

Multiplying and Dividing Rational Expressions – Intermediate Algebra

To Multiply Rational Expressions:

1. Factor the numerator and denominator of each fraction (if possible).
- ~~x~~ 2. Divide out any common factors.
- ~~x~~ 3. Rewrite as a single fraction.
4. Leave in factored form.

Examples: Multiply the rational expressions.

$$1. \frac{40x^3}{6y} \cdot \frac{15y^2}{5x^5} = \frac{\overset{4}{\cancel{5}} \cdot 8x^3}{\cancel{2} \cdot 3y} \cdot \frac{\cancel{3} \cdot 5y^2}{\cancel{5}x^5} = \frac{4 \cdot 5x^3y^2}{yx^5} = \boxed{\frac{20y}{x^2}}$$

$$\begin{array}{ll} 40 = 5 \cdot 8 & 15 = 3 \cdot 5 \\ 6 = 2 \cdot 3 & 5 = \end{array}$$

$$2. \frac{a+5}{a-2} \cdot \frac{a-3}{a+4} = \boxed{\frac{(a+5)(a-3)}{(a-2)(a+4)}}$$

$$3. \frac{(h+2)(\cancel{h-8})}{(\cancel{h-8})(\cancel{h-6})} \cdot \frac{(\cancel{h-6})(h+3)}{(h-2)(h-7)} = \boxed{\frac{(h+2)(h+3)}{(h-2)(h-7)}}$$

$$4. \frac{n^2 + 6n + 8}{n^2 + 3n + 2} \cdot \frac{n^2 - 1}{n^2 + 8n + 16} = \frac{\cancel{(n+4)}\cancel{(n+2)}}{\cancel{(n+1)}\cancel{(n+1)}} \cdot \frac{\cancel{(n+1)}(n-1)}{\cancel{(n+4)}(n+4)} = \frac{n-1}{n+4}$$

$$n^2 + 6n + 8 = (n + 4)(n + 2)$$

$$n^2 - 1 = (n + 1)(n - 1)$$

$$n^2 + 3n + 2 = (n + 2)(n + 1)$$

$$n^2 + 8n + 16 = (n + 4)(n + 4)$$

To Divide Rational Expressions:

1. Multiply by the reciprocal of the second fraction.
2. Factor the numerator and denominator of each fraction (if possible).
3. Divide out any common factors.
4. Rewrite as a single fraction.
5. Leave in factored form.

$$\frac{\frac{1}{2}}{\frac{2}{4}} \cdot \frac{\frac{4}{3}}{\frac{4}{5}} = \frac{\frac{1}{2} \cdot \frac{4}{5}}{1}$$

Examples: Divide the following rational expressions.

$$1. \frac{8}{15} \div \frac{4}{7} = \frac{8}{15} \cdot \frac{7}{4} = \frac{14}{15}$$

$$2. \frac{d+3}{d-5} \div \frac{d+3}{d+8} = \frac{d+3}{d-5} \cdot \frac{d+8}{d+3} = \frac{\cancel{(d+3)}(d+8)}{\cancel{(d-5)}(d+3)} = \frac{d+8}{d-5}$$

$$3. \frac{18x^2+9x-20}{x^2+2x-35} \div \frac{6x^2+13x-15}{x^2+10x+21} = \frac{\cancel{(6x-5)}(3x+4)}{\cancel{(x+7)}(x-5)} \cdot \frac{\cancel{(x+7)}(x+3)}{\cancel{(6x-5)}(x+3)} = \boxed{\frac{3x+4}{x-5}}$$

$$x^2+2x-35 = (x+7)(x-5)$$

$$x^2+10x+21 = (x+7)(x+3)$$

$$6x^2+13x-15 = \underline{6x^2-5x+18x-15}$$

$$x(6x-5) + 3(6x-5)$$

$$(6x-5)(x+3)$$

$6(-15) = -90$	$\begin{matrix} n & A \\ 13 \end{matrix}$
$-6 \quad 15$	9
$-5 \quad 18$	13

guess!

$$18x^2+9x-20 = (6x-5)(3x+4)$$

$$18(-20) =$$

check: $18x^2 + 24x - 15x - 20$

$18x^2 + 9x - 20 \checkmark$