Name: _____ Date: _____

Writing Equivalent Rational Expressions
Algebra 1

We know from middle school mathematics that two different fractions can have the same value when reduced. These are called **equivalent fractions**. The keys to writing and recognizing equivalent fractions are the following two properties of real numbers:

$$\frac{a}{a}=1 \text{ as long as } a\neq 0 \text{ and } b\cdot 1=b$$

***Exercise* #1:** Write three fractions that are equivalent to $\frac{3}{2}$ by multiplying by one in various forms.

***Exercise* #2:** Consider the rational expression $\frac{x+2}{3}$.

(a) Write an equivalent rational expression by multiplying by $\frac{2}{2}$.

(b) Write an equivalent rational expression by multiplying by $\frac{x}{x}$.

(c) Verify that these expressions are equivalent by entering the answer that you wrote in (a) into Y_1 and your answer to (b) in Y_2 into your calculator. Fill in the table for selected values of *x*.

x	Y_1	Y_2
1		
4		
7		
10		

***Exercise* #3:** Which of the following is *not* equivalent to $\frac{x-6}{x+3}$?

(1) $\frac{2x-12}{2x+6}$

(3) $\frac{3x-6}{3x+3}$

(2) $\frac{x^2-6x}{x^2+3x}$

(4) $\frac{-x+6}{-x-3}$

Simplifying Rational Expressions with Monomial Denominators – Often rational expressions contain monomial denominators (only one term in the denominator). Simplifying these types of rational expressions is an important skill.

***Exercise* #4:** Consider the rational expression $\frac{2x^5y^2}{6x^3y^5}$.

(a) Write this expression as the product of two fractions, one of which is equal to one.

(b) Write this rational expression in simplest terms.

***Exercise* #5:** Using a process similar to what was used in *Exercise* #4, simplify each of the following rational expressions by writing it as the product of two fractions, one of which is equivalent to one.

(a) $\frac{4x^6}{12x^2}$ (b) $\frac{10x^3}{25x^8}$ (c) $\frac{8x^5y^2}{12x^3y^7}$

We would, of course, like to do this simplifying without writing out these two fractions. You should be able to use the exponent law for division to simplify these more quickly.

***Exercise* #6:** Simplify each of the following.

(a) $\frac{a^3b^6c}{a^2b^4c^3}$ (b) $\frac{12x^3y^2}{18xy^4}$ (c) $\frac{6x^3y^{10}}{2x^9y^2}$

Because division, like multiplication, distributes over addition and subtraction we can also simplify rational expressions that have polynomials in the numerator.

***Exercise* #7:** Simplify each of the following.

(a) $\frac{6c^3-12c^2}{3c}$ (b) $\frac{10x^3+25x^2+30x}{5x}$ (c) $\frac{4x^2y^5-2x^6y^3}{2x^2y^2}$

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Writing Equivalent Rational Expressions
Algebra 1 Homework

Skills

1. Which of the following is *not* equivalent to the fraction $\frac{5}{3}$?

(1) $\frac{10}{6}$ (3) $\frac{20}{12}$

(2) $\frac{-5}{-3}$ (4) $\frac{7}{5}$ _____

2. Which of the following is equivalent to $\frac{x+2}{x-1}$?

(1) $\frac{3x+2}{3x-1}$ (3) $\frac{4x+8}{4x-4}$

(2) $\frac{x+10}{x-5}$ (4) $\frac{x^2+2}{x^2-1}$ _____

3. Written in simplest form the fraction $\frac{-6x^3y^2}{12xy^5}$ is equal to

(1) $\frac{-x^2}{2y^3}$ (3) $-2x^2y^3$

(2) $\frac{2y^3}{x^2}$ (4) $-\frac{2x^2}{y^3}$ _____

4. Simplify each of the following rational expressions involving only monomials.

(a) $\frac{a^{10}}{a^4}$ (b) $\frac{-28x^3}{4x^9}$ (c) $\frac{18x^{12}}{6x^3}$ (d) $\frac{12x^4}{3x}$

(e) $\frac{4a^2b^5}{6a^4b^{10}}$ (f) $\frac{27x^3y^5}{-9x^7y^2}$ (g) $\frac{10a^2b^5c}{25a^7b^3c^8}$ (h) $\frac{10a^6b^9}{4a^2b^3}$

5. Which of the following is equivalent to $\frac{30x^6 - 15x^4}{5x^2}$?

(1) $6x^3 - 3x^2$ (3) $6x^4 - 3x^2$

(2) $4x^4 - 3x^2$ (4) $4x^3 - 3x$

6. Simplify each of the following rational expressions that contain a polynomial numerator and a monomial denominator.

(a) $\frac{32x - 20}{4}$ (b) $\frac{8x^3 - 4x^2}{2x}$ (c) $\frac{xy - x}{x}$

(d) $\frac{8x^2 - 12y^2}{4}$ (e) $\frac{32x^3z^4 - 40xz^2}{-8xz}$ (f) $\frac{30n^3 - 24n^2 + 18n}{6n}$

(g) $\frac{20p^3 - 15p^2 + 25p}{5p}$ (h) $\frac{18x^6 + 9x^5 - 15x^4}{3x^2}$ (i) $\frac{6x^3y^5 - 8x^2y^4 + 2xy^5}{2xy}$

Reasoning

7. Consider the rational expression $\frac{4x^2 + 8x}{2x}$.

(a) Write the expression in simplest form.

(b) Enter both the original expression and your answer from part (a) into $\mathbf{Y_1}$ and $\mathbf{Y_2}$ on your calculator and fill in the table.

(c) Why are the outputs to the two rational expressions different at $x = 0$?

x	$\mathbf{Y_1}$	$\mathbf{Y_2}$
-2		
-1		
0		
1		
2		