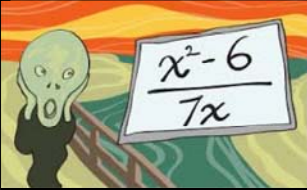
a) $\frac{1c^2 \cdot 15d}{2 \cdot 10 \cdot 2c} = \frac{15c^2d}{40c} = \frac{cd}{4}$
 $= \frac{1cd}{4} = \frac{cd}{4}$
 $c \neq 0$

b) $\frac{2 \cdot 4(x+3)}{3(x-1)} \cdot \frac{5(x-1)}{1 \cdot 8x} = \frac{10(x+3)}{3} \quad x \neq 1, 0$

a) $\frac{2a^2 \cdot 3b^2}{3 \cdot 8 \cdot 5a^2} = \frac{2b^2}{15a} \quad a \neq 0$

b) $\frac{12x(x+2)}{3x} \cdot \frac{5(x-4)}{4 \cdot 8(x+2)} = \frac{5(x-4)}{12} \quad x \neq 0, -2$

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Ex.) Simplify each expression.

a) $\frac{5n^4}{-2} \div \frac{(5n)^2}{6}$

$= \frac{5n^4}{-2} \cdot \frac{6}{(5n)^2}$

$= \frac{1 \cancel{5} n^4 \cdot 2 \cdot 3}{-1 \cdot 2 \cdot 5 \cdot 5 \cdot \cancel{n} \cdot \cancel{n}}$ $\frac{n \cdot n \cdot n \cdot n}{n \cdot n}$

$= \frac{3n^2}{-5} \cdot \frac{-3n^2}{5} \cdot \frac{-3n^2}{5}$


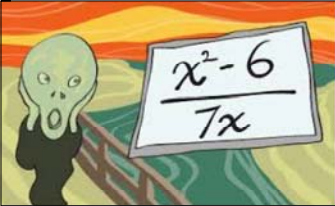
$n \neq 0$

b) $\frac{2(x+1)}{3x} \div \frac{4(x+1)}{x(x-2)}$

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

$= \frac{(x-2)}{6} \quad x \neq 0, -1, 2.$

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a) $\frac{7n^3}{4} \div \frac{(7n)^2}{-12}$

$= \frac{1 \cancel{7} n^3}{1 \cdot 4} \cdot \frac{-12}{7 \cdot 7 \cdot \cancel{n} \cdot \cancel{n}}$

$= \frac{-3n}{7} \quad n \neq 0$

b) $\frac{5(x-3)}{2x} \div \frac{10(x-3)}{3x(x+5)}$

$= \frac{1 \cancel{5} (x-3)}{2x} \cdot \frac{3x(x+5)}{2 \cdot \cancel{10} (x-3)}$

$= \frac{3(x+5)}{4} \quad x \neq 0, -5, 3.$

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Identify & Correct Any Errors

$$\begin{aligned}
 & \text{b) } \frac{-2ab^2}{5a^3b} \div \frac{-4a}{15ab} \\
 & = \frac{\cancel{1} \cdot \cancel{2} a b^2}{\cancel{1} 5 a^{\cancel{3}} b} \cdot \frac{\cancel{3} \cdot \cancel{15} a b}{\cancel{2} \cdot \cancel{4} a} \\
 & = \frac{6a}{b^2} \quad \frac{3b^2}{2a^2} \\
 & a \neq 0 \\
 & b \neq 0
 \end{aligned}$$

$$\begin{aligned}
 & \text{b) } \frac{15(x+5)}{2x^2} \cdot \frac{8x}{5(x+5)^2} \\
 & \text{b) } \frac{\cancel{3} \cancel{15} (x+5)}{\cancel{1} 2x^2} \cdot \frac{\cancel{4} \cancel{8} x}{\cancel{1} 5(x+5)^{\cancel{2}} (x+5)} \\
 & = \frac{12x}{(x+5)} \quad \frac{12}{x(x+5)} \\
 & x \neq -5, 0
 \end{aligned}$$

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