4-2 MULTIPLYING AND DIVIDING RATIONAL EXPRESSIONS

Multiplication of rational expressions follows the same principles as those involved in simplifying them. The process is illustrated in *Exercise* #1 with both a numerical and algebraic fraction. Notice the parallels.

***Exercise* #1:** Simplify each of the following rational expressions by factoring completely. For the numerical fraction, make sure to prime factor all numerators and denominators.

(a) $\frac{6}{8}\cdot\frac{10}{3}$

(b) $\frac{x^2-4}{x^2-x-6}\cdot\frac{3x^2+15x}{6x^2-12x}$

The ability to "cross-cancel" with fractions is a result of the two facts: (1) to multiply fractions we multiply their respective numerators and denominators and (2) multiplication is commutative. The keys to multiplication, then, are the same as that for simplifying – factor and then reduce.

***Exercise* #2:** Simplify each of the following products.

(a) $\frac{8y^7}{5x^3}\cdot\frac{10x^2}{6y^3}$

(b) $\frac{6x^2y^3}{4x^5y^2}\cdot\frac{10xy^2}{9x^5y^7}$

(c) $\frac{2x^2+12x}{4x+8}\cdot\frac{x^2-4x-12}{x^2-36}$

(d) $\frac{9-x^2}{2x^3-6x^2}\cdot\frac{4x^2-4x}{x^2+2x-3}$

Division of rational expressions continues to follow from what you have seen in previous courses. Since division by a fraction can always be thought of in terms of multiplying by it reciprocal, these problems simply involve an additional step.

***Exercise* #3:** Perform each of the following division problems. Express all answers in simplest form.

(a) $\frac{15x^2}{6y^5} \div \frac{5x^8}{2y^7}$

(b) $\frac{30y^6}{20x^3} \div \frac{24y^2}{8x}$

(c) $\frac{x^2+2x-8}{8x-16} \div \frac{x^2-16}{2x+10}$

(d) $\frac{9x^2-1}{3x^2+7x+2} \div \frac{5-15x}{x^2-5x-14}$

***Exercise* #4:** When $\frac{x^2-25}{3x}$ is divided by $\frac{x+5}{9x}$ the result is

(1) $\frac{x+5}{27x}$

(2) $3x-15$

(3) $\frac{x-20}{3}$

(4) $9x-5$

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